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ABSTRACT

This document contains 35 papers on graduate and inservice teacher education and technology that address the following topics: teaching practice and the design of professional development activities; merits of mentoring and modeling in Internet technology integration; educating the educators; preparing teachers to investigate the effects of technology-supported instruction in effective partnership with researchers; the evolving concept of literacy with regard to media and digital literacy; developing teachers' technological fluency with LEGO Mindstorms; practical ways to improve instructional effectiveness using Internet-based course supplements; reflective judgment and cognitive interaction in an electronically distributed astronomy course for educators; a synergistic approach to technology education; using the Internet as a teaching tool to find statistics for use in graduate education; introducing modular in-service diploma courses at Trinity College Dublin (Ireland); classroom-based technology training for inservice teachers; incorporating ISTE (International Society for Technology in Education) standards and performance assessment in a constructivist approach to graduate teacher education; computer technology in foreign language teacher training; implementing the virtual campus learning community for teacher education at George Fox University; active learning environments that prepare teachers for technology; modeling technology use in special education teacher training; an effective model for professional development in using technology to learn; using the Internet to create a virtual learning community; metaphoric scaffolding--using digital video techniques to overcome teacher apprehension about new approaches to learning; the Alliance for Catholic Education (ACE); CTER (Curriculum, Technology, and Education Reform) online; using WebCT (Web-based course tools) to extend learning in graduate educational technology courses; the Targeted Instructional Staff Development Project; designing learning practices as professional development for teacher educators; a masters program that prepares teachers to use information technology; technology autobiographies in teacher education; the TUTORPEA project for adults' teachers lifelong learning; integrating technology into the school curriculum with thematic units; training sessions designed to help teachers enhance lessons with technology; the computer mediated communication environment as

it fosters collaborative ways of knowing, teaching, and learning; a constructivist approach for professional development; the linear-nonlinear problem-solving approach to a multimedia and Internet course; task-oriented training in staff development; and how post graduate students on initial teacher training courses develop their information technology skills. Individual papers contain references. (MES)

Graduate & Inservice

By. Caroline M. Crawford., Ed.

GRADUATE & INSERVICE

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Research within the areas of graduate and inservice remain a predominant area of importance concerning the appropriate integration of technology into today's learning environment. Graduate and inservice learners have come to insist upon learning environments in which the sound understanding of appropriate technology understanding and integration is expressed; as a representation of this necessity, the outstanding articles within this section attest to the latest innovations and discussions pertaining to graduate and inservice learning environments. The authors offer the latest research and theoretical issues through which the future of appropriate technology integration will appear. For ease of discernment, the following research paper summaries are presented in alphabetical order by the author's surname.

Abate explores the relationship between numerous classroom learning activities and tools; specifically the integration of technology into the learning environment. Within Abate's paper the initial findings, based upon ethnographic field data and survey administration, is presented. Specific aspects of the survey data that is addressed are three points: middle school facilitator's classroom activities; technological level of such activities; and, any impediments that may occur to the integration of technology into the learning environment.

Bauder, Rossi and Mullick offer a discussion surrounding the integration of a supportive modeling technique and mentoring aspects within Internet inservice workshops. The integration of these aspects is meant to facilitate the integration of instructional technology into learning environments. As a reward for their efforts, the teachers reported an increased level of comfort when integrating the Internet and subsequent Internet tools into the learning environment.

Beam and Beam present a process and outcome description of a project that was focused upon the investigation of classroom instructors with a wide spectrum of technological experience who were shifting career goals. The learning the challenges faced during their learning curve as content authors within a commercial content authoring company are addressed.

Borras and Manriquez describe a procedural model through which teachers learn to conduct research studies through the integration of technology-supported instruction. The context through which this model is facilitated lies within the model's working relationship between the researcher and teacher. In conclusion, Borras and Manriquez offer a number of aspects that may positively affect the inquiry efforts and attitudes of the research and teacher.

Brownell and Brownell discuss the evolving concept of media literacy and digital literacy within a classroom technology masters-level degree program. Examples of resources are offered, the course participants' feedback is presented and an outline of the specific course under discussion is offered.

Butler, Martin and Gleason present a project wherein a collaboratively designed and implemented program pertaining to control technology for use with primary-level students is outlined. The project design, project implementation and the development of a learning community wherein support structures are enhanced are discussed.

Carlson, Repman, Downs and Clark document the methods implemented to increase the traditional face-to-face learning environment discourse effectiveness through the integration of Internet-based interactive activities. Suggestions for future instructors are presented.

Carr focuses upon an Introductory Astronomy for Educators course wherein the evaluation of the course efficacy towards meeting the predetermined goals of flexibility, critical thinking and cognitive interaction are addressed. Research-based findings and issues raised are included.

Cotugno and Kahn examine the theoretical implications and realistic pathways through which the appropriate integration of technology into classrooms is examined. Of interest is the overarching focus of Cotugno and Kahn upon the instructional process within the instructional unit, rather than at a classroom-by-classroom focus level.

Cox discusses strategies that instructors can implement to offer students the ability to locate necessary statistical information on the Internet. The efficient capture of statistical information and the ability to critically evaluate an Internet site, as well as the statistical information presented within the Internet site, are primary focuses.

FitzGibbon, Drury, Oldham and Tangney reflect upon the introduction of a modular inservice program, entitled Hero's Journey. The focus of this modular inservice program is pedagogical and cirricular issues and, therefore, relies upon the contribution of experienced classroom instructors.

Gallagher offers an alternative model for inservice teachers wherein technological training is provided within a classroom-based environment. The success of the alternative technological training model is apparent; however, the monetary amount necessary to sustain such an innovative program is also addressed.

Gibson and Kear analyze the importance of appropriate technological integration into a graduate teacher education program. The focus of this integration is to attempt a transformation of teaching practices towards a more student-oriented learning environment model.

Glatz presents information pertaining to the integration of technology into learner-centered foreign and second language teacher training programs. A discussion surrounding background information, important developments and problematic issues pertaining to the teacher training are addressed.

Headley and Carr offer a grass-roots alternative to traditionally designed and developed online course presentation and delivery models. The effectiveness of the grass-roots model is discussed, as well as early lessons within the process and recommendations for future grass-roots initiatives.

Heath describes the design and development issues pertaining to active learning environments for professional development sessions. Such innovative aspects presented within this paper are instructional strategies, classroom management models and the successful integration of technology into the learning environment.

Hegwer-Di Vita presents a summarization as well as a discussion of appropriately integrated technological modeling techniques within special education teacher training program coursework. A primary concern of Hegwer-Di Vita is the possible discrepancy between the level of technology that is available within the university systems and the availability of technology within the P-12 systems.

Hollon, McIntyre and Majdalani document an effective model for professional development wherein the appropriate integration of technology into classroom situations is imperative for the active engagement and use of existing and emerging technologies. The support structure within he collaborative technology professional development model for P-12 students, P-12 teachers, university preservice teachers, university faculty and instructional technology professionals is addressed.

Hutchinson, Verkler and Delius present a case study wherein the efforts of instructors towards an improved communication between fellow instructors are described. Of interest is the constantly shifting desires and needs of the instructors are being addressed due to the knowledge acquisition and expertise gained by the instructors.

Keefe and Tsantis present a work-in-progress report on metaphoric scaffolding. The use of digital video techniques aid in the reduction the teacher apprehension levels pertaining to innovative approaches to learning.

Larsen, Barry and Staud provide an overview of the creative initiative regarding the integration of technology into a holistic teacher education program. Further, Larsen, Barry and Staud offer an exploration of the role of technology within the current program, a description of recent adjustments within the initiative and the development of technology surveys. A needs-analysis report will be presented at the SITE conference.

Levin and Waddoups discuss the integration of a different, highly interactive online learning environment model. An in-depth effectiveness evaluation is reported.

Maeers examines the use of WebCT, an online course development tool, in two graduate-level technology courses. Data is presented and interpreted so as to address WebCT's effect and responsibility towards the enhanced learning of the students within the course.

Mullick, Bauder, Sarner and Carr offer successful results pertaining to an instructional staff development project. The goal of the project was to facilitate the appropriate integration of technology into the learning environment.

Odenthal and Voogt emphasize the design of learning practices as appropriate professional development activities for teacher educators. Of interest are the specifications for the design model and a description of the initial prototype is presented.

Plumer discusses a masters program that successfully prepares inservice teachers to appropriately integrate technology into the instructional environment. A focus of this paper is the use of information technology to its full potential.

Rhodes explores the impact of online interactive World Wide Web sites as integrated into graduate pre-service literacy education courses. A qualitative research aspect is chosen due to the key themes that emerged and which revolved around issues of teaching and learning. The responsibility of the university to appropriately prepare teachers is addressed.

Rodriguez, Perez, Garcia and Mompo describe an Intranet that has been developed for a teacher's lifelong learning international project. The focus is upon developing and interactive environment through which a supportive, fostering community environment may emerge.

Stephen, Gammon and Podleski describe a project that attempts to address barriers surrounding the integration of

technology into the school curriculums and thematic units. The authors emphasize curricular areas that necessitate strengthening, as identified by the United States of America's Department of Education.

Topp, Eshleman and Hirschfeld focus upon a successful model of inservice teacher training, which is designed to support teachers to enhance lessons through appropriately integrated technology. The focus of the inservice teacher training model is to engage the learner in the learning environment through teacher training in the areas of technology integration, lesson design and brain research

Wildner-Bassett summarizes a retrospective ethnographic and pedagogical theory analysis pertaining to key features of a computer mediated communication (CMC) environment within a course structure environment. The collaborative efforts pertaining to knowing, teaching and learning are emphasized.

Wilson, Phillips, Spence and Gibbons utilize a constructivist theoretical model approach towards the implementation of a professional development situation. The enhancement of learner-centered opportunities pertaining to information integration and conceptual frameworking develop a knowledge base and aid in the development of higher order thinking skills.

Yang, Shindler and Keen examine the bilinear problem-solving instructional strategy that was designed, developed and implemented within a graduate applied technology course. The authors provide conclusions and recommendations regarding the problem-based learning strategy model.

Zhang and Stacks present an article that documents the integration of a task-oriented training model in a Midwestern city within the United States of America. The task-oriented training significantly contributed to the technological competency and theoretical understanding of the learners.

Graduate and inservice research and discussions surrounding pertinent theoretical issues are imperative as the technological hardware becomes available to all levels within the educational environment. Only through the thoughtful reflection and rigorous research that the authors within this section have presented will the appropriate integration of technology into all levels of learning environments become a reality.

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Teaching Practice and the Design of Professional Development Activities

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Abstract: This paper explores the relationship among classroom teaching and learning activities, the design of technological tools, and technology integration in the classroom. Ethnographic field methods were employed to represent and understand the teaching and learning activities of a middle school community. Surveys were administered. Descriptive accounts of classroom interactions were recorded as field notes and follow-up interviews were conducted in order to develop a preliminary understanding of classroom / technology interactions. The preliminary study examined the teaching /learning activities across four content areas; Science, Mathematics, Social Studies and Language Arts. A suburban middle school participated in the study. This paper will present initial findings based on the survey data regarding the 1. types of learning activities employed by the middle school teachers, 2. level of technology use related to those activities and 3. perceived impediments to technology integration.

Teachers who integrate technology into their teaching on a regular basis still represent the minority of classroom teachers. (OTA, 1995) Despite considerable cost and effort the potential of technology has by and large remained unfulfilled in the classroom. This unfulfilled potential of technology represents a major problem for advocates of technology integration as questions regarding the efficacy of educational technology intensify (Stoll, 1995). What makes the current situation increasing untenable is that over twenty years of inquiry into the barriers to technology integration have led to an understanding of many of the key obstacles to integration. However, despite increased knowledge of the obstacles, widespread adoption of technology remains elusive.

Dias (1999) has identified resources, teacher time, training, and support as critical to technology integration. As more districts equip schools with computers, software and internet access issues regarding resources; hardware, software, and accessibility to technology have given way to questions regarding the nature and quality of professional development; teacher time, training and support (Ohio SchoolNet, 1999). Further, in spite of the adjustments in research focus, the integration of technology remains as challenging a problem today as it did twenty year ago. Research has identified other significant impediments to implementation. Prominent among these are attitudinal issues such as teacher beliefs (Ertmer, Addison, Land, Ross & Woods, 1999) and adoption of instructional reforms (Neiderhauser, Salem, & Fields, 1999). Neiderhauser et al have commented that traditional beliefs about schooling remain strong and stable and that dissatisfaction must occur in order for teachers to change their beliefs. Technology integration as a component of instructional reform requires that teachers change beliefs and practices. The question remains for many teachers whether the level of dissatisfaction is sufficient to institute technology reforms.

All of these documented obstacles are critical to the acceptance and widespread integration of technology into teaching. Underlying the analysis of these obstacles is the assumption that the technological tools currently available to teachers support classroom activities of teaching and learning. Although this paper recognizes the importance of the documented obstacles, it deviates from current lines of inquiry by revisiting the assumption that technological tools currently available to teachers are appropriate. The assumption of appropriateness is explored from a design perspective. Are the technological tools designed for teachers' work environment? This study considers this question in light of how currently available technological tools are implemented by teachers and students in a middle school setting.

Issues of usability

Interest in the usability of technological tools is a relatively recent phenomenon. This interest is an outgrowth of a technology market that has matured from one consisting primarily of individuals with technical orientations such as engineers, scientists, and mathematicians to a wider population representing all occupations. How the change in user audience has influenced computer usability is a significant attribute in assessing if current technological tools meet the needs of teachers.

Cooper (1999) has identified two categories of computer users. One category experiences frustration for failing at attempts to use technology while the other category feels powerful at overcoming the difficulty imposed by technological hardware and software. These two extreme emotions polarize people into being either a "survivor" or an "apologist". According to Cooper an apologist is synonymous with a power user. Someone who regardless of how hard or useful an interaction is will ignore the difficulty and use it. Video cassette recorders (VCR) provide a good example for an apologist. Most VCRs require a manual to program, the directions are typically poorly written, and the VCR does not respond gracefully when the user enters an inaccurate key press. The apologist will point out to a novice user that the VCR is really not all that difficult to operate. Simply enter an arcane list of commands in the appropriate order and you can record a program.

At the other end of the spectrum are the survivors. In most occupations the survivor cannot abandon technology. It is not that the survivor fails to grasp the difference between hard and easy but rather that the technology is required for their work. For example, a marketing executive's initial efforts at using a spreadsheet to create graphs may not be perceived as easy. However, the job requires the use of hardware and software, so the survivor learns to use enough of the operating system and the spreadsheet program functions to create a finished product. In the workplace the survivor is not in a position to choose whether to use technology or not.

Despite attempts to integrate technology into the curriculum, many teachers do not perceive technology as supportive of their goals (Abate & Jin, 1999). The majority population, the teachers that would be survivors in other occupations do not have a job imposed requirement to use technology so their level of technology integration is low. To simply require the use of technology in education as it has been required in other work setting assumes that the work of education is commensurate with the work of business.

Historical Perspective

Sutherland's *Sketchpad* a graphical design program was one of the first programs to make it possible for users to implement a direct manipulation programming environment. It was twenty years later that Sutherland's ideas became refined, elaborated, and widespread with the introduction of graphical user interfaces (Hutchins, Hollan, & Norman, 1986). The underlying principle behind the graphical user interface was to make computational media available to a wider audience by making it more intuitive to the casual user. The idea was to make technology user friendly. The graphical user interface was a significant step from the command line orientation of early computer systems.

Ease of use reflects a dynamic construct. What made the original Macintosh interface successful was the perception that it was easy to use. This ease of use was based on consistency of the graphic user interface across applications. (Winograd, 1996) Guidelines were created for developers to insure that standardization of the interface was maintained. (Apple Computer, 1987). Standardizing simplified use. When something can't be designed without arbitrary mappings and difficulties, the option remaining is standardization (Norman,1983). A standardized system only needs to be learned once but the conditions of standardization still require training. If the standard is set while the technology is still primitive problems inherent in the mappings and difficulties become locked into the design. Based on the rapid advances in hardware, software, and networking, current technological tools though powerful appear primitive at least in regard to usability. This issue is born out by personal experience. The Windows and Macintosh OS interfaces are based on pull down menus and windows but the mappings across the two systems are different and so are the standards. When instructing students familiar with one system, it is quite common to hear the complaint that whichever system was learned first is better than the one learned second. (Abate, 1999). Neither operating system is intuitive to the novice user. Currently, ease of use is based more on user familiarity with a standard than on natural mappings.

Work and Technological Tools

The effect of technological tools on people at work is linked to assumptions about the work they undertake. How well those assumptions correspond to the reality of what those individuals do on the job influences the individual's productivity and job satisfaction (Kuhn, 1996). The considerations that must be made in building technological tools for professionals in a business setting require a different set of design requirements then those made for teachers who employ the tools in a setting for learning and teaching (Nicol, 1990). This connection of design to work task speaks directly to the assumption of the appropriateness of the technological tools currently available to teachers. Have design principles been applied to the creation of educational hardware and software? An argument supportive of software specifically designed for education can be made solely on the basis of the hundreds of software titles currently available in K-12 education. Regardless of the quality of these titles, they are marketed directly for classroom use. The same argument cannot be advanced for hardware. With minor exceptions, hardware tools have historically been designed for the business or home markets and then adapted as tools for education

Survey

Limitations

The procedures and methods adopted and implemented in this design emerged from a non-standard view of why the integration of technology into K-12 teaching falls below the standards promoted for educational technology. The research problem from this viewpoint proposes that factors other than professional development and accessibility to technological equipment are influencing the levels of technology integration in the classroom. This viewpoint is supported by prior experiences with professional development in the integration of technology (Abate, Atkins, Hannah, Benghiat, & Settlage 1996). Instead, the technology integration problem is considered with respect to the design of technological tools. This viewpoint of a tool design problem evolved from a pilot study that suggested that many of the technological tools currently available to teachers may not match the learning activities commonly implemented in their classrooms (Abate & Jin, 1999). The tool mismatch problem presumably influences technology integration by teachers regardless of their level of expertise. As such, the problem considered in the study was the role of technological tools and the classroom environment on the integration of technology in teaching.

In explaining the specification of the problem, after analysis, it is tempting to make the research approach appear purposeful and conscious. However at the outset there was not a well formulated rationale for the approach. Rather, while in the field the 1. environment of the classroom and 2. functionality of the tools made explicit a rationale for concentrating on certain kinds of phenomena. An assumption was made early in the inquiry that matters of importance to these two key issues would reveal basic understandings regarding the integration of technology.

Not all participants in the study were considered equally. The classroom teacher, the technological tools and the aspects of the classroom environment as they impinged on the teacher were of central concern. Emphasis was placed on studying issues that mattered most to teachers regarding the implementation of technological tools with students.

Method

The method of investigation involved a form of participant observer employing three methods- participant observation, interviews, and enumeration/sampling. For participant observation the author directly observed classroom teachers in a middle school setting and played a quasi participant role by providing technology workshops for the teaching staff. Interviewing occurred following observations of classroom teaching. Since field observations are still underway, this preliminary analysis considers only the survey data.

A four part survey consisting of 47 items was distributed to 44 teachers at a suburban middle school. The first section consisted of six questions that contributed background information on the respondents. Included in this section were questions on teaching experience, grade level, subjects taught, technology expertise, and student expertise in technology.

The second section provided a list of eighteen possible learning activities along with a four-point scale indicating the anticipated frequency of the learning activity. Traditional and technology based methods for implementing the activity were listed below each learning activity. The teachers were directed to rate all items

that applied. The eighteen activities represented a range of learning activities including; writing, collecting data, organizing data, analyzing data, presenting information, classroom discussions, reviewing instruction, and developing projects. Ideas for the learning activities were based on sample activities included in assignments submitted by teachers enrolled in a graduate level instructional development course during the past ten years.

Fifteen different technologies were presented in the third section. The teachers were presented with a four-point scale to indicate how often they modeled or directed their students in the use of the fifteen technologies. Included in the technologies were: Internet, email, word processors, spreadsheet, databases, statistical software, video tapes, simulations, graphics, hypermedia, drill and practice, teacher utilities, presentation packages, overhead projectors, and other.

The fourth section of the survey included eight questions pertaining to students use of computer based tools. These statements were also scored using the four-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

Approximately ninety-five percent (42 of 44) teachers returned the surveys. Section one focused on general background information. Of the forty-two, twenty-nine respondents taught one or more of the four content areas; Language Arts, Social Studies, Mathematics, and Science. The median years of teaching experience for this group was in the ten to twenty year range with grade levels five through seven represented. Nineteen of twenty-nine teachers taught more than one content area. Less than one-third of the content area teachers (8 out of 29) considered themselves to be experienced with technology.

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. A four-point scale; 1- never, 2- rarely, 3- occasionally, and 4 - frequently was employed. Seventeen of the eighteen learning activities had an median score for one or more methods of implementation at or above the "occasionally" level suggesting that the learning activities listed for analysis did occur in these classrooms. The exception was "writing correspondence" whose median score was "rarely". In retrospect this category could have been incorporated into one of the other writing categories.

Section three considered the teachers' modeling of technology. Again a four-point scale was employed. Of the fifteen items listed only word processing and use of the overhead projectors received scores of 3 signifying occasional modeling by the teachers. Video tapes received a median score of 2 or rarely. Other was never selected. The median score of the eleven other technological tools (spreadsheets, E-mail, Internet, databases, statistical software, presentation software, simulations, graphics, teacher utilities, hypermedia, and tutorial software) was 1 (never) with and mean score of 1.40 across the items.

Section four posed eight questions regarding students' current use of computer based instructional tools. The four point scale was used and respondents were encouraged to identify the reason for their selection from a list of twenty-four possibilities. The median score across the 8 questions was 1-never with two items word processors, occasionally and calculators, frequently. The most common reasons for calculator use was that they were inexpensive, useful, and easy to use. Common reasons for using word processors included "easy to use" and "professional looking".

Conclusion

The survey portion of this study provided a snapshot of the learning and computer integration activities of the middle school teachers who teach Language Arts, Science, Mathematics and Socials Studies. The distribution of technology skills reported by the teachers may be unique to this middle school.

The 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 field data currently being collected at the school site.

What remains open to question are the reasons influencing the use and non-use of technologies in learning activities? Several variables proved confounding. Lack of equipment was identified as a key reason for student non-use of tools. Yet, two computer labs were available, several of the science classrooms were equipped with ten computers, and most classrooms have one or more computers available. Comparing the results of the science teachers who have access to ten computers in the classroom with the entire group there were differences. Whereas the eleven technological integration items averaged 1.4 for the entire group, they averaged 1.8 for the six instructors who taught science. The science teachers were less likely to list "not enough equipment" but listed "not useful" as a as a reason for not employing computer based instructional tools. Also, presentation packages received a median score of three from this group so questions regarding technology access will require further consideration during the collection of field data. Lack of student training, and time needed for student use was also noted as a problem by several teachers.

The primary arguments listed against tool use were "not enough equipment" and "lack of training". As such the survey results mirror the concerns identified earlier. (Dias, 1999 & Ohio SchoolNet, 1999) The studies concern regarding the assumption of the match of tool design to tool use remains open to question. The only locations where a response of "useful" appeared were with word processing and calculators. Why wasn't useful listed with other tools? This result is somewhat confusing as learning activities that might benefit from computer tools such as the activities of drawing maps, collecting data, and organizing data all recorded the relatively high median scores of three "occasionally" or four "frequently" as learning activities. Yet, databases, the Internet, and spreadsheets, technology integration tools that support the collection and organization of data averaged 1.28 with 1 signifying a use of never. This result reveals a more complex relationship between learning activities and technology than simply access to equipment. Based on the results of the science teachers, even when technology is available it is not perceived to be easy to implement.

The survey data provided a starting point for analyzing the connection between technology tool design and technology tool use at this middle school site. Without question, the issues already identified in the literature as pertinent to technology integration are evident as impediments to integration at this school site. Additional work is required to establish an understanding of how the teachers perceive the technology available to them and whether this technology supports the learning activities they employ in their teaching. The survey results suggest preliminary questions regarding technological tool design and tool use. However, ongoing collection of field data is required to establish if the design of technological tools is a key factor influencing the use of technology by this group of teachers and students.

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Merits of Mentoring and Modeling in Internet Technology Integration: Overcoming Operational Obstacles

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Abstract While most Internet inservice workshops include hands-on activities and opportunities for exploration, not all also offer the support found by modeling techniques and mentoring new users. The Targeted Instructional Staff Development Project was designed as a professional development project to facilitate the integration of instructional technology in the classroom. While the project consisted of nine separate workshop modules, the Internet modules focused on Web search strategies, Web page design, and instant messaging. In addition to teaching these skills to teachers, the Web design module also included a session with students and teachers so that teaching strategies could be modeled. Although the modules were designed with careful scope and sequencing, unforeseen difficulties presented challenges to success. In spite of the difficulties, the teacher participants reported increased comfort and interest in using Internet tools in the classroom. Materials provided by the instructors and modeling of techniques, particularly when teaching student/teacher teams, both were seen as important steps to success.

Introduction

While most Internet inservice workshops include hands-on activities and opportunities for exploration, not all also offer the support found by modeling techniques and mentoring new users. Modeling the behaviors expected in integrating technology into the classroom has been found to be an effective means of reinforcing skills taught (LeBlanc & Oates, 1997). Mentoring can be accomplished by training lead teachers, through telecommunications, development of mutually supportive cohort groups or faculty-student interaction (Planow, Bauder, Carr, & Sarner, 1993), (Bauder & Sarner, 1996).

The Targeted Instructional Staff Development Project was designed as a professional development project to facilitate the integration of instructional technology in the classroom. The ultimate goals of the project were to empower students to use technology in all phases of their education, to facilitate teachers as learners, and to achieve the New York State Learning Standards by developing interdisciplinary thematic units focusing on Mathematics, Science and Technology and English Language Arts and at the same time fully integrating technology into the curriculum. The Project involved a consortium of four local districts in a metropolitan area in Central New York.

The participants were 25 teachers in grades 3-5 from nine different schools within these districts. While the project consisted of nine separate workshop modules, the Internet modules focused on Web search strategies, Web page design, and instant messaging. In addition to teaching these skills to teachers, the Web design module also included a session with students and teachers so that teaching strategies could be modeled. The instant messenger service was

to be deployed for mentoring between workshop instructors and teacher participants and between college and elementary school students. The Internet modules were attended entirely by teachers from the Utica City School district and held at SUNY Institute of Technology at Utica/Rome.

This paper describes only the Internet portion of the comprehensive professional development program and the methods used to ameliorate difficulties faced by participants and instructors. At the time of grant writing, some assumptions were made concerning the audience, timeline, and scope of Internet modules. Teachers were to be chosen from grades 3 – 5, have some experience with computers and the Internet, and have access to the Internet on at least one computer in the classroom. They were expected to be teachers who had already been using the Internet in classroom activities and for professional development, but who wanted assistance in being more efficient in doing so.

Over the course of several months, teachers would attend, in groups of 12 – 14, a full-day session on Web searching and instant messaging. The Utica School Web Project portion consisted of a full-day session for these groups on Web page design followed by one more full-day attended by 4 – 6 teachers with two students each. Two instructors from SUNY shared the teaching load and team taught the session on Web design with students. As soon as the instant messaging was taught, teachers were expected to use it and email to keep in touch with each other and the instructors, and to teach their students to use instant messaging to communicate with mentor students from SUNY's Learning Center.

Challenges

Although the modules were designed with careful scope and sequencing, unforeseen difficulties presented challenges to success. The sponsor's timeline compressed the workshop schedule into a near impossible timeframe. The total time available for the entire project was six months, rather than one year and for the Internet modules was six weeks rather than 12 weeks. As a result of the teachers reported that there was too much to learn into short a time frame, and when combined with all of their of their responsibilities, they could not into internalize all of the information. . Shortages in substitute teacher availability made participation difficult at times. Some teachers are arrived at the training sessions only to be greeted by a message that they had to return to school because there was no substitute teacher for them. To miss one session of the total of three with no opportunity to make up for the session because of the tight time frame only added to the teachers' and instructor' frustrations.

Teacher participants did not necessarily have the skill or comfort level nor access to Internet resources that had been expected. During the web search course, the instructor found that she had to teach Internet basics before she could teach Internet search strategies. Although it had been expected that the teachers would not only have access to e-mail but would use it, neither of these true it proved to be true for the teachers. Unfortunately the tight time frame did not allow for a reorganization of the course to teach the use of e-mail to a degree that would have been optimal for the students. Adding a brief introduction to e-mail before teaching the Internet messaging, meant that the messaging portion of the course was shortchanged. Teaching Internet messaging was further hampered by the messaging service being accessible at the time of one of the classes.

Back in the classroom, it appeared that the technical services were not what either the teachers or workshop instructors had been promised. In some classrooms computers did not yet have Internet access, instant messaging had not been installed, and in many cases the teachers had no access to e-mail other than signing up for a free e-mail service on the web. Technical support was so slow in coming that some teachers never did have access to the instant messaging service in the classroom before the end of the spring semester. Only one or two teachers were able to establish the service and usage for the student mentoring portion of the project.

Although the web page design portion of the project progressed more smoothly, it turned out to that the school had no web hosting capability for the teachers. For some teachers the incentive to learn web page development was diminished by the inability to host and maintain their own pages. Fortunately the Continuing Professional Education department at SUNY and was able to provide web hosting on at least a temporary basis.

Overcoming obstacles

In spite of these difficulties, the teacher participants reported increased comfort and interest in using Internet tools in the classroom. What methods were used to overcome the difficulties presented and assist teachers in increasing their confidence and skills? As most technology educators know, flexibility is one of the keys to success.

Instructors utilized different techniques for presenting materials: overhead projections for live demonstrations, handouts, instructor exchange at key moments in the syllabus, but gained the most success by offering a genuinely safe environment in which to experiment, make mistakes and correct those mistakes for optimum learning. The instructors presented themselves as life-long learners dedicated to sharing that philosophy with other adults; the tone for mutual sharing and open learning was established at the outset.

Being able to adapt the workshops even slightly to the abilities, interests, and needs of the participants helped them to understand that they to have to be flexible in using technology in the classroom. For example, when it became apparent that most of the teachers in the workshops did not have e-mail addresses and had not used e-mail, an immediate shift was made to teach them how to set up and use Hotmail accounts. Less time was spent on Internet messaging, but a detailed handout was provided to the teachers to assist them when they went back to the classroom.

For many beginning Internet users, error messages are a constant source of frustration. Taking the time to explore and understand these error messages helped the teachers realize when problems were caused by their mistakes, and when they were caused by circumstances beyond their control.

The Utica School Web Project constituted one facet of the larger project described by this paper where modeling was most explicitly used to facilitate skill building and technology integration. The Web Project sought to engage teachers and students together in a learning process under the facilitation of SUNY instructors, where material was presented and interpreted by the instructors with the intent of teaching both content and instructional methodology to teachers. It was here that mentoring and modeling were most crucial to overcoming difficulties faced by the teachers. Attention is given to the details that made this portion of the project successful in influencing teachers' attitudes toward the entirety of the Internet portion of the professional development project.

The Utica School Web Project benefited from the teacher group's prior experience in learning to use Internet tools. Specific lesson plans for teaching teachers to design web pages began upon completion of the earlier project phase in which they learned to use the Internet and instant messaging. At this point, instructors knew where their skills were, had already experienced the way in which the group engaged in shared learning and were able to anticipate and plan for diverse reactions to new material.

Foremost in planning was the ensuing task of facilitating teachers back into their native teaching role with children. To that end, the instructor team planned for three outcomes:

1. Teachers will be comfortable using Netscape Composer to create a Web Page
2. Teachers will have ideas for a useful application of this skill in their classroom
3. Teachers will have an opportunity to give instruction to children under the guidance of SUNY instructors

At the end of their Web Design training session, teachers had expressed anxiety at the potential for ridicule by the students for being novices. Upon the teachers' return with their students, the instructors were careful to leave authority with the teachers and concentrate on the syllabus. Everyone needed nurturing. The instructors included sensitivity to that need in all planning and presentation.

Syllabus

The instructor team produced a syllabus geared to logical, yet organic learning modules. These modules included:

- what is HTML
- creating a web page with HTML

- designing a web page with an HTML editor (Netscape Composer)
- searching for copyright-free material to enhance the web page
- saving and printing web material
- uploading material to a server, and
- possible scenarios for classroom application of the training.

Materials

Three distinct sets of materials supported the Utica School web project: a Master Packet, Teacher Packet, and a Student Packet. The Master Packet included all Teacher and Student handouts plus instructor notes for timing, suggested moments for reflection on real world application of the current training, and assorted ideas and tips for breaking up student training modules or customizing the student learning modules.

The Teacher Packet, designed to recall the classroom training in subsequent off-campus settings, also included all the children's handouts. Particular handouts were specifically designated to be printed and used as lesson plans in the elementary classroom.

The Student Packets were the briefest. They consisted of several lessons:
- Looking at Web Pages
- Designing your own Web Page on Paper
- Use Netscape Composer to make your Web Page
- Find Clip Art for your Web Page
- Format your Web Page
- Make a Hyperlink
- Conclusion with summary

The teachers were encouraged to take the supporting materials and adapt them to their own teaching styles and settings. In this way, the SUNY instructors acknowledged that the teachers are the best arbiters of their own domains yet provided the support necessary for them to teach the new material.

Setting

Training took place on the SUNY Institute of Technology campus, a few miles north of the city of Utica, NY. The Continuing Professional Education lab, a state-of-the-art-facility with Pentium class machines, Ethernet connections, large monitors and ergonomic chairs (a real plus when sitting for several hours at a time!) provided an ideal training lab. Its décor and large windows enhance the lab's physical environment. In short, the setting encouraged comfort on the part of the trainees, which usually translates into decreased resistance to new ideas and greater willingness to learn. This particular factor in learning is hard to measure, but the teachers commented on the surroundings more than once! Incidental facilities, such as the computer laboratory building's cafeteria, beautiful campus and access to phones, restrooms, etc. further increased the teachers' comfort level.

Procedures

One session was devoted to designing web pages with each group of teachers. The teachers learned a little HTML to create a Web Page, created a Web Page with Netscape Composer, then saved and uploaded the file to the SUNY Institute of Technology server. Another training session followed the web design segment, this time with students. Teachers handpicked the students who accompanied them for training at this second session. These children presented a diverse group, culturally, in gender, in Internet experience outside of the classroom and in education level, including one special education student who experienced similar success to other students.

While the teachers had learned the basics of Web page design in their earlier training, the focus in the teacher/student session was on assisting them in teaching the skills to their students. At each step of the way, time was give to introspection of teaching technique, hands-on activity with students, and analysis of supporting materials. Sample web pages were analyzed for both content and design, and templates were provided to assist in the design of students' own pages.

With two instructors in the lab, there was at least one instructor available to any teacher/student group in need of further assistance. Discussions of security and privacy issues, copyright, and citing sources were imbedded into the lessons. To preserve password security, the instructors uploaded the children's pages to the SUNY Institute of Technology server during a short break. Prior to the training session, the instructors created a home page for the Utica School Web Project; the home page included a table of links to student pages, one table for each of the training sessions. The students returned to class and discovered that the Instructor's station was now able to see their pages, their classmates' pages and other student pages from the Utica School Web Project via the World Wide Web. As certain pages still contained minor errors, the children also were able to witness some of the updating process.

Conclusion

Teachers considered these workshops an opportunity to see the potential for Internet tools in the classroom and gain some initial skills to use in ongoing integration projects. Materials provided by the instructors and modeling of techniques, particularly when teaching student/teacher teams, were both seen as important steps to success. Teachers felt successful in guiding their students through this (now less threatening) process; students felt terrific about creating a page for cyberspace.

The pre and post-test questionnaires used to determine the effectiveness of each of these three modules yielded significant results (Mullick, Bauder, Sarner & Carr, in press). The results of the t-tests for dependent (paired) samples showed that participants rated the modules significantly more favorably on the post-test compared with the pre-test, indicating that they believed the modules to be effective. Open-ended responses further supported the finding. When asked to indicate the single most valuable feature of the module participants said : "All the hands-on, make and take, the resource materials and the Internet Web Page design". "Having the children involved in the Web Page construction." "The Web Page Development". When asked to indicate the single weakest feature of the module, participants said: "We are not connected to the Internet in our classroom. The Internet ideas are great, if I had access." Until we have technical support to post our own Web Pages, this seems to have little merit for usage". "The time- too much information in too short a time".

These comments support the observations made by the instructors during the workshop sessions. In spite of the difficulties with time-frame, accessibility to resources, availability for training sessions, and insufficient prerequisite skills, the workshops did provide the teachers with opportunities to explore and learn to use Internet tools in the classroom.

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Educating the Educators: Reflections from a Mature Public Sector ISP

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Abstract: The Education Network of Ontario is a telecommunications corporation creating a network community for and by Ontario's elementary and secondary educators and funded with assistance from the Ontario Ministry of Education. ENO provides industry-standard ISP services, web-based Intranet services, professional development opportunities and model classroom projects. This paper describes the process and outcomes of a project to investigate a small group of teachers with a wide spectrum of experience in technology as they became content authors at a specific level of sophistication with a commercial content authoring company, watAGE Inc.

Introduction/Context

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 seventy thousand teachers, administrators, trustees and education faculty, well over half of the K-12 education personnel of the province. The organization, a public sector Internet Service Provider has moved from project funding from the government to an independent not-for-profit corporation with an active and informed Board of Directors selling services to various levels of government.

The project has retained dial Internet access from any home or school location in Ontario and mail and conferencing services. However, ENO is fully retooled to enable browser-based moderated Intranet newsgroups, model classroom projects with interactive web creation scaled to suit the size of the province, and teacher development of industry-standard content. An industry-standard, no-cost, bilingual call centre supports all of the members and a web support site with automated tools for registration and access and service 'fixes'.

Teachers' Practices

Quantitative analysis tell us that our membership of 72,000 educators use the dial access an average of 9000 times a day with total connect time of 200,000 minutes a day in a summer or holiday month. The contention ratios on that access are the limits during the school year. In spite of that, a school month has statistics 50% greater to a total online time of nearly 9,000,000 minutes a month. However, the daily usage pattern changes from early morning through to midnight in the summer holiday to school times - late afternoon (after school) then throughout the night until leaving for school in the morning. Our servers handle as many as 100,000 messages a day. Some of our classroom activities sites register as many as 30,000 hits a day during peak activity times. This indicates a tremendous interest in and usage of the Internet and ENO resources; it also points out a real dearth of access equipment and time at the work site, at school.

Our anecdotal analysis and day-to-day experiences tell us a great deal about how educators use this suite of services. The major activity of the teachers continues to focus on the moderated conferences/newsgroups 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. This 'mode' has expanded to include professionals from the Addiction Research Foundation who help teachers work positively with addicted students and the addiction resources regularly circulated to schools as a part of this agency's mandate.

Smaller groups of teachers voluntarily initiate a series of professional activities such as writing primary school curriculum units themed on ideas such as two-dimensions – measurement, journalling, drawing, electronic and snail mail. This arose from a typical and very successful example, the web-based project devoted to showing young students how to conceptualize two dimensions with a central fictional character called 'Flat Stanley' (http://www.enoreo.on.ca/flatstanley/). 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.

Our largest project to date is an online environment to assist the Canadian National Marsville Program (http://mars99.enoreo.on.ca/index.en.htm), 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.

Background for this Specific Research Project: Educating the Educators as Content Producers

In all of its activity, ENO enables personal, small group and even province-wide professional development. One of ENO's projects involved developing on an on-line course about telecommunications and writing for the technical environment for senior secondary students in English or Business Studies. ENO found that there are two distinct types of professionals at this time. The creation of even modules of a course requires a tremendous amount of design, content knowledge and technical skill. Many teachers could create small modules of engaging material. However, the ability to create usable modules for online and fact-to-face which would withstand scrutiny with respect to content objectives and be sufficiently technical to sustain students at a distance was not a part of every teacher's agenda. Those who had deep skills and interest were interested in markup standards such as SGML and XML that would produce a stable course, testing procedures that involved feedback from students, and Intranet applications such as newsgroups and chat to support 'classroom routines'. We engaged watAGE Inc whose content authoring model can be reviewed at http://www.online-learning.com/ptw

We began to focus on a smaller group, six teachers with varied experience and computing skills from a very advanced user with several years of programming in an insurance environment and a number of computer-based class initiatives underway, through members with some computer training and supervision of student projects to two neophytes with low key-boarding skills.

Because this was initiated as a research project, with a fixed set of objects, time frame and budget, the teachers involved were permitted to select their personal areas of lesson development and the depth and

scope of lesson materials. All projects run interactively in a Web browser, can be distributed via CD or server to students and other classes and all can be used in conjunction with other computer expressions within any parts of the Board's curriculum.

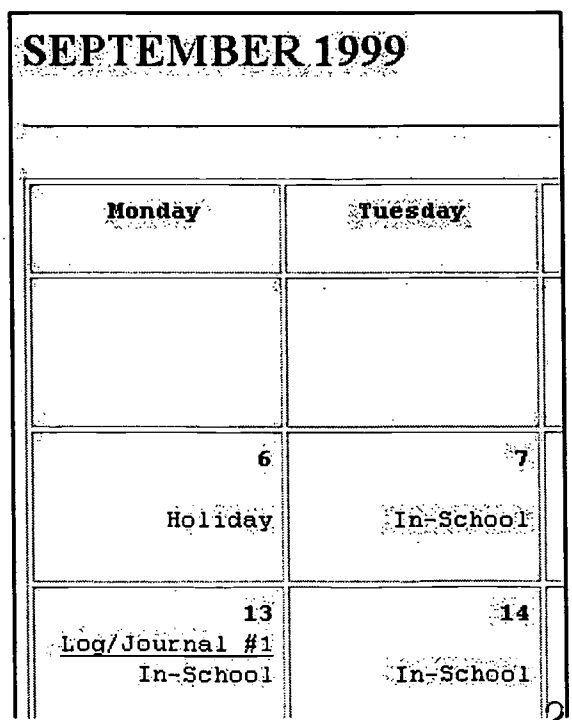
The six secondary school teachers worked with the staff from ENO and watAGE to:

- learn how to author online courses using Web editors and course authoring tools – specifically SGML-based technology, using an SGML editor, InContext 2.1
- learned how to convert these documents to either HTML or RTF and append "options" files such as HTML headers and CSS style sheets using the watAGE Converter
- create Cascading Style Sheets for HTML
- learn how to create projects for students, link modules of learning for other teachers and use shared resources amongst a group of teachers.
- learn how to instruct other teachers in some of the fundamentals of online learning, using the materials the group designed and built together

The tools available to the project consisted of:

- ENO's Conferencing site at server http://www.enoreo.on.ca. This includes all participants' accounts, the project's private conferencing area and the online basis for exchange of information, documents and access to each member's project, as well as group files and activities
- The GEAC Incontext2 SGML editor for the creation of all project modules
- 4 watAGE DTDs and converters to produce both HTML and RTF versions of all authors' SGML materials, including the CGI student questions for interactive surveys and online assessment of students
- watAGE's Course Administration Tool (CAT) to enable teachers to create and supervise accounts and locate and receive online assignments within the course structure.
- The 'Quiz' SGML software to enable instructors to develop interactive short-answer questions directly inside lessons, with the answers for correct and incorrect student responses and the abilities for student self-checking of progress and for the distribution of student answers to course databases for analysis and grading.

Teacher Projects: Creativity and Integration



Specific examples from the teacher projects will demonstrate their use of modularized and reusable components. We sought from the outset to initiate methods and subjects which seemed to encourage replication, both by their authors in related areas and potentially by other teachers and instruction groups.

DM developed an SGML-based Calendar, which converts into a simple HTML table with dates for the school year using the watAGE Converter. This Calendar feature, created by one individual, may be distributed easily and incorporated into any online course.

The Calendar, a portion of which is pictured on the left, enables teachers in any subject to outline

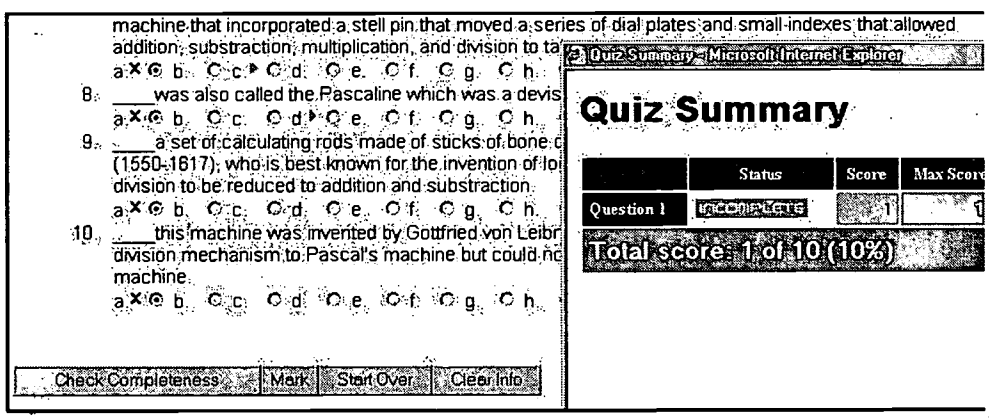
assignment due dates, important readings, and test dates for students in an easy to understand format.

In addition, students experience "just-in-time" learning through the live hyperlinks within the Calendar. For example, in the Calendar fragment pictured, a student may proceed directly to the "Log/Journal #1" assignment from the Calendar page. This prevents students from mishandling important information such as assignment and test dates.

watAGE has developed a Quiz facility that allows teachers to create interactive quizzes in SGML and render them as HTML through conversion. It enables instructors to generate interactive CGI scripts directly into lessons. These scripts allow a student to submit answers in a series of some eight short-answer formats – fill-in-the-blank, true/false, multiple choice, etc. The instructor combines these questions at any point in a lesson. The student's responses are displayed to the student for correction and support, used to initiate some remediation for the segment of the lesson if the results fall below a certain range and can be incorporated into the student's record for that segment of the lesson and course.

Teachers may select either "quiz" or "formal"; a "quiz" is marked on the desktop and the results are revealed only to the student for information (see the inset below for an example display). The "formal" test results are sent to the server to be marked, stored, and the results sent to a specified location such as the teacher's email address and the grade record.

This is an example of **DD**'s History of Computers test using the Quiz software.



Quiz accepts questions of many kinds: multiple choice, matching, fill-in-the-blanks, true/false. The instructor can enter these questions and their ranges of answers or they can be easily modified from existing models to suit a particular lesson need or class. Students can be linked at the level of the performance display results directly to materials which explain the reasons for acceptance or rejection of their answers. In this way students can determine for themselves the levels of their understanding of particular information and they can choose the amount of additional study they wish to undertake to assure competency in that subject.

'Quiz' inquiries can also be adapted to elicit users' reactions to issues and situations so instructors can incorporate evaluation into lessons at any point. These results can be used to determine learners' satisfaction and perception of the effectiveness of the learning materials. These can then be adapted to better meet users' desires and hopes. This point is often ignored or underestimated in teaching generally, but it is a major contribution to the success of online instruction in the system's ability to identify and correct weaknesses and errors which can all too easily go undetected in the interchange and bustle of a classroom.

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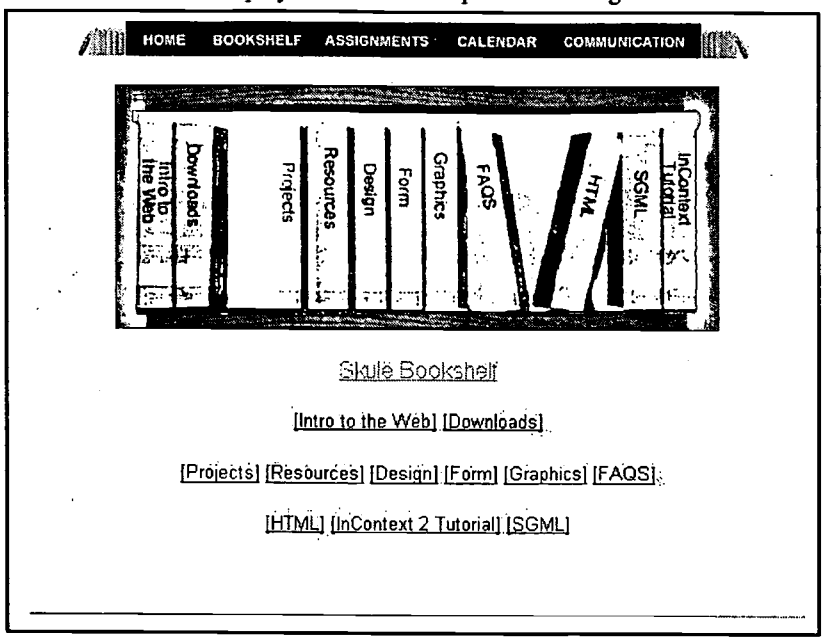
The BookShelf employs a familiar metaphor for the organization of course data. The modular units of the course, created by the teacher or many teachers, are stored behind a bitmapped image of a bookshelf. The books are coloured according to thematic threads or functionality – assignments as light blue, reference materials as dark.



Information may be created and shared with little imposition on individual teachers while the ability to collaborate increases immensely. MD1 and MD2 collaborated on their Web site and created a very extensive outline of the new Introduction to Information Technology in Business course:

Welcome to our section of the Waterloo Online Learning Project. We have created a number of lessons dealing with the **new Introduction to Information Technology in Business** course. We thought that since most schools would begin implementing this course in September 1999 and that they would be able to utilize new software (**Claris Home Page**) that this would be a practical application of online learning.

To date we have concentrated on Unit IV: **Electronic Communication** and in particular Activity 4: **Web Publishing.**

Activity	Time(Minutes)
Desktop Publishing	380
E-Mail and Voice Mail	76
Web Publishing	760
Office Presentation Tools	380
HyperStudio	760

- Activity 1: DeskTop Publishing
- Activity 2: E-mail and Voice Mail
- Activity 3: Web Publishing
- Activity 4: Office Presentation Tools
- Activity 5: HyperStudio

They used the structure of SGML to modularize their course according to Ministry requirements and sound pedagogy. In the figure on the left is an example of how their lesson plans are organized according to Ministry requirements and delineated for students with active links to each of the lesson activities. Using SGML helped focus the organization of their Web site and render the material in a logical, usable form for students.

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Conclusions

We used this company's commercial content creation model as a research tool to 'tease out' the support necessary for a set of teachers to create sophisticated lesson and modular material. It was a great deal better and more productive than the HTML primer and training approach tried the first time. It was successful because the group was very hard working and compatible. However, the group required a great deal of time with highly technical personnel to move to a more sophisticated structure and content.

The process is not finished after three months with this level of support. This group will need to be supported and expanded over the next year to create and test online materials. To this point there is little or no board-level support for this steep learning curve and the resources to support it. This has proven to be a very expensive exercise that is not first on the funding list when so many educators need so may different kinds and levels of professional development.

Our deep concern is the ultimate cost to the public education system if teachers do not feel like 'producers' but are relegated as a group to the role of passive consumers of very expensive, dynamic web-based materials.

This research model should be created as a course and distributed to instructors and students via a CD which would include the course content on the BookShelf, all software in a program which installs it on the individual's PC, and reference materials for online processes and information retrieval. Links could be made as needed from the individual's machine to the course web server for the exchange of email, assignments and participation on group online activities. The CD could also contain instructions and tutorials in the authoring lessons and project modules. The resulting 'course' would provide a quite complete synthesis of teacher needs and course services. This professional development model works; it, or a similar model needs to be aggressively disseminated to foster Canadian educators as producers, not consumer of online materials.

Preparing Teachers to Investigate the Effects of Technology-Supported Instruction in Effective Partnership with Researchers

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Abstract: This paper describes a procedural model aimed at forming teachers to conduct research in technology-supported instruction within a context where researcher and teacher work effectively together to promote knowledge advancement. First the steps of the model and the roles of the teacher and the researcher within each one of them is explained. A study conducted according to the model is then summarized. In its final section, the paper suggests a number of variables that may optimize researcher' and teacher's inquiry efforts and attitudes within the model's framework.

Introduction

According to the document "NCATE 2000 Standards Revision" issued by the National Council for Accreditation of Teacher Education (NCATE, 1999) teacher candidates "should understand the importance of using research in their teaching" (p. 8). However, if teachers are to attain the Council's goal, they should be given the opportunity to actively construct such understanding through participation, as major players, in the research endeavor.

Two noteworthy efforts at providing such opportunity include practice-reflection and action research. A proponent of the former, Schön (1987) highlights the "need to create or revitalize a phenomenology of practice that includes, as a central component, reflection on the reflection-in-action of practitioners in their organizational settings." (321). Weighing the value of the practice-reflection stance, Bereiter (1999) contends that although individual teachers may benefit from taking a reflective stance their findings don't contribute to advancing the knowledge of the field and so achievements reside in the culture of practice.

The second effort is action research that aims at engaging teachers as reflective researchers of their own classroom decision-making processes, the learning of their students, or their interactions with them. In its early forms, practitioner-based research consisted of isolated cases of theory application to the specifics of a particular site and learning situation (Wallace, 1987). More recently, this type of research has been viewed as decisive for the generation, not just the application, of instructional theory (Miles & Darling-Hammond, 1998). Critics of the approach (Wells, 1994), however, contend that its possibilities to advancing knowledge are limited because, left in their role of researchers and in charge of identifying research topic and procedures, teachers are prone to address only their local needs and loose sight of the larger context of inquiry.

An alternative to the above efforts lies on what Bereiter labels a "hybrid culture" (1999, p. 4). A culture that demarcates the goal of the teachers, guiding students' learning about the world, from the goal of the educational researcher, understanding cognitive and social processes operating in classrooms. But, at the same time, a culture that encourages continuous dialogue between the school and research communities to promote symmetric knowledge advancement (Scardamalia, 1999).

How should teachers be prepared to contribute to research within the framework of this hybrid culture? For Bereiter, a possible answer resides in providing teachers with "intensive *training* in teaching for understanding" (1999, p. 32). However, the training that Bereiter suggests should encompass not only teaching for understanding but also *researching* for understanding research. It is through appropriate research practice that teachers may gain

insight to recognize and promote the type of classroom ideas and experiences that researchers can make to serve more principled kinds of knowledge integration.

This article takes a first step toward normalizing a way by which to provide teachers with that type of training. To this end, a research procedural model is presented first. A k-12 study developed according to the model is summarized next. Finally, a reflection on some of the variables that may improve teacher' and researcher's efforts within the model framework is provided.

The Procedural Model

Diagrammed in Figure 1 there is a six-step procedural model that contemplates the interest-, skill-based distribution between researcher and teacher of the variety of tasks involved in an educational research project.

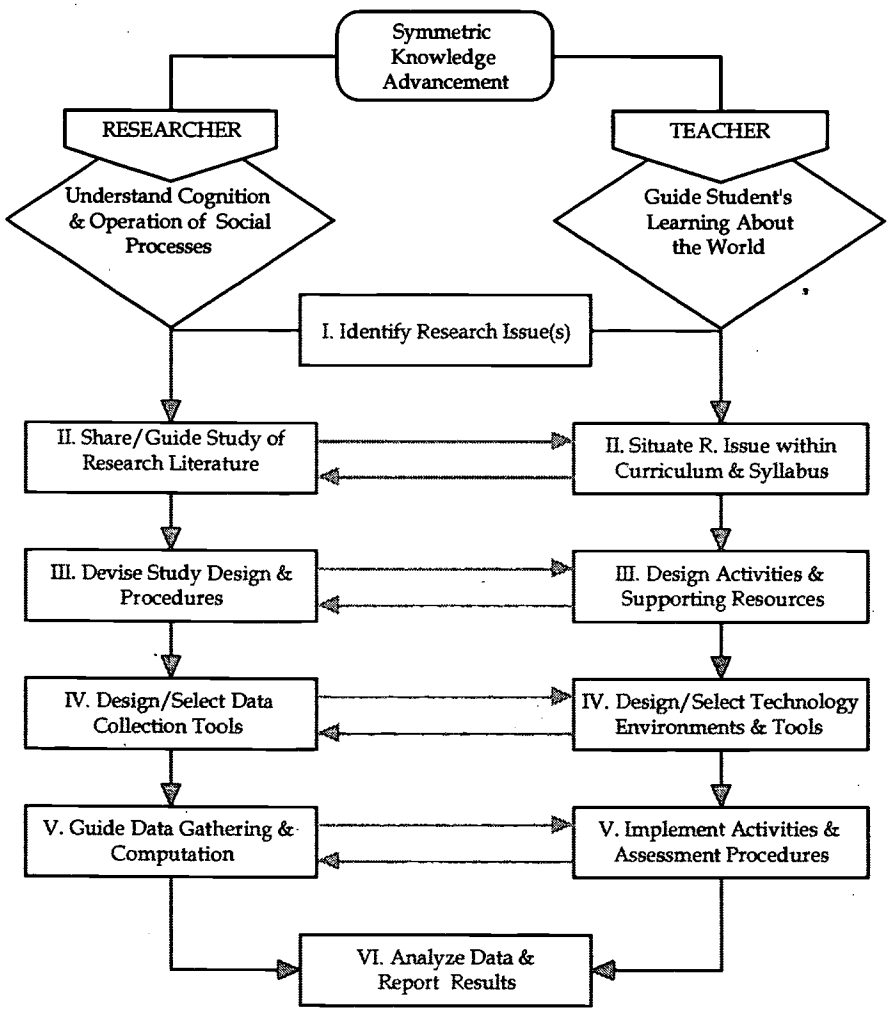

Figure 1. A six-step procedural model for educational inquiry

In steps I and VI of the model, teacher and researcher work in the same tasks. Whereas in steps II through V they work in different but sequentially related tasks, the work being, as indicated by the dimmed horizontal arrows, mutually interactive.

In step I, teacher and researcher act collaboratively to identify the research issue. Through this shared responsibility, the model aims at generating a fruitful comparison and contrast between the researcher's views on the issue and its theoretical and empirical contexts, and the teacher's views on it derived from his/her practice.

In step II, the task of the researcher concentrates on processing and studying the theoretical literature relevant to the research issue(s) addressed in the project. The task also includes sharing with the teacher the selected literature and guiding the teacher's own investigation of the practical literature pertinent to the study. Through sharing and mentoring, the model takes into account the fact that it is the impossibility of the demand, rather than the lack of interest (Wells, 1994, McGrath, 1999), what frequently prevents teachers from addressing this key component of any investigation. As Branson (1998) observes, "research duties be informed by a massive literature that cannot possibly be mastered by individual practitioners (p. 3).

On the other hand, the main task of the teacher within this step is to situate the research issue(s) within the requisite curriculum and syllabus so as to satisfy his/her administrative and moral obligations. Indeed, the teacher has to figure out how to address the research issue through activities that satisfy in an optimal way the imperatives of the curriculum (Shulman & Tamir, 1973). From a moral standpoint, because research may consume a considerable amount of in-school time and because that time is designated for instruction, the teacher has to design classroom experiences that are relevant to the main research beneficiaries: the students (Wong, 1995).

In step III of the model, the task of the researcher is to fulfill two basic research requirements, which are careful design and systematic procedures. If research findings are to transcend the local practice and contribute to the advancement of knowledge those procedures should be handled by the researcher rather than by the teacher, as is often the case in action research.

The task of the teacher within this step is to design the experimental activities and supporting resources. Because of their practice-grounded views on curricular design, teachers are very well equipped to address the formal aspects of the design activity, including specification of activity's objectives, delivery methods, and required classroom organization. More importantly, because of their first hand knowledge of their students, teachers are in a unique position to promote, if given the freedom and means to do so, activities that foster students' beliefs in the power and value of their own ideas (Wong, 1995).

Within step IV of the model, the researcher chooses, or designs and field-test, the appropriate data collection instruments, whereas the teacher designs the technology-supported environment and chooses the software tools to be used in the study interventions. To effectively address his/her task at this step, the teacher should have a degree of technological literacy equivalent to the "Appropriation" or "Invention" phases of Dwyer, Ringstaff, and Sandholz's (1990) model of teachers' adoption of technology. Indeed, according to that model, the computer expertise supposedly attained by teachers in those phases respectively enables them to experiment and to implement "fundamentally new forms of teaching and learning" (Gearhart, et al. 1990: 42).

In step V of the model, the researcher guides the teacher's gathering of data and proceeds, or delegates to qualified personnel, with their computation. Conversely, the teacher implements the research activities and, with the appropriate coaching from the researcher, addresses the assessment procedures. The researcher's coaching becomes crucial at a moment when, as Schön (1987) observes "there is a movement toward new ways of thinking about research and practice--ways that emphasize the merits of full, qualitative description of phenomena and the utility of well worked-out cases of intervention..." (p. 312). Since the procedures to assess such interventions are bound to be complex, training in their use should be provided to ensure reliability and replication.

Finally, in step VI, the researcher and the teacher team once again to analyze data from the study and to interpret the results. Collaboration at this level is particularly important if, adopting a contextualized perspective (Means et al. 1993), the study focuses on finding out specific outcomes as well as on understanding the relationships among various elements of the study and the ways that contributed to those outcomes.

Through its various steps the proposed procedural model may provide teachers with the amount of training and the degree of guidance they need to actively "feel" and appropriate the research practices, rather than just learning about them from "experts." Indeed, the model, because of the extensive exposure to training it secures throughout its steps, may have a longer lasting impact on professional skill improvement than apparently do "nutshell" professional development activities (Fullan & Stiegelbauer, 1991). Also, the model features "procedural specifications" of a developmental nature (van den Akker, & Plomp, 1993) that, by providing how-to-do-it advice, may help teachers elaborate on the what, when, how, and why of the incorporation of research into their teaching.

Application of the Model

The above model was applied to a study conducted by the presenters that assessed the effectiveness of a course for 9th bilingual graders, *Español 5/6*. The course addressed San Diego City Schools District's (SDCS) mandatory standards for Language Arts through a literature-driven (Shehanan, 1997), technology-supported curriculum, and was grounded on social learning (Bandura, 1971) social development (Vygotsky's, 1978) and collaborative learning (Pea, 1994) principles. Effectiveness of the course was comprehensively evaluated through measuring its short- and long-term impact on the language performance, technological literacy, collaboration skills, and learning perceptions, of eighty-six students in three "low," "average," and "high" achieving classes.

The study featured a causal-comparative design (Cook & Campbell, 1979) and, to triangulate results (Yin, 1994), used data from thirteen quantitative and qualitative sources. Eight of the sources included the subject's scores on the course four partial exams, the pre- and post-course Spanish Placement Test (SPT), the final electronic portfolios, and the post-course activity and were aimed at verifying language comprehensive performance and growth. The portfolios and post-course activity sources also served to verify the level and evolution of subjects' technological skill.

The ninth source, the videotape records of subjects' interactions while working in pairs or groups, was used to assess the nature, breath and depth of the collaboration processes that took place during the course and their impact on subjects' performance. Record analysis focused on the occurrence, length, and supporting tools of six types of learners' interactions: Orienting, Information Seeking, Information Sharing, Monitoring, Collaborating Writing, and Collaborative Authoring.

The remaining four sources comprised the subjects' ratings on the pre-, post-, and delayed learning surveys, and the subjects' answers to the three open questions of the delayed Perceived Learning questionnaire. These sources aimed at unveiling subjects' perceptions of the learning gains (linguistic, literary, and technological) they derived from the course and the value of the course collaborative activities.

Data were collected using the SPT, four limited-response partial exams, the Portfolio Evaluation Criteria, the Post-Course Activity Evaluation Criteria, the Learning Interactions Recording Form, and the pre-, post-, and delayed Perceived Learning questionnaires.

Course activities were organized around four units, "Poesía," "Civismo," "El Cuento," and "La Novela," which drew on a series of fictional and non-fictional reading from different Chicano and Latin American writers. Students were guided in their use of the print and www resources, and the software tools including *ClarisHomePage, ClarisWorks, Graphic Converter, HyperStudio*, and *Ofoto,* required to complete the activities. Course syllabus and reading materials were distributed via the World Wide Web.

Implementation of the course extended over a four-month period, from February 1st to May 31 of 1999. Using the web and the selected software tools, before, during, or after class time, and working mostly in pairs or groups, students completed the course activities and the end-of-course electronic portfolios. They also completed the SPT, the four partial exams, and the pre- and post-learning perception questionnaires. Six months after the experiment, and to assess the long-term effects of the course, students completed a web activity that required their use of the skills they had learned in the course and filled in the delayed Perceived Learning questionnaires.

Results, which can not be fully described here due to paper length restrictions, indicate that students in all course sections increased their linguistic, literary, cultural, and technological skills. Students also gained in learning confidence by participating in curricular experiences relevant to their socio-cultural background and mastering technology tools that would had been otherwise out of their reach. (A complete report of the study, including all descriptive statistics, will be published elsewhere).

Optimizing Variables

For the proposed model to generate that *need* for research that according to Bereiter (1999) should be "keenly felt by the practitioners as well as the researchers," (p. 24) a number of variables relevant to the researcher and the practitioner should be taken into consideration.

Regarding the researcher, a crucial variable is his of her true involvement in the research endeavor. Frequently, researchers are brought into a research project, or various ones, to ensure the project's allocation of

funds. Instead, the researcher should commit himself/herself to a research project in all its steps and in true partnership with the teacher.

A second variable relevant to the researcher is flexibility. Researchers should keep in mind that the complexity and unpredictability of classroom and school environments may affect the most sophisticated research design and that, consequently, they should learn how to readjust it if necessary. Learning first hand the constraints that teachers confront on their organizational settings and the ways they cope with them may be very instrumental in this respect.

The third researcher-related variable includes the acquisition, or cultivation, of negotiation skills. Indeed, researchers should be able, through a constructive process of listening and negotiation with teachers and school administrators, to conciliate potential conflicting views about a research project and to move teachers' interests on and solutions to local problems to a level where the solutions may have a more universal application.

On the other hand, if teachers are to participate in educational research projects in the ways suggested here, they should be given the appropriate recognition and incentives. Regarding recognition, teachers should feel that they are not viewed as subordinate research collaborators with a role often limited to the distribution to and collection from students of data gathering instruments. As pointed out elsewhere (van den Akker & Plomp, 1993), teachers should no longer be viewed by other education players "as 'gatekeepers' who should be overwhelmed or circumvented, but as partners in interactive and purposive learning processes" (p. 12).

With respect to incentives, appropriate mechanisms should be put in place to give teachers involved in research projects equitable release time so that they can devote to those projects the large amount of time and energy they require, particularly when they address issues pertaining to technology-supported instruction. However, reward mechanisms, particularly those in the form of release time or merit increase, should be designed very carefully to avoid professional rivalry that distorts and damages the collegiality that should inform the quest for effectiveness.

Finally, two incentives, of a more "ethereal" but very powerful nature, particularly for highly committed teachers, should be considered. One the assurance that teachers' research effort won't be an isolated one with little or no impact outside their classrooms. And the other, the assurance that teachers' understanding of the implications of a project is a worthwhile goal *per se*, independently of the research "success" or "failure" (Wong, 1995)

When occurring in combination, the above variables could help researchers and teachers to work toward resolving what Schön (1987) defines as *"The Institutionalized Dilemma of Rigor or Relevance"* (p. 309).

Conclusion

This article has highlighted the need for developing a research culture that, on a bi-directional and continual basis, draws from the knowledge and experience of both teachers and researcher to advance and integrate knowledge. More importantly, the article has proposed a procedure model, and summarized an illustration of its application, to prepare teachers to participate effectively in such culture. Both the research culture issue and the procedure model are topics for future discussion and testing.

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Media Literacy

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Abstract: This paper identifies and defines the evolving concept of literacy with regard to Media Literacy and Digital Literacy. The importance of Media/Digital Literacy for teachers and students is explained. An outline of a course, EDTL 639 - Media Literacy for Teachers, recently introduced into an M.Ed. in Classroom Technology program for teachers, is offered. Examples of important resources are given and course participants' feedback is covered.

Introduction

In a now widely accepted definition stemming from the Aspen Institute's National Leadership Conference on Media Literacy Education, held in 1992, media literacy has been defined as the ability of a citizen to access, analyze, evaluate and produce communication in a variety of forms (Aufderheide & Firestone, 1993). While media literacy as part of the curriculum is well established in every other major English-speaking country in the world, it has been only recently that a growing movement in the U. S. has begun to integrate media literacy into the curriculum (Tyner, 1998; McBrien, 1999). Kubey and Baker (1999) report that in the last few years progress is finally being achieved, over a decade after Ernest Boyer, then president of the Carnegie Foundation for the Advancement of Teaching, stated, "It is no longer enough simply to read and write. Students must also become literate in the understanding of visual images. Our children must learn how to spot a stereotype, isolate a social cliché, and distinguish facts from propaganda, analysis from banter, and important news from coverage...." They report that media literacy concepts are now included in the curricular frameworks of 48 of the 50 states. They further report that, of the 50 states, media literacy concepts are included in English, Language Arts and Communication strands in 46 states; in Social Studies, History and Civics strands in 30 states; in Health and Consumer Skills strands in 30 states; and in a Media strand in 7 states. They also report that most state curriculum frameworks include media literacy concepts in at least 2 of the identified 4 strands. Additionally, Hobbs (1998) states that media literacy as a subject in teacher education programs is growing, as is involvement by health groups such as the American Academy of Pediatrics. Indeed, as Tyner (1998) has pointed out, literacy in the information

age has expanded beyond traditional alphabetic literacy to include a variety of media which are, increasingly, digital (hence the term digital literacy). An ability to access, analyze, evaluate and produce communication in various forms has become essential to successfully functioning in society, both economically and as a citizen of a representative democracy.

Key Concepts

Regarding media messages, key concepts of media literacy have been identified as follows:

1. All messages are constructions.
2. Messages are representations of social reality.
3. Individuals negotiate meaning by interacting with messages.
4. Messages have economic, political, social and aesthetic purposes.
5. Each form of communication has unique characteristics.

(Hobbs, 1997)

Given these key concepts and the importance of media literacy, a graduate course, EDTL 639 - Media Literacy for Teachers was recently added to the Master of Education in Classroom Technology program at Bowling Green State University. The program follows the national guidelines in computer education developed by the International Society for Technology in Education (ISTE) and adopted by the National Council for Accreditation of Teacher Education (NCATE), (ISTE, 1992; NCATE, 1992; Thomas, 1993). The course provides a variety of experiences for students and helps to further implement Standard 2.4 of the NCATE/ISTE guidelines for the program:

"Candidates will use computers and other technologies in research, problem solving, and product development. Candidates use a variety of media, presentation, and authoring packages; plan and participate in team and collaborative projects that require critical analysis and evaluation; and present products developed." (ISTE, 1992)

Course Intent/Description

Constructed around the concepts identified above, the course involves several key components/approaches to the subject of media literacy. First, this offering combines material on media literacy concepts in relation to media such as web sites, television, video/film, still photography, advertising, and the news, with an appropriate hands–on component involving video. (In the past, some offerings of similar courses at other institutions have not included such hands-on experiences - this course is approximately 40% hands-on.) Second, the course approaches media literacy from an acquisition model (Desmond, 1997). This model goes beyond the protectionist model which tends to demonize media as something from which citizens need to be protected. Instead, the acquisition model presents media as a positive opportunity for learning activities. Such opportunities are focused on social artifacts whose meaning, use, and value can be questioned through access, analysis, evaluation and production. Third, the course investigates the value of media

literacy both as an understanding of various media constructions as art forms (television, web sites, advertising, etc.), and as an understanding of the potential effects of various media products on citizens in a representative democracy (Tyner, 1998). In addition, the course builds on concepts from a previous course in the program, EDTL 611 - The Curriculum, where curriculum and the curriculum development process are presented as representations of numerous ideologies in society. These various ideologies continually vie for a voice in curriculum and instructional practice (including the integration of technology into the schools). As students analyze, evaluate and produce various media messages, they relate that work to the climate of the schools and their roles as teachers, technology users and change agents.

Additionally, the fact that we approach Media Literacy from a positive, acquisition model (mentioned above) as opposed to the more negative protectionist model, is strongly emphasized to students. The importance of analyzing, understanding, and producing media in our culture as a way to help produce good citizens in a democratic society and as a way to understand the highly developed art of producing (constructing) modern media are reiterated to students as important course themes. Also, three interwoven strands in the course are identified to, and experienced by, participants: 1) the in-depth, understanding of relevant theory and research strand, achieved partly through readings and discussion; 2) the hands-on strand, including analog camcorders, digital camcorders or hybrid digital/Hi-8 camcorders, editing video on the computer, web searches for resources and also web site analysis from a media literacy perspective etc.; and 3) the practical strand - including three assignments whereby students integrate media literacy into some aspect of the curriculum in their current professional position. The course catalog description follows.

EDTL 639 - Media Literacy for Teachers (3) Fall, and on demand. Introduction to media literacy and its place in the curriculum. Techniques for analyzing media products (e.g., ads, television, film, news, web sites, music videos) and application of media literacy to the curriculum. Introduction to video/camcorders as classroom tools including student-created video. Prerequisite: EDTL 611 - The Curriculum, or permission of instructor.

Course Objectives/Selected Materials

A listing of specific course objectives follows.

To provide student's with:

• an understanding of the importance of digital literacy/media literacy;

• experiences and skills to analyze the following from a media literacy perspective: Television; Video/Film; Music Videos; Advertising; News;Web Sites;

• an understanding of the importance of "reading," and "writing," various media in a democratic society;

• an understanding of the importance of video and still photographic images and their potential integration across the curriculum as student-created and analyzed products;

• the skills and experience to use camcorders (analog) to create in-camera edited videos;

• the skills and experience to use digital camcorders to create videos;

• experiences using computer-based video editing software;

• the opportunity to create assignments (and analyze the products created) which integrate student-created video products into the current curriculum;

• the opportunity to examine, evaluate and recommend relevant web-based resources regarding media literacy;

• the opportunity to meaningfully integrate media literacy concepts and skills into a unit length, or longer, portion of the existing curriculum. regarding, but not limited to, one, or more of the following areas: Television, Video/Film, Music Videos, Advertising, News, Prevention Issues, and Web Sites;

• opportunities for reading/reflection and discussion of significant content in the area of media literacy theory, research and application

• an opportunity to learn about and apply The Partnership for Media Education's (PME), stated goals for media educators: 1) We teach that listening to a variety of voices deepens our understanding of complexity: 2) We teach children not to accept facile interpretations of challenging issues, but to think critically about all aspects of a message: the content, the source, the motive in creating the message, its form, and more; 3) We ask them to probe more deeply beneath the surface so that they can uncover complex truths and come to their own conclusions; and 4) We invite those with different viewpoints to join with us and participate in the dialogue.

A wealth of material is available regarding media literacy, including numerous informational, advocacy and commercial web-sites. Key organizations/projects such as: The Center for Media Literacy, The Media Education Foundation, The Just Think Foundation, The New Mexico Media Literacy Project, The Center for Media Literacy, The Media Literacy On-line Project, etc., provide gateways to relevant, helpful material and opportunities for communicating with university and K-12 instructors as well as students with an interest in media literacy. The major conference, Summit 2000, to be held in Toronto May 13 to 17, 2000 (http://www.summit2000.net) will build on last year's exceptional National Media Education Conference held in St. Paul, Minnesota as a source of information, networking and inspiration. A sample of videos currently used in various ways within the course include: *Tuning In to Media* (Center for Media Literacy), *Teach the Children* (California Newsreel), *Production Notes: Food for Thought* (Video Data Bank: The Art Institute of Chicago), and *The Ad and the Ego* (California Newsreel).

Participant Feedback/Conclusion

Student response to the idea of such a course as well as to the course experience itself, has been extremely positive. Participants understand the rationale for this offering and welcome the opportunity to explore the topics in the course, gain more skills in the use of technology, reflect on where media literacy fits into their curriculum, and then implement projects in the schools. In the near future the course will be available as an elective to students in another program within our division, a Master of Education in Curriculum and Teaching degree. While adjustments may need to be made to the hands-on portion of the course depending on students' prior experience (or lack of prior experience) with technology, the hands-on component will remain in the course. In such an instance, students will still gain all aspects of the experience, as they access, analyze, evaluate and produce media in a variety of forms. In both programs, such experiences are timely, important and highly valued by teachers and K-12 students alike.

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Empowering Minds by Taking Control:
Developing Teachers' Technological Fluency with LEGO Mindstorms

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Abstract: This paper documents "Empowering Minds," a project that has established a partnership between St. Patrick's College (Education faculty of Dublin City University), the Irish National Centre for Technology in Education (NCTE), the Media Lab at the Massachusetts Institute of Technology (MIT), and selected Irish primary schools. In this project, we are collaboratively designing and implementing a program for the use of control technology with primary school children, which it is hoped will open the gateways to new ways of learning in schools.

Background

Funding for this project is provided under the NCTE's (www.ncte.ie) Schools Integration Projects (SIP) initiative. This initiative is funding a wide diversity of Information and Communications Technology (ICT) based projects across the first and second (elementary through high school) levels of the educational system in an attempt to identify good practice which can serve as models to be replicated across the educational system.All Irish schools were invited to respond to the SIP initiative in October 1998. The four schools selected are loosely representative of the main school types prevailing in Ireland (large middle class suburban; inner city disadvantaged; medium semi-rural; two teacher rural). The participating teachers within each school volunteered their involvement in the project. The experience level with ICT among the teachers would range from complete beginner to experienced. The project builds on previous research on educational applications of control technology developed at the MIT Media Laboratory. We are using the commercial version of the MIT "programmable brick"—the LEGO Mindstorms Robotics Invention System (Martin, 1988; Martin et al, 2000 [in press]). We are also working with teachers/researchers who participated in early programmable brick research (Martin, 1996; Hayward, 1995).

Rationale

Across the globe there is an urgent need to develop and use educational frameworks for integrating ICT into the school curriculum. These frameworks needs to be informed by sound educational theories and practices, as technology of itself does not directly change teaching or learning. Therefore, we must encourage a careful and intelligent meshing of educational and technological agendas. Much prior research has focused predominantly on the child in the educational environment. We believe a change of focus is required; the key to successful implementation of technology is the teacher.

Attention, therefore, needs to be directed at the 'chief agents of change'—the teachers—and how they view not only technology, but more importantly themselves, the learner, and what is to be learned. Assumptions about the nature of the learner and the teacher in the process of learning will have implications for not only how technology will be used in education, but also for everything that happens within the classroom. The most common uses of technologies in schools today generally reflect instructionist educational philosophies, which view students as recipients of information dispensed by the teacher or by the technology. Rather than the acquisition of specific skills or knowledge, "the real potential of technology lies in its capacity to support pedagogical approaches that encourage students to become active participants in their own learning and to acquire critical thinking skills and more complex understandings" (O.T.A., 1995, p. 126).

Teachers' assumptions about the nature of learning need to be challenged. Primarily, we would hope that the project would act as a catalyst to challenge the perceptions and assumptions about learning which it is hoped will result in a major change in classroom practice at primary level. Teacher education needs the same conditions as good classroom learning. Teachers need time to experiment, reflect and discuss with others in a supportive learning environment before a shift in their thinking can occur. We believe that the "real promise of technology in education lies in its potential to facilitate (these) fundamental, qualitative changes in the nature of teaching and learning" (President's Report 1997). Technology, in the proper context and a supportive learning environment, can facilitate the teacher as a learner. Therefore the design of an effective computational learning environment should ".....emphasise the importance of constructivism and the learner's activity in building mental models of .... knowledge. The environment should ... support conversational and collaborative learning ...give sufficient feedback and be able to adapt to the needs of various learners."(Ruokamo-Sari & Pohjolainen, 1997, p.82) It was with this premise in mind that the project was organised from a constructivist perspective.

According to the constructivist's learning theories, knowledge is individually constructed in a social setting. Consequently each individual must be active in the learning situation and be responsible for their own learning. If the learners are actively involved in the learning process, the experience is 'meaningful' and motivation levels will rise accordingly (Ruopp, 1993; Thompson et al, 1992, pp.11, 68; Thornburg, 1994, pp.24-25). If teachers see themselves as learners along with their students, they will be inspired to implement change both in their classrooms and in schools in general.

Project Design

In the proposal to the Schools Integration Project, we presented the following plan as 'Phase One' of our larger goal to bring meaningful technology design projects to the Irish first level schools in a large-scale way. As of this writing, we are midway through the 1999–2000 academic year.

March 1999	An initial workshop with selected teachers, parents and children
May - June 1999	Delivery of materials to classrooms and exploratory work by teachers in their classrooms
August1999	Second workshop with teachers
September 1999 through June 2000	Full classroom project work

Table 1: Phase One of Empowering Minds Project

Materials and Concepts

For the technology basis, our project uses the LEGO Mindstorms set of robotic design materials. This set of materials includes the "RCX Microcomputer" (a hand-held computerised LEGO brick that can be built into LEGO models), electronic sensors, LEGO Technic components (motors, gears, axles, and wheels), and the standard set of LEGO building bricks. These materials allow children and teachers to have rich and in-depth explorations of key ideas in control technology, including (but not limited to!) mechanical design, power, speed, gearing, friction, sensing, feedback, software design, and project management.

A significant part of the design experience in working with the Mindstorms system is the programming of one's model. We evaluated two different software packages for this purpose: RoboLab, marketed by LEGO Dacta (the school division of the LEGO Group), and RCX Code, part of the retail package. Most of our teachers gravitated toward the RCX Code software because it is adequately powerful and substantially easier to use.

The Initial Workshop, April 1999

After the teachers were selected, the initial workshop was conducted at St. Patrick's College of Education, in Drumcondra (a suburb of Dublin). The workshop ran for five days over the Easter holidays. For the first two days, we had invited participation from two parents and four children from each of the four selected

schools. The final three days were spent working exclusively with the teachers chosen for the project. This format was an interesting innovation; an infectious enthusiasm from the children greatly contributed to the excitement of all, and built a great base for subsequent parental involvement. The days with the small group of teachers were focused and productive.In this workshop, teachers were asked to design their own projects, a novel experience for many. They all engaged wholeheartedly with the materials and were so immersed they were reluctant to leave even for lunch. There were times of frustration as they struggled to achieve their goal. Ultimately, however, they achieved success and the sense of accomplishment was palpable. These experiences opened up many conversations about how to implement this approach in the classroom and how to get the children started—whole class at once or sub-groups? From the beginning, it was apparent to all that we would be relying on the intuitions and expertise of the teachers to implement classroom models effective for their own particular situations.

Exploratory Work in Classrooms, May - June 1999

After some problems, material was procured and delivered to the schools, with approximately four weeks left in the school year. This was just enough for teachers to bring the materials to their children in a limited scale, and themselves obtain this practical experience which would serve as the basis for subsequent reflection in the summer workshop.The exploration with the materials before the second workshop proved valuable in many respects not only for the direction taken in the second workshop, but also for the teachers' implementation approach for the autumn term. The teachers made specific requests for the workshop content as they realised the need to develop their own understandings of the principles of building solid structures, how gears worked, etc. These inputs were acted upon and the second workshop was designed to accommodate the teachers' expressed needs.

As an example of 'lessons learned', one of the teachers working with the inner city children before the summer quickly realised that the majority of these children had no prior experience of building with LEGO. They had major difficulty trying to follow even the simplest of building plans, and this combined with their social background made it very difficult for them to share materials. Consequently, attempting to use the materials with the whole class simultaneously was a recipe for disaster. The teacher tackled these issues by enlisting the help of the support teacher and the infant teacher in the school. Withdrawing a small group of six children each time, she slowly worked through constructing simple models, with and without plans. In this way, she was able to give each child the attention he or she required. The teacher also worked on developing the children's ability to work together. As the children became more experienced, she began withdrawing two groups at a time and has now progressed to having the whole class working on their own models at the same time. This approach combined with the time spent organising the materials has been the key to progress. This teacher plans to have weekly whole-class building sessions and begin to withdraw the small groups again when the children are ready for programming.

The Second Workshop, August 1999

We were fortunate to be able to bring in John Bilotta, a district technology co-ordinator with over twenty years of primary classroom experience, who had participated in previous MIT research on programmable bricks. We used a substantially more structured format in this second workshop, providing teachers with focused half-day experiences rather than a multi-day open design process. These half-day focused activities proved invaluable for helping the teachers gain some important insights. For example:

The Silent Game: In this activity one person improvises a model, another responds by adding on to it, and a third observes. Although less than 20 minutes was spent on producing the models, many of the builders had a strong sense of it being 'theirs' and had mixed feelings about the Responders adding on to them. The Observers' presence highlights the different possible interpretations of builders' intentions. For the teachers, this crystallised the need to respect children's sense of ownership, and made them realise that it is hard to tell children's intentions from only seeing snapshots. This was brought into relief for the group by Joan's response to John's model. He hadn't intended to make a pattern, but she replicated his model, taking something that he intended as 'random' and making it a clear pattern.

Slow-car Building Challenge (Build the slowest car possible that still moves): This challenge drove home the theory and practice of gear reduction, and pointed out the complexity of designing successful models. One group had lots of trouble building the supporting frame around the gears and didn't finish until the next day. Another group's car fell on the floor and smashed to a thousand bits. They

commented that it was the best thing that could have happened: they needed a full redesign, but had not been prepared to take their model apart!

Building a Learning Community

Other people are the greatest source of alternative views (von Glasersfeld, 1989) that stimulates new learning. A key feature of this project is that the teachers and children are externalising their thinking and reflecting on what they are doing and how they are learning i.e. thinking about how they think. All the children are keeping a log into which they record the models they have built illustrating it with diagrams and pictures. Each teacher is keeping a journal in which they record how the project is developing in their classroom, problems they have encountered, things that have worked particularly well for them, etc. Reflecting on how they are learning and discussing it with the children in the classroom and within the group is providing the opportunity for them to realise that everyone has their own way of understanding. As they work together they are realising the importance of dialogue and the interactions among group members, as they struggle to solve their problem collaboratively. Two things are happening simultaneously: teachers are engaging in a learning environment, and are reflecting on the process of how they are learning. They are learning *with* technology, not *about* technology. Technology if harnessed in this way could provide the vehicle for lasting change and for improving learning.

The importance of a learning community where ideas are discussed and understanding enriched is critical to the design of an effective learning environment. "Teaching, more than many other occupations, is practised in isolation, an isolation that is at times crushing in its separateness." (Maeroff, 1988, p.3). But "increased communications is one of the biggest changes technology offers ...to .. transcend the walls of isolation" (O.T.A., 1995, p. 2). Therefore, if this power of technology is harnessed and used in a collaborative environment, an effective learning community can be established among educators. Current problems of isolation will be reduced, the community of learners widened, and classroom walls, as they exist at present, broken down. To this end, a mailing list was set up for all participants in the project. Initially, use of this was confined to the more experienced users of the group. However, one of the teachers suggested that we mark Netd@ys (www.netdaysireland.ie) by getting the children emailing to the group a sample of some of models they had been working on. This was the springboard that was needed and it provided the context for children to begin to communicate with one another. It has generated excitement among the children who, inspired by what others had been working on, began to incorporate or adapt some of the ideas they had seen in the emails into their own models. The emails also sparked off interesting discussion as children pondered design issues e.g. how a particular gear train had been structured and what effect it had on the movement of the model. We hope to develop these links with other schools and institutions nationally and internationally. This will provide teachers and children with a relevant and meaningful context to make use of the internet and email as valid communication tools for accessing information and 'comparing notes' about their designs and the problems they are experiencing.

Removing Barriers

Other research has identified potential barriers for teachers' effective use and integration of ICT within the curriculum. We have minimised these by providing:

- adequate and appropriate hardware (e.g. computers and digital cameras)
- support structures
- appropriate professional development (cf. workshop descriptions and support structures)

Adequate and Appropriate Hardware

The majority of teachers chose to have their schools augment the grant provided, and purchase laptop computers rather than desktop machines. This has been significant in the teachers' development of computer skills and the subsequent integration of their newly acquired ICT expertise into the curriculum. All of the teachers claim that without the opportunity to bring the computer home, to "tinker around and play with", they would not have achieved such a computational fluency. Neither would they have had the confidence to use it so widely in their everyday classroom work, e.g. writing up their journals, sending

email, finding resources on the Internet, programming the models, etc. To the teachers, the value of having the computer at home to use on their own time, rather than having to stay behind after a tiring day in school cannot be overemphasised. This was especially true for the complete beginners, who could try things out at their own pace, in their own time and without the pressure of time constraints and other people's eyes.

A digital camera that recorded pictures on floppy disks (the Sony Mavica- MVC-FD73) was provided for each school to aid in the recording of the models the children created. The deciding factors on which camera to purchase were simplicity and ease-of-use. This has paid enormous dividends as all teachers and children are using the cameras confidently and effectively on a daily basis. Their use has not been restricted to the project only as the cameras are being used for a myriad of purposes—e.g. school events (sporting occasions / concerts) and projects (insects, flowers, trees).

Support structures

A variety of support structures was put in place to provide the teachers with scaffolding as they embarked on the project and their journey into "learning with the children".

Within the classroom—constructivist teaching approach: All of the teachers agree that they have never learned so much since beginning to work with the children in building their models and helping them solve the problems they encounter.

Within each school—two teachers were involved from each school: A buddy system operated as one of the teachers was more experienced with using technology. Having the supportive environment means teachers can take risks in safety as they know if something goes wrong a helping hand is always available to provide advice and support. As one of the teachers remarked "having someone in the school or at the other end of the phone takes the fear out of trying out things. I'm no longer afraid to get myself into a mess because I know if I can't sort it out one of the others will give me a hand."

Across schools: A small number of schools was selected for the initial phase of the project and good relations and a sense of rapport was built up among them over the course of the workshops. Email communication is strengthening this sense of identity and will continue to do so. The cluster of schools act as a source of ideas and inspiration for one another, as well as providing advise about issues as they arise e.g. classroom management and organisation of materials.

The project co-ordinator: The regular school visits and meetings with teachers by the project co-ordinator (Deirdre Butler) provide an opportunity for appropriate skills to be introduced as the need arises. This is the embodiment of what Vygotsky meant by the "zone of proximal development" as we were able to respond to the needs of these children and their teachers and facilitate their development of ICT skills in response to an expressed desire and need.

Resource Team: These provide expertise and advice to the group as they have had prior experience of working with the materials in a variety of settings.

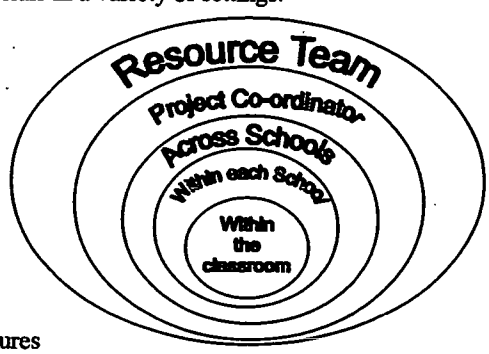

Figure 1: Support Structures

Conclusions

Inspired by both the enthusiasm of their students and the response of the community, the teachers have developed a great strength of belief in the work they are engaged in. They have been invited to give hands-on workshops, present at conferences, and host visits from other interested teachers. This has had the

effect of reaffirming for the teachers the validity of their work, has increased their confidence, and has heightened their awareness of the use of technology in education.

Evidence of improved home/school links has begun to emerge which, we hope, will lead to the development of a more relevant and meaningful approach to learning, both in school and at home. For example, parents have been visiting the schools to see the children's work, and in some cases have volunteered to help out during class and after school. The children also have renewed their interest in building with LEGO materials at home.

As the project unfolds in each individual classroom, we expect that there will be an opportunity for wide-ranging cross-curricular integration, including the development of mathematical skills, problem solving abilities, and opportunities for art, music, drama, writing, and poetry. When teachers incorporate these new technologies and a more constructivist way of learning into their classrooms, they are more able to connect their unique backgrounds with the curriculum and the interests of their students.

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PRACTICAL WAYS TO IMPROVE INSTRUCTIONAL EFFECTIVENESS USING INTERNET-BASED COURSE SUPPLEMENTS

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Abstract: This paper documents methods to increase the effectiveness of conventional lecture/discussion/demonstration classes through the addition of internet-based supplements to those face-to-face classes. Types of websites discussed include informational and interactive sites. The authors share practical experience and student comments on personal websites, listservs and email, and integrated web-based learning packages. Suggestions for instructors who want to begin including web-based components in their instruction are included.

Introduction

While striving to make their classes more understandable to their students, teachers are continually changing course content or activities, reallocating time allotted to certain activities, or increasing student participation through various means. Internet-based course supplements fall into two different categories, informational and interactive. They are used to fulfill very different needs in instruction. Informational supplements provide additional data to the students while interactive supplements help students to transform and internalize information that has already been accumulated. Interactions can be either synchronous or asynchronous. Boettcher (1999) has described four distinct levels of "Course Webness" (p. 50) to consider: web presence, web-enhanced, web-centric, and web courses. A *web presence* has all the information included in the traditional course catalog. But this level is more about marketing than pedagogy. A *web-enhanced* course is a step away from the traditional classroom model. These courses support the distribution of course materials and communication via web-based resources. *Web-centric* courses differ from web-enhanced courses not in the types of web resources used or even in the way the resources are used, but in the amount of emphasis given to the web resources. True *web courses* are designed to be 100% available 100% of the time via the internet and a web browser. Three approaches for supplementing courses are exemplified in this paper: personal websites, listserves and email, and integrated web-based learning packages. They exemplify Boettcher's web-enhanced and web-centric courses.

Approaches for Supplementing Courses

Personal Websites

Personal websites are primarily informational and can be used to post supplemental course materials such as syllabi, documents authored by the instructor or others that the instructor has copyright for, and links to other websites with information available. They provide the teacher the opportunity to present information on the instructional issues in a variety of formats. Using the relatively simple programming language, hypertext markup language (html), basic, functional web pages can be produced by relatively inexperienced programmers. Using a web-authoring program such as PageMill, FrontPage, or Composer (included with your free copy of Netscape), exciting designs including graphics can be produced quickly, with minimal effort. An added plus is that html is system independent, reducing translation problems that often surface in distance environments. We use our web pages (see http://www2.gasou.edu/eltr/tech/rcarlson/frame.html and http://www2.gasou.edu/eltr/tech/jrepman/repmanhome.html) to provide direction on the course (syllabi, daily lessons, or activities associated with specific classes), course documents to be downloaded, or links to various websites that provide amplification to the instruction. These websites also become a point of access to begin searching for other web-based documents related to the lesson - a pointer page for the lesson.

The personal web page helps to foster a sense of community. Students can look at other courses that the teacher has conducted/is conducting and gain a sense of course flow. We also publish our vitas and some writings along with some personal information so that the students can get to know us better. With the students' permission, publishing the students' pictures and email addresses on a class page can extend this sense of community.

Listservs and Email

Listservs and email comprise a type of course supplement that provides students and instructors a way to conduct course discussions. Experts can sometimes be used to anchor these discussions. Additionally, an informational function can be addressed (albeit inefficiently), when documents containing course materials are attached to electronic messages.

Hara and Kling (1999) looked at email interactions from a student perspective. They found that frustration centered around three areas: technological problems, minimal or untimely instructor feedback, and ambiguous communication. Students they observed frequently felt isolated and believed the experiences that they had were unique and not shared. This was especially true when they were frustrated with a technical problem. The students felt as if they were the only ones who experienced a problem. Feedback problems from the instructor's perspective had to do with both the nature of the communication (asynchronous) and the amount of time it took for the instructor to respond to each query. Ambiguity is frequently encountered in situations where there is not the ability to immediately question and clarify instructions or responses. This seems to be the case in this study.

We used email communication as a tool to extend our capabilities. Our students typically are full-time teachers, so they have difficulty communicating with us during the week. One of us seems always to be in class when the other tries to communicate. We impress on our students the importance of using email as an asynchronous communication tool. We insist that all of our students have functional email systems. Early in the semester, we test the systems, usually requiring some small project to be completed and handed in using email. Part of the assignment is to attach a document. This tests the system and the technical sophistication of the user and allows us to provide timely tutoring to those who need it. Later in the semester, students can take advantage of those capabilities by asking questions of the teacher or conducting asynchronous discussions with the teacher or other students. Similarly, a listserv can be used to foster class-wide discussions. We found that free web-based listservs such as OneList (http://www.onelist.com) are easy to use. Of course, almost any college/university information technology department has that service to offer to its instructors, as well. We tried to focus the listserv discussion by breaking it down into small groups and found it was not as helpful as the synchronous chat-type discussions.

Integrated Web-based Learning Packages

Finally, integrated web-based learning packages provide integrated information management for both the instructor and the student. Included in these packages are calendars, asynchronous threaded discussions, course documents, whiteboards, and synchronous discussion (chat) groups. Integrated web-based learning packages

such as LearningSpace, Web Course in a Box, or WebCT are particularly useful to augment our instruction. For a better comparison of these competing products, see Sharon Gray's article in the January 1999 *Syllabus* or access David Wooley's site at http://www.thinkofit.com/webconf.

Dabbaugh, Bannan-Ritland, and Silc (1999) evaluated the pedagogical implications of courses which used integrated web-based learning packages using Kahn's Framework for Web-Based Learning (1998), a comprehensive framework that includes eight dimensions and over sixty sub-components. They found that web courses provide ample opportunity to use appropriate pedagogical strategies – either objectivist or constructivist. Strengths of web courses included clear organization and presentation formats, well directed objectives, exceptional guidance for learners, and the use of collaborative, shared workspace. Weaknesses observed centered around interface design and lack of flexibility. They recommend that course authors focus on the use of collaboration tools such as LearningSpace.

Rittschof (1999) summarized the pros and cons of a course that used *WebCT* as the learning package. This course was a graduate-level course in educational psychology which involved higher-level thinking skills and discussions about theoretical issues. When compared to a traditional classroom setting, students reported that they shared more personal insights, voiced their true opinion more, and interacted with others more. This should encourage instructors who want to generate more discussion and include all class members. However, problems with technical aspects (the chat feature was unreliable) and the feeling of isolation (not knowing the instructor or other students) persisted throughout the course.

We chose Blackboard (www.blackboard.com) as our standard, because it offered comparable features to commercially available products, was easy to use for our students and ourselves to use, and it was free. We particularly liked the communications section, which featured email, threaded discussion, and a whiteboard/chat feature. The email provided all of the features addressed earlier. Threaded discussion provided the teachers and students an opportunity to carry on multiple asynchronous discussions throughout the week. Hot topics flourished while others died. We found that it was necessary to carefully guide the discussions so we might not unduly influence the students, while at the same time helping them to remain on track. The chat/synchronous discussion was the most challenging from a teacher's viewpoint. First, the chats could easily become schizophrenic quite rapidly because a large number of participants deteriorated into multiple conversations. This could be alleviated somewhat by breaking down the chat groups into smaller units (nominally 8 maximum). Technical problems included students with slow modems, slow computers, or inadequate keyboarding skills who subsequently experienced trouble keeping up with conversations. We never found a good way to rectify situations such as those – except for the obvious. The course documents section of the integrated packages allows the publication of course documents such as syllabi, presentations, and text and graphics documents. These were distributed in a fashion similar to those distributed via web pages, but were more convenient.

Student Comments

In order to gather student comments about the course supplements, a survey was emailed to the students of the classes who used the methodology. There were a total of 35 responses, a 67% return rate. The survey asked:

1. How did the materials posted on the web (on Blackboard or on a personal/class web page) aid your learning?
2. What communication tool worked best for you - Blackboard threaded discussion, email (listserv included), or chat? What made them helpful or not helpful for learning?
3. Did the fact that you were physically located at a different site from the instructor for at least part of the course affect the usefulness of the tools mentioned in questions 1 and 2? Why?

Materials

Almost universally, the students liked to have the class materials available on the web. Every class had a component that used PowerPoint as a presentation tool or class notes prepared on a word processor. These documents were made available through the instructor's web page or through the integrated web-based learning

package (BlackBoard). Students were able to use the documents as advance organizers, allowed them to focus on the lesson, and saved time copying notes. They also appreciated the cost savings over printed notes that instructors have previously made available at the bookstore. The following statements are typical.

"...the ppt slides were a great reinforcement to my readings."

"By looking at these slides before class, I was able to focus on the important parts of the reading assignment."

"I had them before class and was able to add *important* in formation to them instead of concentrating on writing *everything* down." (italics added)

"I spent more time listening and less time copying notes."

"...established an anticipatory set..."

"...helped to review the lesson."

Problems tended to be technical and avoidable. The following are examples.

"...problems are many. It was VERY slow."

"The only problem I had was that if they were not posted the night before class, I have a hard time getting them."

"...problems getting the notes off BlackBoard."

"...server down..."

Communication Tool

When asked to name the communication tool that worked best, students split between email and threaded discussions. But the reasons that they liked the tools were surprisingly similar. First was convenience in both time and location. Students liked being able to adapt their learning to their lifestyle.

"...time was not an issue..."

"...without driving 3 1/2 hours round trip..."

"...communicate in our own time frame..."

"...could ask my questions when they were fresh in my mind..."

"...immediate feedback..."

They also liked having a written record of the discussion.

"...good for documenting the responses..."

"You could see the development of the discussion..."

"...You could see all the posts..."

Students thought that the discussions provided new ideas.

"...thoughtful comments..."

"...can be very thought provoking..."

"...made me look at things in a different way..."

Being able to prepare a response was important, also.

"...believe it or not, I like to think before I answer!"

Problems centered around access.

"...couldn't use group chat due to access problems..."

"...couldn't schedule a time for chatting (among the group)..."

"...chats never work..."

Training on how to use the various tools was another issue.

"More instruction on how to use the various BB components would be helpful."

"...have to get into the habit of checking BB..."

"Probably 'how to use' instruction would have been helpful."

Timeliness also was frustrating.

"...not everyone responds as quickly..."

"I don't think everyone understands how it (threaded response) is supposed to work..."

"...makes everything too drawn out."

"Email is more immediate..."

Physical Location

Being physically located away from the instructor for much of the course was not a problem as long as there was some prior contact.

"...helped me with personal questions that may not apply to the whole group."
"...I felt in-touch without having to travel 4 hours every week."
"...sense of connectedness..."
"...should have met physically at least once..."
"If I had not met the people, I would have had a much harder time..."
"...have a mental picture of who I was talking to..."

But students didn't like to work with one another on projects.

"...problems with different sites on the group project..."
"...only bothered me during group projects..."

Recommendations

From our experience, we would make the following suggestions to instructors who want to begin including web-based components in their instruction.

- Start small. Begin at Boettcher's first stage and work your way up. It is a gigantic leap from a web presence to a full web course.
- Make sure that you provide for training on the applications to be used. Not everyone is as sophisticated as you. Most students overestimate their technical ability.
- Make sure that the students understand that they must have access to appropriate hardware and what that hardware is. If their access is limited (to either school or home) they are going to make their course interaction more challenging.
- Have at least one face to face session. This allows the students to build a mental image of the person to whom they are talking and makes communication easier and better. If that is not possible, post pictures, biographies, and audio files on the web so that this information can be used to acquaint the class with each other and the instructor.
- Post materials in a timely manner. They should be up on the web at least two full days before the class. This also helps to bypass unavoidable technical problems.
- Have a way to help students work through technical problems.
- Provide digests or written records of chats to those who request them.
- Discuss strategies for group work at a distance.

Following a logical progression will help you enhance your course by using tools that are available and easy to use.

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Reflective Judgment and Cognitive Interaction in an Electronically Distributed Astronomy Course For Educators

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Abstract: An Introductory Astronomy for Educators course was delivered over the Internet using mostly-asynchronous communication tools, as well as interactive Java simulation and data-sharing applets. The on-line environment was teacher-designed to provide a platform for rich interaction and critical thinking, while providing for maximum time and space flexibility for students and instructors. The purpose of this inquiry is to evaluate the efficacy of the course in meeting the goals of flexibility, science literacy through critical thinking and cognitive interaction. Data were collected in the form of student coursework, electronic records, fieldnotes, and student learning journals. Findings indicate that critical thinking and cognitive interaction were uniquely facilitated in ways that are problematic in the traditional classroom setting. Issues raised include the need for technical preparation, varying readiness for critical thinking, and the high demands placed on the instructor.

The landmark document *Benchmarks for Science Literacy* (AAAS Project 2061, 1993) set in place specific goals for science literacy. Development of critical thinking in science is suggested by *Benchmarks* as a primary component of science literacy throughout schooling. One important means of helping all students reach this goal is to provide in-service teacher training in science, featuring methods that promote critical thinking. Can the internet be used to deliver flexible, interactive in-service science education in a way that successfully models and fosters critical thinking? This study examines the delivery of a summer in-service course entitled *Astronomy for Educators* using a teacher-developed internet environment.

Structuring For Flexibility and Collaboration, and Critical Thinking

Overcoming learner isolation is a primary goal of in-service teacher education. Cognitive interaction in *Astronomy for Educators* (AFE) was facilitated using a variety of networking tools, each having different temporal and access features:

	Electronic Interaction Tools		
Function	**Study Group**	**Idea Container**	**Live Chatroom**
Time	Asynchronous	Asynchronous	Synchronous
Place	Chosen by student	Chosen by student	Chosen by student
Interactive Function	Unmoderated small-group dialogue	Unmoderated community dialogue	Unmoderated community dialogue

Table 1: Interactive Features of AFE

AFE is designed to foster a complex network of flexible, cognitive interaction. The rich interactive structure of the AFE course was interpreted using Granott's Interaction Framework (Fig. 1), a model in which cognitive interactions are classified in a two dimensional model (Granott, 1993). Using this model, the various electronic conversations that took place in AFE can be classified, forming a composite profile of the interactivity of the environment as a whole.

One dimension of the model describes the degree of collaboration in the interaction. Collaboration can involve high mutuality, with a common focus of attention (Rogoff, 1990). Such collaboration is highly interconnected and non-local in nature. Other interactions, though, involve minimal two-way exchange of ideas and common focus.

The second dimension describes the participant's relative knowledge or and expertise in the content of the interaction. A peer-peer interaction is termed *symmetric*, while an expert-novice interaction is termed *asymmetric*. These aspects of interaction can be presented visually as a 2-dimensional space, in which each dimension is considered to assume a continuum of values (Fig. 1).

Asymmetric	Imitation	Apprenticeship
Relative Expertise	Counterpoint	Guidance
Symmetric	"Parallel Activity"	Mutual Collaboration
	Independent	**Collaborative**

Figure 1: Interaction Framework (adapted from Granott, 1993, p.187)

Structuring For Critical Thinking: Constructing Personal Knowledge

Critically thinking students do not simply learn *about* astronomy, they practice *being astronomers*. To facilitate *being astronomers*, the course was structured as a sequence of problem-centered activities in which students construct an increasingly powerful personal cosmology based on actual observations and data. This structure is supported through the use of interactive, data-sharing modules, some delivered using JAVA programming language, in which students make astronomical observations, post and share data, and draw conclusions using the on-line environment. Such activities require critical thinking and reflection at a level comparable to scientists in the field.

The Reflective Judgment Framework (RJF) is a powerful tool for assessing the use of, critical thinking (King & Kitchener, 1994). Analysis of over 2000 intensive interviews of college students (using a wide variety of ill-defined problems) gave rise to the construction of a three-level developmental model based on the different way in knowledge and justification were viewed. *Pre-Reflective*, *Quasi-Reflective*, and *Reflective* levels of reasoning, characterized by distinct views of knowledge and justification, provide a framework by which the developmental nature of reflective thinking may be understood.

Stage	View of Knowledge	Concept of Justification
Pre-Reflective	Absolutely certain or temporarily uncertain	Authority based (known) Opinion based (unknown)
Quasi-Reflective	Always uncertain	Contextual, observer-dependent justification
Reflective	Outcome of process of evaluation.	Weight of the evidence, value of interpretations

Table 2: Overview of Reflective Judgment Framework (Adapted from King & Kitchener, 1994, p. 44-74)

Using the RJF, growth in critical thinking during AFE can be understood in terms of three broad developmental stages. Using the model, students work can be both evaluated qualitatively, and understood developmentally.

The Study

Distributed learning de-localizes school in both social and cognitive ways. Social/cognitive interaction and critical thinking are key components in a professional development science course for educators. The purpose of this study is to evaluate and analyze the implementation of on-line *Astronomy for Educators* in meeting the goals of time/space flexibility, critical thinking, and cognitive interaction. Results indicate that AFE was effective in blending maximum learner flexibility with strong intellectual development and social interaction. Caveats about AFE include technological and cognitive readiness, and the time demands of instructor involvement and interaction.

Data Sources

The electronic nature of AFE provides a unique and powerful opportunity for data recording and analysis. Data were collected electronically and automatically, giving the researcher more powerful and direct access to the content of both student work and student interaction. In this study, three separate instances of course implementation were analyzed, consisting of a total of 40 students over three different semesters. The data collected was analyzed according to grounded theory, a researcher-driven, qualitative methodology often used in teacher research (Strauss & Corbin, 1994). The data were generated from a variety of sources:

- **Synchronous Meeting Transcripts**
  Several synchronous on-line meetings were conducted. Attendance at these on-line "chat" sessions was optional. Text transcripts of these hour-long meetings were saved and analyzed. Approximately 100 pages of on-line meeting transcripts were collected.

- **Study Group Transcripts**
  Each student was assigned to a four-student electronic study group, which consisted of a message board with access restricted to group members. Approximately 200 electronic study group interactions were archived in text form for later analysis and interpretation.

- **Idea Container Transcripts**
  Each activity included an electronic message board to which all students and instructors were provided access. Approximately 500 electronic idea container postings were archived in text form for later analysis and interpretation.

- **Reflective Learning Journals**
  Thirty-five students wrote entries in an electronic learning journal in which access was limited to the individual students and instructors. Journal content of approximately 150 pages of text was parsed and passages relevant to cognitive interaction and growth in reflective judgment were extracted, forming a reduced record.

- **Reflective Essays and Other Student Work**
  A series of reflective essays, activities, and exams were administered. The first asked students to reflect on the meaning of distributed education; the second asked students to reflect on the evaluation of critical thinking after completing midterm exams. The third asked students to reflect on the impact of cognitive interaction in the course. The final essay asked students to summarize how individual cosmology changed as a result of the course. Essays and content of other student work (approximately 1000 pages of text) was parsed and passages relevant to cognitive interaction and growth in reflective judgment were extracted, forming a reduced record.

- **Structured Interviews**
  Two extensive structured interviews of approximately one hour each in length were carried out with off-campus students. The interview content was videotaped for analysis. Interview content was transcribed, and the resulting text recorded.

Profiling Electronic Interaction

Figure 3 displays the way the learning environment was used for various types of interaction in Granott's framework. The idea containers were used for the broadest range and amount of interaction.

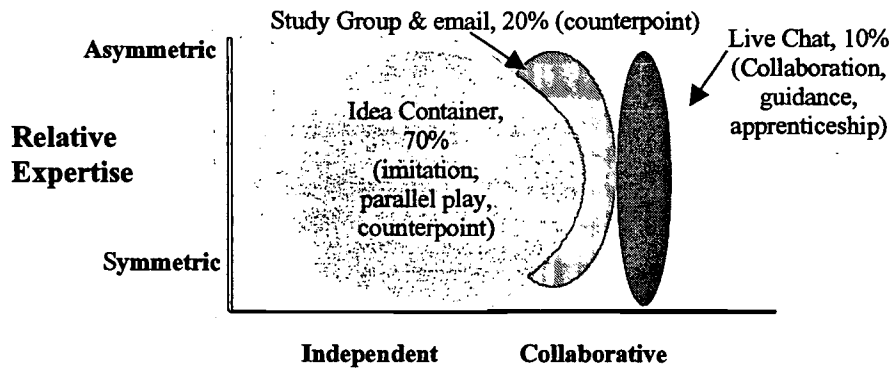

Figure 3. Distribution of Interaction Types in the Granott Framework

Imitation and "parallel play"

Imitation is an independent, roughly asymmetric interaction in which a novice learns form an expert through direct modeling, with limited two-way interaction. Idea containers were extensively used for imitation. It was reported that it was useful to "see others ideas when I was stuck" (Student Evaluation, 3/98). The perception that others' ideas were worth reading and evaluating indicates an open and critical sharing of work and ideas.

Different from imitation is the notion of "parallel play," a non-collaborative , symmetric interaction. Parallel play differs from imitation in that "partners" perceive each other as having equal expertise in the activity. The perception of equality is evident in reports that "I liked compare my ideas to others to see if I was on the right track." The idea containers facilitated the imitation—parallel play continuum in a very flexible and effective way.

Guidance and Counterpoint

More collaborative than imitation or parallel play, guidance and counterpoint were also evident in idea container interactions, as well as in study group communication and in live meetings. Counterpoint consisted of short periods of interaction interspersed through independent activity, taking the form of "question-answer" (asymmetric) or "point-counterpoint" (symmetric) dialogue. Often, counterpoints were separated by days or even weeks in time.

Collaboration and Apprenticeship

Collaboration is characterized by a highly interaction between peers of equal expertise (Granott, 1993). Collaboration is reciprocal and symmetric, with quick shifts of dominance from one to another. The participants are engaged in common activity, with common goals, sharing materials. "The participants co-construct their knowledge by continuously sharing their ways of understanding. Their knowledge structures, therefore evolve simultaneously" (Granott, 1993, p.189).

High levels of collaboration were rarely, if ever, observed in asynchronous idea container or study group interaction. Some counterpoint interactions were extended into "counter-arguments" but the central features of collaboration such as common goals and synchronous learning was not evident. To observe collaboration in the AFE we must turn to synchronous communication. The meeting room interactions demonstrated Granott's criteria for mutual collaboration (symmetric) and apprenticeship (asymmetric collaboration).

Development of Reflective Judgment

About 70% of the in-service teachers, many of whom had limited background in science, initially held a pre-reflective view of knowledge and justification in astronomy. The remaining students began with at least a quasi-reflective view, with a few demonstrating "expert", reflective understanding of the nature of astronomy knowledge.

Most students experienced some initial and understandable discomfort with applying reflective thinking skills in an astronomy course. Many students were able to integrate higher level skills as the course progressed, and reported that the interactivity of the course was an important factor in growth:

> "I really enjoy taking control of my learning, but it does take a while to get going with such a new concept...I do enjoy this type of approach, though because it gives me the chance to be responsible for gets done and to what extent. It gives me the sense of initiative needed to gain the knowledge that is required to pass this course. It also gives a self-confidence as a learner because I am also a teacher. I like the on-line chat program where we can go with questions and comments to get help or to help other students (Student Evaluation, 12/97)."

> "I learned a great deal. I enjoyed finding the planets in the evening sky. I enjoyed plotting the sunrise and sunset and moon phases. It was fun creating a sun dial and finally understanding how they work. Working through the units in determining the size and mass of things allowed me to discover things beyond this solar system...I have been out of complicated math for so long that I was frustrated a bit at times...I liked the flexibility of working when I found the time. It was a great experience completing things at any hour and submitting it. I appreciate the flexibility that you had with me, especially when my computer was not being user friendly. I appreciated the help that you gave when needed. In the beginning there was more student to student interaction...I enjoyed reading what comments people submitted. I could see myself doing even better the next on-line class I take... It was really cool being able to look up information on the internet. It was also fun going to sites set up in the various units. It is amazing how much information I could access. I felt that this class provided many opportunities to have the student interact with the subject through the idea tank (sic), physically viewing the sky, creating sundials etc. I think I have spent more time on this subject than any others - It was fun...I have come away from this class with a great deal and you have furthered my love of science. I will be able to use many of the things I learned with my family and my Second Grade Class" (Student Evaluation, 8/99)

> "I have really enjoyed taking this astronomy class. I have learned a lot. This is not just book knowledge, but I was able to see (both literally and figuratively) these facts for myself. This course did encourage me to think critically... Being able to talk to others taking the class definitely helped. There were times when I got stuck on an activity and reading what they had done put me in the right direction to solve my problem. There were also times when I was able to help others. As a teacher I really enjoyed that" (Student Evaluation, 8/99)

Discussion

Along with the enthusiasm of a predominantly successful experience with AFE comes awareness of a number of challenges for future implementation. By addressing these caveats on an on-going basis during future development I believe that AFE has the potential to facilitate powerful, robust learning for in-service teachers.

Student Technological Readiness

About half of the students began the astronomy course with skills inadequate for independent utilization of the technology. As one student put it, "I feel as like this should be a nine-credit class. I work on it constantly." It turned out that the student was engaged in two simultaneous tasks. He was not only engaged in the problem-solving tasks intended by the course designers, but was spending a great deal of time learning basic computer and internet

skills as well. The student suggested that perhaps a separate training course with instruction in the necessary technological skills would meet his needs.

Providing a course "on-ramp" which is technically negotiable for as many students as possible is one of the most challenging facets of AFE implementation. Many tasks that seem transparent to course designers such as habitually saving work to disk, using hyperlinks, efficiently arranging the computer desktop, sending email from a variety of environments, and even finding and connecting to an internet service provider can prove to be a great consumer of time and cause of frustration for students. It is recommend that future AFE course designs include optional training modules for those who are unfamiliar with the network technology.

Student Cognitve Readiness

A few students were challenged by both the independent nature of the course and the critical nature of the activities, becoming at times angry and regretful at having enrolled in the course. In two instances, students were unable to meet the demands on the on-line environment, reporting that they needed "clearly written lectures and definitions," and were unable to progress beyond the initial activities due to "a total lack of direction." One bluntly reported, "this was not the course for me." Ironically, both reported being "excellent" students otherwise, one being an earth science teacher in the middle grades. The issue of cognitive readiness for critical thinking in science seems to be problematic even for seemingly qualified students. There is no doubt a variety of reasons for this, including past experience in school, particularly in traditional science courses, which de-emphasize critical thinking in favor of "covering material.".

Increased Time Demands

I found that as my students work harder in learning Astronomy, I work harder as well. This runs contrary to common notion that on-line environments are a way to cut costs in terms of instructor time. In AFE this was hardly the case. The increased interaction and depth of learning was rewarded by longer instructor hours. Class sizes in interactive on-line course should remain comparable to those in traditional courses and be staffed equivalently.

Conclusion

The implementation of electronically distributed AFE largely met the educational goals of critical thinking and rich cognitive interaction while providing for flexibility and convenience for students. While no learning environment can be pre-programmed to be "complete" in and of itself, the mostly-asynchronous distributed learning environment as implemented by the researcher provides a complementary blend of time independence, student ownership and accessibility, and teacher facilitation. It also maintains a dynamic, flexible teacher-owned platform for further development.

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Technology Education: A Synergistic Approach

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Introduction

In the mid-60s Federal money was beginning to pour into urban school districts to improve basic instruction. Money for science materials, reading texts and audio-visual equipment slowly transformed each classroom into a state of the art learning environment. The excitement of new hardware energized the teaching staff. But slowly the equipment that we loved to have in the classroom fell out of use. It was pushed into corners, never to see the light of day again. In the rush to spend the funds, a vital step was missed. We were never really trained to integrate the new technology into our instructional process.

Since those early attempts to integrate technology into the curriculum, technology itself has taken a quantum leap into the future. In some districts, unfortunately, technology itself has become the end. During many visits to local school districts, we have observed a pattern re-emerging. New computers and software were in the classrooms but were being used at best to be a reward for students who completed an assignment early. School media specialists reported that assignments given to students for research over the Internet consisted mostly of the student downloading information and submitting it to their teacher. I t seems that the objective for this use of the Internet *was to use the Internet!*

The February 1999 issue of Educational Leadership was devoted to integrating technology into the classroom. One of the articles outlines a successful program's philosophy by stating: *"Technology became the new tool. The staff determined early in the process that technology would not be the driving force, instead it would be to provide curricular support. They adopted the philosophy: We use technology to learn, not to just use technology."*
With this framework, we began to examine how the successful integration of technology into the instructional process could be institutionalized. The Pennsylvania State Department of Education helped in this quest.

State Program—Link to Learn

The State of Pennsylvania has established a $166 million Link-to-Learn initiative to serve as a catalyst for the effective use of information technology to enhance education, promote community partnerships, and support economic growth in a knowledge-based society. Institutions of higher education are encouraged to be innovative in developing delivery systems that will make systemic changes both in pre-service programs as well as in-service staff development processes. Providing hardware, software and training is a fundamental part of this program.

Grant Description

Chestnut Hill College proposed to increase the proficiency of its pre-service teachers to use technology to improve teaching and learning. As a result of this initiative, by June 2000, participating pre-service teachers will possess the following minimum technology competencies:

Ability to use word processing

Ability to use database software
Ability to use spreadsheet software
Ability to use timeliner, concept mapping, graphing, prewriting software
Ability to evaluate game and simulation software across the curriculum
Ability to evaluate and use Internet and Web resources
Ability to design activities in which students use Internet and Web resources
Ability to create support materials for the use of technology in classrooms by children
Ability to integrate use of technology into the curriculum, choosing age-appropriate software and creating activities that connect software used to topics being taught
Ability to organize the classroom's physical layout and activities to maximize the use of one computer in a classroom

These competencies will support effective teaching of the emergent Pennsylvania academic standards in English language arts, mathematics, science and social studies for grade levels K-8.

Additionally, these competencies will support language arts, mathematics, science and social studies curricula for cooperating teachers in grades K-8.

These competencies were developed through examination of the standards for technology usage by classroom teachers articulated by ISTE (the International Society for Technology in Education) and NCATE (the National Council for the Accreditation of Teacher Education) and through content and technology standards articulated by discipline specific organizations (e.g., National Council of Teachers of English/International Reading Association; National Council of Teachers of Mathematics; National Social Studies Association; National Science Teachers Association).

To enable our pre-service teachers to acquire these competencies, Chestnut Hill College proposed:

(1) to require a beginning course in Educational Technology of all pre-service students
(2) to educate the methodology/practicum faculty on the integration of technology into their courses
(3) to place pre-service teachers with in-service teachers who have been or are being educated about the use of technology in education (This is directly in keeping with the *Pennsylvania General Standards for Institutional Preparation of Professional Educators [proposed]*, Section I-H which addresses both the quality and importance of field experiences.)
(4) to educate in-service teachers about the integration of technology into their curricula so that these in-service teachers and their classrooms may serve as practicum sites for our pre-service teachers
(5) in conjunction with the Graduate Program in Applied Technology, to establish and maintain a Technology-in-Teaching Resource Center for in-service teachers so that our pre-service students will always be assured of appropriate placements. (This is directly in keeping with Section I-I of the proposed *General Standards* which speaks to collaborations with higher education to "design, deliver, and renew effective programs for the preparation of school personnel...")

In sum, in order for our students to learn to use technology in their classrooms, they must not only learn the technology and design lessons and units incorporating technology, *but must also see the use of technology modeled in their practicum sites.* Since the lack of appropriate sites remains a serious obstacle to full preparation of our pre-service teachers, by partnering with K-8 sites and educating their teachers, we create opportunities for our pre-service teachers to practice what they have learned.

During the funding period, this project is directly serving approximately 117 pre-service teachers and approximately 10 higher education faculty.

Chestnut Hill College should be able to sustain this initiative after Commonwealth funding by 1) creating a cadre of higher education faculty to serve as the basis for the Technology-in-Teaching Resource Center and 2) by establishing a pool of cooperating in-service teachers who can a) model the use of technology in the teaching of content areas and therefore benefit future cohorts of our pre-service teachers; and b) serve as mentors to other teachers in their school and in the neighborhood.

Actually, Chestnut Hill College partnered with two Philadelphia public schools, two Catholic schools and two private academies to develop a relationship between pre-service and in-service teachers. These schools provide a diversity of populations and promote a variety of teaching and learning styles. Like Chestnut Hill College, all partner schools are located in the northwestern section of Philadelphia and constitute Chestnut Hill College's "service area". During the funding period, this project will directly serve approximately 60 in-service teaches and approximately 1550 students in grades K-8. Once educated, however, these in-service teachers will continue to impact pre-service teacher populations from Chestnut Hill College as well as other teacher preparation institutions for many years to come.

Findings

In order to effect institutional change we found that teacher preparation institutions, local school districts and teachers as a sub-culture must all interface with a singleness of purpose. This of course is easier said than done

The Teacher Preparation Institution

The Department of Education at Chestnut Hill College was more than ready for systemic change. It had recently revamped both of the graduate and undergraduate programs. New course requirements such as "Technology in the Classroom" and " Introduction to Special Education" were introduced while some of the traditional "methods" courses became electives. A two-semester generic methodology course was created. However for technology education to become a part of all of these courses, the department members themselves must be trained. Each of the department members as well as three faculty members from departments that were integral to the teacher training process took part in a course that was designed for them.

It was intended that each faculty member would incorporate these methodologies into their pedagogy thereby serving as a model for the pre-service teachers. This was not an easy process. Some of the faculty members embraced the changes while others were more reluctant. In the end faculty members cooperated in their own manner yet became significantly more skilled than before the course.

The role of the teacher preparation institution in effecting true change has been ignored or underestimated in the past. Local school districts must depend on colleges to provide an infusion of new ideas and procedures as well as the enthusiasm that new teaching staff member bring to the table. If the college faculty themselves are not committed to changing their practices, how can we expect the pre-service teachers to incorporate them into their methodology? At Chestnut Hill the Education Department and the Technology Department have formed an alliance that has been mutually beneficial. Other departments who also educate the pre-service teacher have seen the potential for significantly improving their courses by incorporating technology into their curricula.

We would like to digress for a moment to expand upon our use of the word "technology". Technology as we use it is more than hardware; it is the Internet, software but also a state of mind. A desire to rethink old procedures and be open to new approaches to teaching which involves the manipulation and digesting of a torrent of new information which cascades over us each day.

The School:

One of the most difficult aspects of this project was to effect systemic change in the planning and implementation of the instructional program. We found that each school had its own unique decision making process in terms of curricular/technological change. As part of the project each school appointed a Link to Learn coordinator to work directly with the College. These individuals served as on-site "experts" to help cut through the school's bureaucracy and provide a valuable source of information to the college on both suggestions for training for their in-service teachers and also the performance of the pre-service teachers.

However a fundamental question arose, "How does change take place?" Can an outside agency, a college or State Department of Education, encourage an individual school to incorporate technology into its delivery system? As usual we found that the answer does not fit nicely into a pre-determined mold. The outside group can provide motivation, training, and expertise and of course, funds to begin the process. Yet without the

commitment of the principal, who sets the tone for the school, and a core group of respected dedicated teachers who believe in the program change will only occur sporadically and without survivability after the project expires. This finding is not new. A school has its own culture that resists change of any kind. Therefore, we have found that it is equally important to know "who" should be involved as well as the "how" it will or should occur. There must be a schoolwide philosophy which outlines how technology will be integrated into the curriculum for success to be achieved.

The Teachers:

One of the requirements to receive funds for equipment for individual teachers was for those teachers to participate in a graduate course of their choice, which has a technology focus. We found that after they overcame their initial reluctance, they truly found the course to be extremely helpful and motivating. For many of the teachers this was the first course they had taken in many years. We also found that some used this course as a first step to an advanced degree.

The interaction between the pre-service teacher and the in-service teacher in the classroom help to institutionalize the technology changes into the classroom milieu. This forced interaction helped both individuals. The in-service teacher now had to change their methodology to serve as a model for the students and the pre-service teacher saw an actual lesson being taught that incorporated the theory they had been taught.

Implications for the Future of Technology-Education Integration:

The goal of this project was to create placement opportunities for our practicum and student teachers in which they would see technology used, as well as classroom instruction at the college that included technology (in courses other than the single hand-on course). This is essentially a process of changing behaviors, both of cooperating teachers and also of college faculty. We know that meaningful change happens slowly, and only when teachers own the process. This seems to be true in our case, for both groups of teachers.

Cooperating teachers in the six schools

The state made all the funds available to us almost immediately and expected that we would spend all the money and that we would do so quickly. This raised the issue of who made decisions. We chose to offer options to each of the schools and to each of the individual participants, options in courses as well as hardware and software purchases. The process took longer than the state officials seem to have expected. But this process seemed worthwhile to us. It seemed critically important to honor the individual needs of each school, and to move in rhythm with each school to make appropriate and productive decisions.

For instance, we did not create a "one size fits all" technology course for the cooperating teachers. Instead we called a meeting and explained the content of the courses we offered in the Applied Technology program, inviting each participant to choose a course that addressed his or her needs. This meant that some teachers took courses in the summer, while some took courses the following fall. If we think of this program as having duration of fifteen months, this is problematic, because placement sites would not be immediately available for the fall for all of our students. If, however, we choose to envision this program as the beginning of an evolving relationship with these schools, the deliberate pace with which we began allowed for some critical understandings to be established.

The first understanding is that each of these schools has a culture and a history, and that they must make decisions with which they can live. In addition to giving them course options, it seemed important to us to pass the decision-making power on hardware and software to each of the schools. We did the ordering of hardware, but only after the technology coordinator at each school indicated to us what would be required. It took longer to establish a useful base of equipment, but the purchases were all necessary and desirable. In fact our funding came through in February and March, and schools did not have their equipment until September.

Software purchasing followed a similar pattern. We refused to prescribe software for the schools, inviting teachers instead to wait until they each had taken a course, and knew what was available to support their curricula. Again, we used each school's technology coordinator to oversee this process, to guarantee that teachers did not make redundant purchases. Most software was purchased in the fall. We had offered in April to do presentations for each faculty, demonstrating software and

talking about methods of evaluation. Only one of the schools was ready to take us up on that offer immediately. Other schools needed more time to have the equipment and begin the year, and then requested presentations.

The next understanding is that teachers need time to think about their curricular goals, and consider whether and how technology can be used to achieve those goals. The offer to do presentations for schools will be extended again as we begin our spring semester at the college, acknowledging that teachers may not all be ready to hear information at the moment we choose to provide it. We could ignore this reality, and have our presentations fall on deaf ears, or wait until they ask for a presentation, in the hope that this request indicates a willingness to listen.

College faculty

Educating the college faculty has been equally tricky. The grant provided funds to pay ten professors to enroll in Applied Technology courses. Five professors took courses (again of their own choosing) during the summer. This group included adjunct faculty members and professors from other disciplines in the college. Time constraints, professional obligations and just plain resistance have kept five of the full-time education faculty from taking a course and their endorsements of technology in their courses vary from professor to professor. We remind ourselves again that change takes time, and that meaningful change must be owned by the teacher. This lesson is true even when that teacher is a college professor.

We evaluate this program in terms of our long-term goals: providing students with placements in which they see technology used; and integrating technology into our college education courses. Our placements differ among themselves, of course, because the schools in which our students work have differing cultures, and because each teacher is an individual. But we feel secure that the opportunities are more readily available to demonstrate roles for technology in elementary classrooms as a result of this project. Our college courses will also vary in the extent to which technology is integrated in them. This is to be expected.

Moreover, our evaluation of the project is only a snapshot of the first days of the journey, as we begin to create what we think of as a professional development community. This community includes our college, with its teacher education program and applied technology program, and six distinctly individual elementary schools, all working to communicate about best practices and creative approaches to teaching and learning.

USING the INTERNET as a TEACHING TOOL to FIND STATISTICS for USE in GRADUATE EDUCATION

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Abstract: At the University of Louisville, many graduate students in Education take "Introduction to Research Methods and Statistics," to meet their program requirements. As a teaching tool, the Internet is being used as a source for finding statistical data sets. The data sets are then utilized to complete various class exercises. While, the assignment sounds simple, it is not as simple as it sounds. Students in graduate school come from different backgrounds in terms of disciplines, level of knowledge, computing or Internet networking skills. Regardless of a student's knowledge base, graduate students are expected to have a certain level of proficiency. This paper will be helpful to both the educator and students. It will discuss strategies on navigating the Internet to find needed information, how to capture statistics efficiently and critically evaluate an Internet site and the information.

Background

The University of Louisville (U of L) Libraries has a well-developed Information Literacy Program (ILP). "Finding, evaluating, and using information from a variety of resources is the essence of Information Literacy." (IPL Index Page, 1999) The ILP provides several services to the U of L community of faculty, staff and students. A few of these services are:

(1) *Jumpstart Classes* are designed to meet the needs of students and the university community in general with finding computer and library resources;
(2) *Short Courses* are designed to meet the needs of faculty and staff related to computer and library resources;
(3) *Research 1-On-1* is designed for individuals who need help with their research meet with a librarian to discuss the best resources for their project; and
(4) *Librarian Visit* is designed for a librarian to meet with a class and provide effective methods of research.

Another aspect of ILP is the Library's Liaison Program. The Library Liaison Program at the University Libraries provides U of L faculty with a personal contact in the libraries. This contact, or liaison, can help answer questions about the libraries and inform teaching faculty about new services and products. The Library Liaison Program was established as an on-going partnership with teaching faculty. From this partnership, the libraries hopes to:

- build collections that reflect curriculum and research priorities;
- supply user-centered services;
- integrate information literacy into the curriculum;
- create resource-based teaching and learning programs; and
- encourage lifelong learning.

How does all of this relate to "USING the INTERNET as a TEACHING TOOL to FIND STATISTICS for USE in GRADUATE EDUCATION?" Librarians assist, instruct and inform faculty and students on how to access and use paper and electronic resources available both, in-house (locally) and via the Internet (remotely). In this instance, a Library Liaison to one of the departments in U of L's School of Education was asked to provide instruction to students in a graduate level statistics class. The professor wanted the students to be able to find data sets on the Internet that could be downloaded into a spreadsheet or Statistical Package for the Social Sciences (SPSS). Clemmitt (1996) said, "good internet sites also give students a tremendous amount of control over data access." So once students find good sites, they should be able to find data that meets their needs and be able to manipulate the data for various class exercises and projects. The class session was scheduled and the class visited the library to meet with

the librarian, in the Collaborative Learning Center (CLC). CLC is a classroom in Ekstrom Library designed with 25 student computer workstations, Internet access, and a high quality projection and audio system.

Many people have access to the Internet and are amazed at the abundance of information available on the World Wide Web (WWW). In a graduate classroom setting, students come from different backgrounds and are at various stages of their educational program. Someone may have recently received a baccalaureate degree, while someone else is returning for some sort of certification, and yet another, is pursuing an advanced degree, after being out of the field of education or school for several years. Some people may use the Internet regularly, while others may not even own a computer. Regardless of their level of education or familiarity with the Internet, students need to be able to find statistics and manipulate the data for various reasons. Students and educators need to know how to find data sets. While there is no easy or correct way to search for information on the Internet, there are searching techniques that will aid the user in searching the Internet.

The Search

Many libraries have subject guides, which provide students with places to start searching for their information needs. Basically, a subject guide is a list of books, periodicals, and electronic resources including databases and electronic journals that a librarian has reviewed to aid researchers in search of information on a particular subject. On the U of L's Research Center Web page (Fig.1), anyone can use their mouse and click on the subject of their choice. While this list is not inclusive of everything available in the library or on the Internet, it provides a broad range of subjects to explore. A subject guide can be in either paper or electronic format. An example of an electronic subject guide on the Internet is available at U of L's Research Center Web page see, (Figure 1), (The Research Center, 1999).

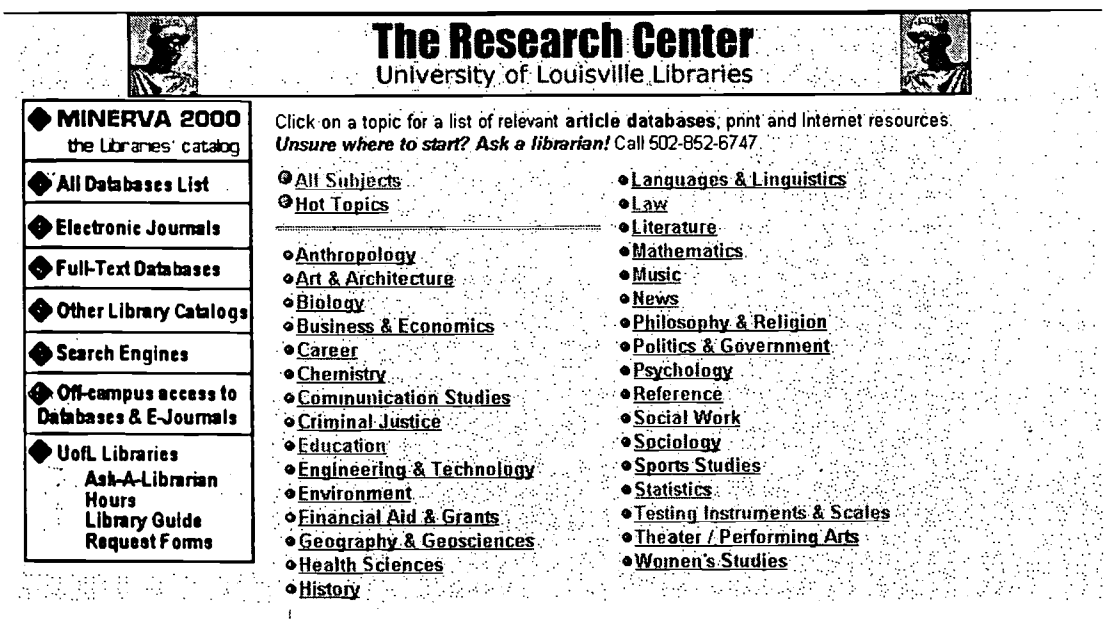

Figure 1. The Research Center is a virtual gateway to resources at the University of Louisville Libraries.

By clicking on a particular subject, from Research Center Web page, the library has provided the patron with basic information on that subject to begin a quest for information. When searching the Internet, it is strongly suggested that the user have a strategy. For a productive search, it is highly advised that students brainstorm a list of words that best describe the subject/topic for the information being sought (Crehan & Teitelman, 1998). These words should define or identify the unit of analysis and they will be used as *keywords*. It is the keyword that is instrumental in navigating the Internet. Once the keyword(s) have been identified, the search can begin.

Another method used to search the Internet is *natural language* or *free-text* searching. This method allows the user to type into the text box provided by the search engine, specifically in sentence form the subject being

searched. It should be noted that there are many types of search engines and they vary greatly. It may also be necessary to go to the help section and modify the keyword or the natural language search. All search engines are not the same, but they have similarities, see (Figure 2), (Internet Search Engines, 1999). According to an online dictionary, a search engine is a computers program that, when executed, it retrieves a list of documents based upon the search strategy provided by the user (Webopedia, 1999). For more information regarding searching and search engines visit the web page *www.searchenginewatch.com* (Search Engine Watch, 1999).

The Research Center
University of Louisville Libraries

RESEARCH CENTER: SEARCH ENGINES

Selective Indexes	Extensive Indexes	Metasearch Engines
Search engines that selectively index the web.	Search engines that automatically index a large number of sites.	Services that search multiple search engines.
About.com Argus Clearinghouse E-Blast Galaxy Lycos Top 5% Magellan Yahoo	Alta Vista Excite Go.com Google HotBot Northern Light Lycos WebCrawler	Dogpile MetaCrawler ProFusion SavvySearch

Each search engine works a little bit differently. If you would like more detailed information about how the search engines differ, go to www.searchenginewatch.com.

Figure 2. Web page listing various types of search engines and how they search the Internet.

Finding Statistics on the Internet

Locating statistics on the Internet to download is not a difficult task, but it can be time consuming. It would be helpful for the student to know the unit of analysis and how to evaluate information, before beginning the search. One can be overwhelmed searching the various Web sites given all the available data and the time it takes to determine if what is found is what is actually needed. A list of educational and governmental Web sites has been compiled to serve as starting points to browse and retrieve data sets. These Web sites were chosen based upon the criterion, which will be mentioned later regarding evaluating information on the Internet. Three examples of searches using government web sites for educational data sets are listed:

NCES http://nces.ed.gov/ > NCES Electronic Catalog > 2) Integrated Postsecondary Education Data System > 3) Data file > Search > NCES Search Products Information http://nces.ed.gov/pubsearch/search.asp > Fall Enrollment Data File, 1997 (http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000161) > Download the 1997 Fall Enrollment data as a zip file > Save .dat files as .txt files > Open saved file in Excel

U.S. Census Bureau http://www.census.gov/ > Product Catalog http://www.census.gov/mp/www/censtore.html > Subjects Index "*E*" http://www.census.gov/acsd/www/sub_e.htm > Educational Attainment > http://www.census.gov/population/www/socdemo/educ-attn.html > CPS March 1997 - Preliminary Data (EDUCATIONAL ATTAINMENT OF PEOPLE 25 YEARS OLD AND OLDER, BY SEX: MARCH 1997) (http://www.bls.census.gov/cps/pub/1997/educ_att.htm) > save as .txt file > Open saved file in Excel

NCES - http://nces.ed.gov/ > Electronic Catalog > Data Access Tools > National Public School and School District Locator > Data > pick and click on a ZIP file (it may be necessary to use a Helper Application to unzip the file before attempting to save it as text) > open and save as a .txt file > Open saved file in Excel

Printing and Saving Data

A procedure for printing a report or saving the report as a file depends on the browser or Web site. One may have the option of printing only specified pages of a report, or mailing a document as e-mail to oneself or someone else. Saving a file can be done through the *save*, *save as*, or *load to disk* commands when available. Many reports are in a fixed-width font, based on the 80-column format to provide maximum printer compatibility. These reports can be quite long, so it is advised that you check the length of a report before printing it.

Converting Data to Spreadsheet Format

These instructions are for Netscape 4.07 and Excel 97 SR-2. Procedures may differ with other software applications.

1) Once the full report is on-screen, choose *file*, *save as* and save the data with a .txt extension* (e.g. filename.txt)
*Depending on the software or instructions from the data set site, the extension could be different (e.g., .csv, .pm).
2) *Open* the saved file in any text editor (such as Notepad or Simple Text).
3) In Excel, *open* a file.
4) *Open* the saved data file.
5) A dialogue box will open up offering methods of converting the text file to a spreadsheet.
6) Choose the *Fixed Width/Delimited text* radio button (it depends on the Web site).
7) Click *next* and you will have an opportunity to change the width and placement of the fields. Often Excel will interpret the field widths correctly. If not, you can add a column break by clicking, remove one by double clicking or move one by clicking and dragging.
8) Click *next* again to have a chance to change a field's data type. Leaving the type as *general* usually works fine.
9) Click *finish* and you will have the data in a spreadsheet.

Evaluating Information on the Internet

When looking for statistics on the Internet, one must be careful and evaluate the source of information. As we prepare to use the Internet as a source for finding statistics, we must remember what features makes the Internet, a World Wide Web (WWW) of information. It is a place where the quality of information varies tremendously. The Internet is a place where the lines that define entertainment, advertising, self-promotion and expression are blurred, and this must be kept in mind, when looking for information on the Internet, and this information must be evaluated critically. Five criteria (accuracy, authority, objectivity, currency, and coverage) are listed below that will be helpful in evaluating information found on the Internet see (Table 1), (Web Research Evaluation Checklist, 1999).

Web Research Evaluation Checklist

Accuracy	Questions To Ask	Be Aware That...
	• Are the sources for any factual information clearly listed so they can be verified in another source? • Is the information free of grammatical, spelling, and other typographical errors? • Is it clear who has the ultimate responsibility or the accuracy of the content of the material?	• Almost anyone can publish on the Web. • Most Web information is not verified by editors and/or fact checkers. • Errors not only indicate a lack of quality control, but also can actually produce inaccuracies in information. • Web standards to ensure accuracy are not fully developed
Authority	**Questions To Ask**	**Be Aware That...**
	• What is the nature and purpose of the page? • Is it clear who is sponsoring the page? • Is there a link to a page describing the purpose of the sponsoring organization? • Is there a way of verifying the legitimacy of the page's sponsor? That is, is there a phone number or postal address to contact for more information? An email address is not enough! • Is it clear who wrote the material and are the author's qualifications for writing on this topic	• Often difficult to determine authorship of Web sources. • If author's name is listed, his/her qualifications frequently absent. • Publisher responsibility not often indicated.

	clearly stated? • If the material is protected by copyright, is the name of the copyright holder given?	
Objectivity	Questions To Ask	Be Aware That...
	• Is the information provided as a public service? • What biases might the author(s) have? • Is the information free of advertising? • If there is any advertising on the page, is it clearly differentiated from the informational content?	• Goals/aims of persons or groups presenting material often not clearly stated. • Web often functions as a "virtual soapbox".
Currency	Questions To Ask	Be Aware That...
	• Are there dates on the page to indicate when the page was written, first placed on the web, and last revised? • Are there any other indications that the material is kept current? • If material is presented in graphs and/or charts, is it clearly stated when the data was gathered? • If the information is published in different editions, is it clearly labeled what edition the page is from?	• Dates not always included on Web pages. • If included, a date may have various meanings: ° Date information first written ° Date information placed on Web ° Date information last revised
Coverage	Questions To Ask	Be Aware That...
	• Is there an indication that the page has been completed and is not under construction? • If there is a print equivalent to the Web page, is there a clear indication of whether the entire work is available on the Web or only parts of it? • If the material is from a work which is out of copyright (as is often the case with a dictionary of thesaurus) has there been an effort to update the material to make it current?	• Web coverage may differ from print coverage. • Often hard to determine extent of Web coverage.

Table 1. A Checklist showing five criteria that can be used to evaluate information found on the Internet.

Education and government web sites

The Internet is an excellent source for information. The Web sites listed below do not begin to represent the many statistical web sites that are available on the Internet, but they are a place to start.

Statistical Resources on the Web -- Education http://www.lib.umich.edu/libhome/Documents.center/steduc.html
National Center for Education Statistics (NCES) http://nces.ed.gov/
U.S. Census Bureau http://www.census.gov/
School District Data Book (Oregon/U.S. Census) http://govinfo.kerr.orst.edu/sddb-stateis.html
Journal of Statistics Education http://www.amstat.org/publications/jse/archive.htm
Kentucky State Data Center (KSDC) http://cbpa.louisville.edu/ksdc/
State Data Centers http://dir.yahoo.com/Society_and_Culture/Issues_and_Causes/Population/Data_Centers/
Data Ferret (Federal Electronic Research Review and Extraction Tool) http://ferret.bls.census.gov/cgi-bin/ferret
Inter-university Consortium for Political and Social Research (ICPSR) http://www.icpsr.umich.edu/
The Henry A. Murray Research Center at Radclifffe College http://www.radcliffe.edu/murray/data/index.htm
Social Science Data on the Net (University of California at San Diego) http://odwin.ucsd.edu/idata/
Missouri State Census Data Center Library of Data Holdings http://www.oseda.missouri.edu/infolib/uexplore.html

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Crehan, S & Teitelman, C. (1998). Strategies for Searching with Students. *Technology & Learning*, 19 (2), 23-28.

Internet Search Engines. (1999, February 10). Retrieved November 27, 1999 from the World Wide Web: http://www.louisville.edu/library/research/internet.html

IPL Index Page. (1999, October 26). Retrieved November 27, 1999 from the World Wide Web: http://www.louisville.edu/infoliteracy/

The Research Center. (1999). Retrieved November 23, 1999 from the World Wide Web: http://www.louisville.edu/library/research/

Search Engine Watch: Tips about Internet Search Engines & Search Engine Submissions. (1999). Retrieved November 27, 1999 from the World Wide Web: http://www.searchenginewatch.com/

Search engine - Webopedia: Definition and Links. (1999). Retrieved November 29, 1999 from the World Wide Web: http://webopedia.internet.com/TERM/s/search_engine.html

Web Research Evaluation Checklist. (1999, November 23). Retrieved November 27, 1999 from the World Wide Web: http://www.louisville.edu/infoliteracy/evaluate.htm

A Hero's Journey: Introducing Modular In-service Diploma Courses in IT at Trinity College Dublin

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Abstract: This paper is a reflective narrative exploring the introduction of a modular in-service programme, using the device of the Hero's Journey (features of which are described). The programme is a response to an Irish government initiative which aims to integrate IT into the education system. Pedagogical and curriculum issues, rather than skills or technical matters, are central to the programme; it thus relies heavily on the inputs of experienced classroom teachers. Modules are taught at many centres both on- and off-campus. These features provide organisational challenges. The Hero's Journey proved to be an effective frame for analysing the experience, with both strengths and difficulties being identified and with the spiral nature of the process facilitating replanning. Reculturation, in Fullan's use of the term, has been identified as the essence of the programme.

Introduction

In common with many countries, Ireland is seeking to prepare its education system to meet the challenge of technological development. The major response is entitled "Schools IT 2000" (Department of Education and Science 1997, FitzGibbon & Oldham 1998). It has as major foci to explore creative ways in which IT can be successfully integrated into the Irish education system and provide IT professional skill development for at least 20,000 teachers (Department of Education and Science 1997). Since it involves the whole country and seeks to include all teachers and schools, it is an example of a large-scale educational reform. The nature of such reform measures is, as Fullan points out, largely unappreciated; in his opinion what is involved is *reculturation* rather than *restructuring* of the institution. The former is a much more difficult task (Fullan 1999).

As part of Schools IT 2000, a National Centre for Technology in Education (NCTE) was set up, one of its tasks being to provide in-service courses in IT for teachers. These courses do not lead to certification, but they have created a demand for certified courses. The Education Department at Trinity College (University of Dublin) was already providing in-service courses in other disciplines, using a flexible modular approach in collaboration

with regional Education Centres. The same approach was used in designing and running a programme of such courses in IT.

The introduction and implementation of the university programme is explored in this paper. The experience is analysed using the metaphor of a "hero's journey," as suggested by Brown and Moffett for exploring school transformation: "To walk the path of the hero's journey is to leave the state of unconscious innocence and move towards conscious acceptance that we are living in times of chaos, discord and disequilibrium" (Brown & Moffett 1999 p. 58). Importantly, however, such a journey is one of "hope" (Brown & Moffett 1999 p. 1). This metaphor is used as a frame for reflection on the experience of the programme for two reasons; first, it was perceived to offer insights on the successes and failures which occurred; and secondly, it provides a spiral approach, permitting the replanning and subsequent evaluation to become a seamless activity. The spiral nature of growth, both personal and institutional, is highlighted in the seven stages which are specified for the hero's journey (Brown & Moffett 1999 p. 14):

1. Breakdown and the Call: Innocence Lost
2. Chaos and Complexity: This Way Come
3. The Heroic Quest: The Search for the Grail
4. Gurus and Alliances: Companions Along the Way
5. Trials, Tests, and Initiations: Staying the Course
6. Insight and Transformation: Arriving where we Started and Knowing the Place for the First Time
7. A New Call: The Journey Begins Again

1. Breakdown and the Call: Innocence Lost

Breakdown is understood as the loss of unconscious innocence — hence, the recognition of a problem. In the case of the document *Schools IT 2000*, several sections focus on the need for various kinds of teacher development (Department of Education and Science 1997). As Brown and Moffett point out, "all great mythic quests and journeys represent movements away from the stability, comfort, and safety of the known in response to external opportunities or threats" (Brown & Moffett 1999 p. 41). IT represents both opportunity and threat for teachers, and this phase in the journey might be considered as arising from the sense that breakdown has occurred or is about to occur. The path for the hero is away from unconscious innocence towards enlightened engagement: that is, taking a path of direct experience in which change is confronted directly. The Call, for the government department, is the recognition that the education system needed to integrate technology into the curriculum, and the realisation that this has considerable resource implications: hardware, software and (crucially) teacher preparation were all necessary. Courses are now being offered by many institutions, including Trinity College, specifically the Division of In-Service Education within the Education Department. This is the unit the work of which is critiqued in the paper.

The loss of innocence for the Division was the recognition that it was not meeting the needs of teachers in the "Information Age"; certified courses which would build on the government-sponsored courses were required. The Call was to provide appropriate courses. In particular, there was a need to fill a perceived gap in the market. Other universities were offering courses focused on skills (proficiency in the use of applications packages) or technical expertise (in computer science and machine maintenance). The Trinity College modules were intended to complement, rather than compete with, these courses; in particular, they were to be aimed at teachers with an interest in curriculum and the teaching/learning environment, and with a curiosity as to whether these might be enhanced by use of IT. Thus, the content was to reflect curricular and pedagogical issues, with the aim of increasing capability: capacity building rather than product transfer (Fullan 1999).

To set the context for exploration of the "hero's journey," some organisational features of the programme should be noted. The main outlines for the modules were created by a small steering group with members drawn from three sources: the University Education Department, one of the regional Education Centres which collaborates extensively with the Department, and the ranks of IT educational consultants (teachers with extensive and recent classroom experience in the area but currently working in advisory or support roles). The first three authors of this paper are members of the group. Seven modules were outlined originally: Software and Resource Evaluation, Selection and Use; Communicating with IT; Curriculum Design and Delivery; Presentation using IT; Authoring for Multmedia and the Internet; Planning for IT; and Management Uses of IT (http://www.tcd.ie/Education/In_Service/index.html). It was intended that each module would be developed further by its own team, typically involving members of the steering group and practising teachers with particular expertise in the area concerned. The modules were to be taught at a variety of sites around the country —

reflecting the Division's commitment to an "outreach" model that has not been common in Ireland — and by locally-based teachers as well as Division personnel and those involved in module design. Teaching and learning approaches would be innovative, to allow for creativity as mentioned earlier. Innovation would also be reflected in the style of assessment, which would not be restricted to the production of papers in standard academic format (the norm for assessment for graduate diplomas in the University), but rather would reflect the use of IT and the participative and collaborative approaches that the modules were designed to foster. The remaining sections of this paper examine how these intentions were implemented.

2. Chaos and Complexity

The use of the two terms "chaos" and "complexity" in describing the second stage of the hero's journey is interesting, especially in the light of Fullan's assertion that they are the same thing. He prefers to use the latter term, considering that "the new science of complexity essentially claims that the link between cause and effect is difficult to trace, that change (planned and otherwise) unfolds in non-linear ways, that paradoxes and contradictions abound and that creative solutions arise out of interaction under conditions of uncertainty, diversity and instability" (Fullan 1999 p. 4). The Division's experience echoes this understanding. With hindsight, it can be seen that the inherent complexity of the task guaranteed a measure of chaos. Brown and Moffett quote Bennett who describes the chaos present in schools as "the multitude of variables that can affect quality implementation of a sound educational innovation, chaos is doing too much too fast so that nothing is done well or connected to anything else. Chaos is the lack of a sustained focus" (Bennett, in Brown & Moffett 1999 p. 70). A pertinent question raised is: "How is it possible to improve the quality of teaching and learning ... [with] unrealistic time estimates?" (Brown & Moffett 1999 p. 73) (see Hargreaves 1995).

The In-Service Division had over ten years' experience of organising inservice programmes for teachers. Despite this experience, it was not able to anticipate fully the demands associated with the effective delivery of professional development in the area of curricular integration of IT. These included the need for the Division to engage in: curriculum design, software identification, software licensing and procurement, hardware specification, networking specification, identification of local venues and technical support, tutor identification and induction, identification and access to learning resources for participants (such as software and web-based resources), and identification and dissemination of assessment procedures.

Moreover, time estimates did indeed prove unrealistic. The seven modules listed above were outlined in winter 1997-98, and teaching commenced in Summer 1998. At Education Centres around the country, there was an immediate demand, not only for individual modules, but also for sets of four different ones, so that teachers could complete a diploma inside one year. This, in turn, meant that a larger team of lecturers ("tutors") than envisaged had to be set up. In the first year of implementation, twenty nine modules were offered at seven sites, both on and off the university campus. This caused difficulties. For example, production of documentation was rushed; tutors were appointed in haste, without time for proper induction; designated computer teaching spaces were not available as promised; internet connections were not in place. These can be viewed as examples of external chaos. Examples of internal chaos would include, for the tutors, conflicting emotions and loss of focus when encountering organisational and technical difficulties; for the students, confusion with regard to the nature of IT in education (perhaps perceived as an efficient mode of teaching but encountered as a series of technical problems) and the role of the tutors (expected to be "experts" but not necessarily more expert than some of the participants, especially at dealing with the technical problems).

In this phase it is also necessary to confront the "shadow" elements within an organisation. These are defined as "unacknowledged and covert patterns of behavior that are in competition with the formal, overt components of a business or educational organisation" (Brown & Moffett 1999 p. 60). This includes the extent that the stated purposes or actual reality are at odds with the declared values, and the acknowledgement of limitations such as lack of knowledge and possibly lack of will. An example of the former would be the

contradiction between a declared aim of the Division, "to enable teachers to reach their potential" (as stated in the Students' handbook), and the reality of insufficient attention being given to providing support for completion of the assignments. This was not sufficiently addressed by the Division initially. Perhaps this exemplifies the need for teacher educators to change their habits of practice towards a new model of professional development as outlined by Stein et al.; for example, a shift is recommended from "short duration with bounded personal commitments" to "longer duration with more open-ended personal commitments" (Stein et al. 1999 p. 244).

Because of the nature of the programme, assessment was always going to be a challenge. As indicated above, the course designers wanted to use a variety of modes, reflecting the innovative philosophy of some modules. Given the wide range of topics, tutors and conditions of teaching, it was difficult to ensure equality of standards; in particular, tutors without experience of third-level teaching were "thrown in at the deep end." (In fact, it can be said that a side journey emerged; this was the development of the tutors, especially in relation to assessment.) Moreover, the fact that modules were being run at the same time as the national — non-certified — courses for Schools IT 2000 led to some confusion. Because of their experience of non-certified courses, a number of students queried the need to produce assignments, suggesting that attendance would be sufficient to obtain credit.

3. The Heroic Quest: The Search for the Grail

The vision quest, in the words of Brown and Moffett, is "embodied in our search for ways to translate all that we now know about quality curriculum, instruction and assessment into the daily lives of schools" (Brown & Moffett 1999 p. 82). The underlying aim of the Trinity College Education Department in seeking to introduce IT is that of many educators: to address the needs of increasingly diverse student populations and the complexities associated with the increased demands made on education by society. Finding the way in which this can be achieved can be equated to finding the Grail (see Fullan 1993).

The vision was initially outlined by the small steering group, so — contrary to the suggestion of Brown and Moffett — it was not developed collaboratively with the whole group of tutors. However, as "vision building is an open-ended, dynamic process" (Brown & Moffett 1999 p. 84), tutors were able to input their on-going experience as part of subsequent group meetings, and thus claim ownership of the vision for themselves. This, together with the fast-changing nature of the discipline, has meant that course content has evolved continuously in the period. A contributory factor has been the continuing improvement in computer literacy of students entering the modules. An important aspect of the vision driving the quest was that it should address curricular and pedagogical, rather than technical, interests, as described above; while this remains dominant, it is now possible for some more technical modules (for example, on advanced web authoring) to be introduced, without contravening the spirit of the programme.

Altogether, therefore, it was possible for the process to be viewed as "hopeful," another attribute of the Grail quest. Five recurrent patterns for this phase were revealed (Brown & Moffett 1999, Senge 1990):

a) personal vision building as a sacred commitment — once sure of our vision, we need to stand up for it;
b) shared inquiry as a cornerstone of the successful vision quest — no one can achieve the vision alone, and as it is a process, needs to be subject to constant inquiry;
c) self-mastery as the ultimate jewel in the lotus — all need to be dedicated to self-mastery without which it is not possible to move from unconscious innocence to confront the realities of chaos and complexity;
d) the capacity for collaboration as a prerequisite to achieving the vision — team skills are essential, and also to be able to stand aside from the team if necessary;
e) vision and the "razor's edge of paradox" — to walk on the razor's edge is to be balanced between following the vision and encountering opposition and obstacles.

These patterns were present in the tutors' group, and were perceived to be developing to varying extents within the different class groups of students.

4. Gurus and Alliances: Companions Along the Way

An important part of the heroic journey is the acceptance that personal limitations require reaching out to companions, including wisdom figures, who embody expert knowledge and insight. The Trinity College in-service operation relies heavily on the participation of such colleagues from outside the university. For the IT courses, it was hoped that experienced classroom teachers would do most of the lecturing. Selection of tutors

presented some difficulty; the lack of relevant qualifications meant that many excellent practitioners of IT in the classroom were not formally qualified to teach in the programme (a Master's or higher degree being required). Initiation of the tutors' group, which maintained regular contact using email as well as having formal and informal meetings, was crucial. Members became "gurus" for each other at particular times. Collaboration was the norm, and tutors on a module in one centre shared their experience, presentations, notes, worksheets and other materials with a newer team in another centre. Companions along the way also included books — notably (Grabe & Grabe 1998) — articles, websites and other non-personal sources of information. Also, a model of collaboration as being the norm for educators was being presented to the students.

The students — the teachers attending the courses — are also companions who travel with us. It is envisaged that tutors and students together will be agents of change in the school system.

5. Trials, Tests and Limitations: Staying the Course

This stage recognises the difficulties involved. Those encountered at the beginning were outlined in section 2. Some touchstones suggested by Brown & Moffett are very useful in this context: problems are natural and inevitable, and learning occurs at the edge of chaos (Brown & Moffett 1999 p. 126 ff.).

To stay the course, a systems view must be adopted. One of the difficulties in offering free-standing modules, rather than intact programmes which are the Irish norm, is the higher rate of drop-out that tends to occur. Initial evidence suggests that students are staying with the programme, although a worrying factor was the lower than hoped-for number of assignments submitted (201 out of 527 registrations). In all, there were 29 modules, and sixteen diplomas were awarded in October 1999. More will presumably follow, as students have three years in which to complete assignments. Five students who had previously taken other modules qualified to enter the (follow-up) Master's programme (eight modules completed, with a suitably high average grade).

One aspect raised by Brown and Moffett is that of burnout — following John of the Cross, they term it "the dark night of the soul" (Brown & Moffett 1999 p. 125 ff.) — regarding *initiative overload* and *program proliferation*, resulting in cognitive disconnects and despair. "Giving up"' did occur. Some tutors have chosen not to present during the first term of 1999/2000 academic year. Despair however, was not a contributory factor in their decision; rather, it was the reality of undertaking a full-time teaching job and a part-time tutoring one as well. The challenge to bring about change and transformation in the education system remains with them. In the drive to meet the needs of the students, insufficient care may have been taken of the tutors, for example with regard to the provision of 'amulets' (which could be as simple as encouraging them to say 'no' to requests for more teaching!) to assist them in their roles. New structures are being explored.

6. Insight and Transformation: Arriving Where We Started and Knowing the Place for the First Time

The hero's outcome is the arrival transformed at the point of origin, but knowing and contributing to the place "in a new, more fully conscious way." We hope that, as for a hero, our experiences have equipped us, and our students, with "insight, wisdom, efficacy and commitment" (Brown & Moffett 1999 p. 146). It remains to investigate the extent to which this is the case.

Students were invited to submit an evaluation form, which explored their perceptions of the lecturer, the venue and the suitability of the content, at the end of a module. Of the evaluations received, comments were very positive regarding the teaching, content and timing of the modules; the negative comments related to the technical difficulties which plagued the first modules in particular. Unfortunately, however, the responses were too bland to support further analysis. In many ways, the assignments presented for assessment were more revealing regarding the quality of understanding and level of the attainment of the students. Overall, the quality

of assignments increased as lecturers learnt to modify the task set in the light of their experiences. Several of the assignments reached a high enough standard to support a proposal that they should be made available to other teachers on a website. Students' appreciation of the difficulties of maintaining heavily-used equipment to a high standard of functionality, especially in regard to web connections, grew during the period. Indeed, to the question "what other content should be taught?", a common answer was the skills to maintain a networked system in a school. This lies somewhat outside the scope initially envisaged for the modules, but it is being addressed in a parallel Master's degree programme introduced in Autumn 1999 as a joint initiative between the Education and Computer Science Departments (http://www.cs.tcd.ie/courses/mscitedu), and co-ordinated by the fourth author of this paper.

Further work is planned on assessment and on the development of new modules to reflect the ever-changing field, possibly incorporating the use of web-based discussions and video-conferencing to integrate more local expertise with that in the university and to support students when doing their assignments. It is hoped that the most interesting projects will be made available to other teachers through either the College's web page or the NCTE site, Scoilnet ("scoil" being the Irish for "school"). One possible indicator of success to date is that modules very similar in scope and content to the Trinity ones are now being developed by NCTE.

One conclusion that can be reached is that the programme, and of course those of other institutions, has resulted in the establishment of nuclei of educationalists, critical and analytical of the role and potential of IT in education in the curriculum, around many of the Education Centres around the country. This is in accordance with the purpose of the hero's journey. The legacy of the transformed heroic educator includes being able to approach change fearlessly, to take responsibility for our actions, to know the darker side, to be reinvigorated regarding their role in education and their teaching, to know that we need others and to share with others, and to be aware of the need for resiliency: that is, to take care of ourselves.

7. A New Call

A temptation in undertaking a journey may be to cling to ways that are traditional and comforting and in some respects that happened in the planning and initial presentations of the modules. However the desire to facilitate the type of professional development experience which genuinely impacts on classroom practice has led to a realization that what is necessary is not simply an upskilling exercise but a re-envisioning of teaching and learning and a consequent reculturation of students, tutors and university (Fullan 1999). Students have had to be prompted to go beyond the understandable desire for quick-fix solution and concrete applications for the classroom, and to reflect on the underlying models of learning. Tutors, as a necessary pre-requisite to dealing with the complexity of the teaching task, have had to develop collaborative skills such as peer-learning and team-teaching. The university has had to review its models of assessment to take account of the new media and different modes of presentation.

As the first cohort of IT students proceeds to study for Master's degrees and new groups come forward to take up the modules (established and new), the cycle starts afresh and there is a new Call. We hope that we are approaching the next cycle with more appreciation of the tasks involved, but with the same sense of excitement and hope that promoted the original enterprise.

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Classroom-based Technology Training for Inservice Teachers

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Abstract: An alternative technology training model for non-computer using inservice teachers provided teachers with classroom-based technology training. The training model included access to computers in the classroom as well as a technology mentor/support person for half a day each week. The teachers made significant progress in acquiring the technology skills to use computers and Internet resources for instruction in class. While highly successful for the teachers involved, the amount of resources required for this training model make it an unlikely training model for replication.

Background

Schools are acquiring computers and wiring for Internet access across the country. Along with the challenge of acquiring the equipment to make computers accessible as learning tools in the classroom, is the challenge of training veteran inservice teachers to integrate the new tools into their instruction. A common approach to providing inservice teachers with training is the "one-day workshop." Students are dismissed from classes and the teachers attend a workshop to learn computer skills. The content provided to teachers in these training workshops varies greatly, however, one consistent observation is that most of the workshop time is spent on learning the operating procedures for the computer without much time to focus on how to integrate the tools and resources into the curriculum. Additionally, learning procedures requires practice and rehearsal. The "one-day workshop" format does not provide the conditions necessary for this type of learning. Without opportunities for practice (or required practice), the teacher is not likely to remember the workshop content. Teachers are often frustrated by the low retention rate for the new skills from workshops in this format. Variables such as access to a computer following the training and the relevance of the training content to the teacher's curriculum are important factors in determining the retention rate of the workshop.

In an attempt to provide teachers with a more effective training format, a training model that focused on providing training weekly in the classroom setting was developed. The training model addressed many of the concerns or frustrations that teachers reported experiencing while trying to integrate technology into their instruction. To address the access issues, the model provided five student workstations, a software budget to purchase curriculum appropriate resources, Internet access, a color printer, a digital camera, a laptop computer for the teacher, a LCD projector, and a technology mentor/support person for half a day each week in their classroom for each teacher participating in the project. The goal of the project was to provide training, model the integration of technology tools into instructional strategies in the classroom and then have the project teachers share successful technology lessons with other teachers at their grade level or content area in the participating schools. The project targeted veteran, non-computer using teachers at four different elementary grade levels and four different core-curriculum areas. The project was funded by a grant from a state agency and was designed to run for two academic years.

Research Procedures

This case study research describes the experiences of eight inservice teachers who participated in a classroom-based, inservice, technology training model that was implemented for two years in four school districts in a mid-western state. Data was collected through a series of surveys and interviews during the two-year period of

the project. The surveys used a three point Likert scale with one being low and three being high to determine the value, comfort level or confidence level for the teacher responses. The project teachers responded to interview questions via e-mail throughout the two years of the project. All of the training provided focused on instructional uses for the technology tools as opposed to classroom management or personal skills such as grade book programs or e-mail. The technology mentor also provided troubleshooting and technical help for the classroom teacher. The technology mentor was also interviewed at the conclusion of each year of the project. The project teachers could also have one half day of release time a month to plan and work with the mentor outside of the classroom setting if desired. The teachers learned about the computers and Internet resources by using them for instruction rather than in workshop settings. The series of surveys were given to both the project teachers and the non-project teachers in the participating schools. The results were compared between the two groups of teachers to determine the effectiveness of the training model.

Findings

The project teachers reported increases in their personal technology skills such as confidence in using and understanding technology vocabulary. By the end of the two-year project, teachers increased their understanding of technology vocabulary from a mean of 1.5 to 2.1 on a three-point Likert scale. Their comfort level using technology vocabulary also increased from a mean score of 1.1 to 2 on the same scale. The project teachers increased their confidence level when using technology outside of the classroom from a mean score of 1.7 to 2.6 on the same scale. Likewise, the teachers reported a higher confidence level at a mean of 2.4 up from 1.3 when using technology in the classroom for student instruction. The number of classroom lessons using technology they taught also increased from a mean of 1.8 at the beginning of the project to 4.6 after the first year and declined to 2.8 the final year of the project. The project teachers also increased their confidence in troubleshooting skills and reported helping other teachers in their schools with technology questions or problems. When asked how many technology lessons they had the opportunity to observe being taught, the project teachers reported an increase from .4 to a high of 6.4 after the first year of the project.

The teachers reported an increase in the number of computer applications they used from 12 total applications at the beginning of the project to 39 total applications at the end of the project. Participants also revealed the importance of providing modeling and classroom management strategies for using the five student workstations. Teachers increased the different types of instructional strategies they used with the technology resources in the classroom. The eight project teachers reported using a total of 8 instructional strategies for using computers for instruction at the beginning of the project with an increase to 30 total strategies by the end of the project. The teachers were asked to rate the value of eight different strategies for learning technology skills. The teachers consistently rated "someone to show me how" as the most valuable form of technology training experience. Finally, the project teachers reported an increase from a mean of 1.8 to 2.5 for their comfort level with the classroom-based technology training. The rating for the value of having the mentor in the classroom while they learned how to teach a technology lesson increased from 2.1 to a high of 2.75 after year one. The mean scores for the project teachers increased in every category over the two-year project. The non-project teachers who were surveyed did not show any consistent growth except in the use of the Internet for information searches and many times the mean scores remained at the same level for all three rounds of the survey.

Conclusions

All of the project teachers made more progress in integrating technology tools and resources into their instruction than did the non-project teachers. However, given the fact that the project targeted non-computer using teachers, they should have reported gains of some degree regardless of the effectiveness of the model. Since the non-project teachers would have included teachers who were already using technology, the results of those surveys would not have shown as much growth during the two years of the project. Since the training was based on using the computers for instruction, the teachers learned technology skills required for integrating the tools into instruction. Lessons focused on instructional activities to meet curriculum objectives in addition to more typical student productivity projects.

The teachers were more inclined to plan and teach lessons that used the technology resources available in their classroom rather than using computer labs available in the school. The majority of project teachers had little

difficulty in producing weekly classroom lessons or activities for their students. Usually there is a period of personal productivity as the teacher practices the skills until they have a comfort level that allows them to use the computers for instruction. Most of the teachers seemed to successfully move past this stage, but two of the eight project teachers were often hesitant and did not initiate their own classroom lessons using technology. They relied more heavily on the technology mentor to generate and teach the lessons each week. Comments from the teacher interviews reinforced the importance of being able to watch technology lessons modeled in the classroom.

The difficulties the training model encountered were the amount of time required for the teachers to learn basic machine skills and the amount of technical support required. The rate at which the teachers progressed in their technology integration was varied among the participants and appeared to be related to the personality of the individual teacher. Most viewed the opportunity in a positive way and made significant progress. Teachers who had limited time to invest due to coaching responsibilities or who were closer to retirement did not make as much progress during the project as the other teachers. The teacher's perceptions of the training model varied from being viewed as an opportunity to an additional obligation once a week.

There were problems maintaining the computers in some of the classrooms. Five of the classrooms were Windows platform machines and three were Macintosh machines. The Macintosh machines were literally maintenance free and reliable during the project period. The teachers in these classrooms were able to plan lessons without the worry of technical glitches that might interrupt or ruin the lesson. However, the brand of Windows machines purchased for the classrooms were unstable and frequently required troubleshooting, technical support, and repair above the level of the teachers. All teachers were concerned about maintaining their classroom technology activities without continued technical support after the project ended. The lack of adequate technical support in instructional settings is critical to empowering teachers to integrate technology resources into their teaching.

Summary

While all teachers made significant progress in integrating technology tools into their instruction, the classroom-based training model is extremely resource intensive. It requires providing a "model" technology classroom with equipment as well as support personnel for the teachers. The resources required to replicate the model probably make it impractical to be implemented in most school districts. Continued evaluation of the role of the project teachers in their school should be followed to see if they continue to share their teaching strategies and skills to help other teachers in their schools move toward integrating technology tools into their instruction. If this activity takes place in the schools, then the dissemination value in sharing successful instructional strategies for using technology tools in the classroom might make it worth the investment in resources.

Transforming Teaching Practice with Technology: Incorporating ISTE Standards and Performance Assessment in a Constructivist Approach to Graduate Teacher Education

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Abstract: This paper analyses the importance of integrating appropriate technologies into graduate teacher education programs in an attempt to encourage the transformation of teaching practice into a form appropriate for the new millennium. It describes a site-based, graduate teacher education program based on a constructivist learning model. The importance of including in the program recognized technology standards; situated software training; technology based information management, problem solving and communication processes; and the integration of technology into the curriculum is stressed. The paper discusses technology training that assists graduate students to develop abilities to effectively conduct research using electronic information retrieval systems; to utilize technology to analyze, interpret and represent research data; to appropriately incorporate technology into classroom practice; and to utilize presentation software to communicate effectively with students, colleagues, parents and the public. Various types of performance assessments are discussed that require the demonstration of the inservice teacher's technology competencies.

Introduction

The use of computers and the Internet became a central feature of life in the final decade of the twentieth century. Schools saw a dramatic growth in the use of this technology from computerized grading systems to instructional games and simulations. Effective use of technology by teachers enhanced the teaching and learning process (Jonassen 1996; Kauchak & Eggen 1998). Educational technologies became an essential part of the instructional process (Teachers and Technology 1995) and helped teachers and students to restructure learning to a more meaningful, more individualized experience (Knapp & Glenn 1996). Many knowledge instruction classrooms have given way to knowledge construction classrooms in which technology plays a major role in assisting the teacher to engage and motivate the learner (Fisher, Dwyer & Yocam 1996; Kauchak & Eggen 1998).

Technology skills and knowledge empower not only teachers but also students in their educational endeavors. Technology has allowed a much more flexible, creative learning environment where students are able to pursue their individual interests through the exploration of real-life problems and issues (Knapp & Glenn 1996). Further, students' acquisition of technology skills and knowledge in the school setting provides a basis for their later success in the technology age of the 21st century.

Undergraduate students are now graduating from teacher education programs that integrate technology into the program curriculum. However, many inservice teachers completed their initial degree at a time when little or no technology was incorporated into the program. Of these teachers, many have had minimal inservice activities or taken few if any courses related to technology in education. It is therefore important for graduate teacher education programs to address the development and enhancement of teacher technology competencies.

Background

The need to increase inservice teachers' technology competencies was one issue considered five years ago when a site-based version of The Master of Education (M.Ed.) in Curriculum and Instruction was developed at Wichita State University. Created for classroom teachers and other educators with responsibilities for improving curriculum and instruction, this program was designed to develop dynamic, reflective practitioners capable of monitoring and improving their own practice through the application of educational theory and research. A crucial component of this new site-based program was the role played by information technology in the process of graduate student learning.

Now in the fifth year of operation, the site-based M.Ed. program has been made available to 15 different cohorts at 10 off-campus sites with 280 graduates as of the end of the Spring semester, 1999. Another 240 students are currently in the program with 119 scheduled to graduate by the end of Summer 2000. Master of Education students enroll in a two year core of 24 semester credit hours with a cohort of between 30 and 40 students.

Each site-based program is taught by three facilitators, one from the university, one from the host site and a third person from the field who complements the expertise of the other two facilitators. Throughout the program, a heavy emphasis is placed on reflection on practice and action research. Students work on a variety of classroom, school and district level projects to improve curriculum and instruction. Projects may be conducted by an individual, by small groups from the cohort, or by a collaborative group comprised of at least one M.Ed. Curriculum and Instruction student along with parents and colleagues such as teachers, principals, curriculum advisors, and school curriculum and instruction teams. Project topics, identified by the student, focus on appropriate ways to address needs, concerns and questions about one's own personal classroom practice, school organizational patterns and school-community issues.

This paper discusses one of these site-based M.Ed. programs situated at a sixth grade center. The school's library and adjacent 30 terminal computer lab is used for weekly class sessions and computer lab activities. The remainder of the paper, then, describes the approach taken at this site to integrate technology into the program.

Incorporating ISTE standards

There are six program goals with 29 program outcomes for the Master of Education in Curriculum and Instruction. The program goals state that graduates of the program should be able:

#1 to identify, analyze, and explain (a) successful curricular models and instructional strategies and explore the basis for their success, and (b) curricular and instructional problems impeding the improvement of learning and teaching in classrooms and schools, and propose sound solutions.

#2 to monitor, evaluate, and suggest means to improve instructional practice, including the evaluation of educational outcomes and programs.

#3 to assume responsibilities for the development, implementation, evaluation, and revision of curricula or programs of study in particular disciplines and/or for particular populations.

#4 to locate, evaluate, interpret, and apply appropriate research and scholarship to the study and solution of practical educational problems in curriculum and instruction.

#5 to plan and conduct action research, using sound theory and appropriate research designs, to investigate educational questions related to the improvement of curriculum and instruction.

#6 to demonstrate professional leadership skills and continued professional growth in curriculum and instruction.

To achieve the program goals, students are required to gain an understanding of technology concepts, operations, and applications; and the possibilities for the use of technology in the classroom. Additionally, students must develop and use a variety of technology skills to conduct research and give professional presentations to various audiences. The program uses the International Society for Technology in Education (ISTE) foundation standards to guide the development of the students' technology understandings and competencies. These standards include eighteen different technology standards classified into the three categories of a) basic computer/technology operations and concepts; b) personal and professional use of technology and c) application of technology in instruction.

Technology training in the program

Technology training begins in the first semester of the program with lab activities led by the instructional coordinator from the host district. During regular class time, students select labs that they feel are relevant for them, to learn to use e-mail, the Internet, Microsoft Word, Excel, Access, Powerpoint, and HyperStudio. These lab training opportunities continue throughout the two year core program in addition to individual tutoring sessions as needed.

Students also go on campus to be trained in conducting electronic searches. This training is led by library personnel at the Wichita State University main library. The following week after this training, another class period is spent in the library where students research a self-selected topic for a literature review project. It is expected that they will put into practice the skills gained in the previous week to use available electronic search resources. Students are further expected to complete electronic searches for other projects during the remainder of their M.Ed. program.

Technology and student research

After learning their way around an automated library system and gaining the skills of electronically accessing information, students research curriculum and instruction topics and issues relevant to their classroom practice. The use of software such as Microsoft Word, Excel, and Access, is also integrated into the students' action research projects. These software programs help students to analyze, organize and report the data they have collected. With them, students make tables and graphs that are used for poster presentations, in research papers, or in multimedia presentations that are developed to share research findings.

Technology and student communication processes

In between class meetings, students communicate via e-mail with course facilitators concerning course and program requirements; and with other students about projects being completed collaboratively. The usage of e-mail communication has increased dramatically over the last four years. In one of the first 1995 cohort groups , all of the students received e-mail addresses from WSU and were encouraged to use e-mail to communicate with the facilitators and each other. At that point roughly 20% of the students made use of it for program communication.

However, in the most recent cohort all but four of the forty students already had e-mail addresses before entering the program. E-mail is used on a regular basis to communicate general course and program information to all students. Additionally, almost half of the students already have utilized e-mail to communicate with one or more of the facilitators.

Integration of technology into curriculum and instruction

Technology is viewed by teachers as a viable method to enhance the learning and teaching in their classrooms (Kauchak & Eggen 1998). Teachers' action research projects focus largely on ways to better the education process for the students in their classrooms. Improving curriculum and instruction in any subject level at any grade level, often includes the integration of technology into existing curriculum (Knapp & Glenn 1996). Students conducted action research on technology topics such as using computer generated graphic organizers for reviewing and testing; creating a Web site for the school district and community; effectively using that one computer in the classroom; and using the Internet to benefit students' learning.

One teacher commented in her end-of-semester reflection paper that she had most enjoyed her action research that explored how technology impacts the mathematics classroom. She commented, " I integrated technology, to a certain extent, into my math classroom before I began my study. But I had never replaced an entire unit with an Internet project. What amazed me the most was how well students carried the concepts over into the next unit."

Another context in which technology can play an important role is when teachers have occasion to serve on school Quality Performance Assessment (QPA) or accreditation committees for their school. Students

in the M.Ed. program have utilized their acquired technology skills to construct PowerPoint or HyperStudio presentations for the final review process. They also create charts and diagrams to use as displays, as well as school brochures to distribute to the community, parents and the accreditation review panel.

Performance assessment of teacher technology competencies

Students are required to complete 3 projects in each of the four core semesters of the program. The presentation of all of these projects requires the use of various technologies, thus creating the context of performance assessment for every project.

Projects are reported in four different ways. Following the more traditional manner of presenting research, one project per semester is written as a paper. This requires the use of computer software such as Microsoft Word and Endnote to write and format the paper; and Excel and Access to organize data into graphs and tables for insertion into the paper.

A second way in which projects may be reported is through a poster presentation. Students again may use software to make graphs, tables, titles and labels for their poster. Some students use a digital camera to record events relevant to the project, and then print the photos to display on their poster. A requirement for the poster presentation is that a handout of some type with a summary of the information be available with the poster. This handout often takes the form of a brochure created with software such as Publisher98.

Students can also present their projects orally. Often, students use technology to create visual aides similar to what might be used in a poster presentation. Additionally, video clips, filmed and edited by the student, may be used to enhance an oral presentation.

Finally, at least one multi-media presentation of a project is required during the four semesters of the program core. This requirement is usually completed during the third or fourth semester when students have acquired advanced technology skills.

A grading rubric has been developed by the site facilitators for technology presentations. The rubric shown in Figure 1 delineates for students the competencies required to gain a satisfactory rating for the presentation. A student's ability to successfully complete a technology presentation is based to a large degree on the student's attainment of the competencies set out in the ISTE teacher technology standards.

Conventional Standards for Technology Presentations	**Rating scale (Circle one)**
- True multi-media, two or more types of media in the presentation - Used the Internet as a resource and credited the information used appropriately. - Presentation complements but does not distract from the main idea or theme. (e.g. sound, graphics, video, etc.) - Presentation layout is visible to all audience members - Organizational skills are apparent in the planning for the final presentation (e.g. storyboards, etc.)	4 - Creates a product that exceeds conventional standards. 3 - Creates a product that clearly meets conventional standards. 2 - Creates a product that does not meet one or two of the conventional standards. 1 - Creates a product that does not address a majority of the conventional standards.

Figure 1 A rubric designed by program facilitators to assess student technology presentations.

Student insights into technology training and application

Evidence of the successful integration of technology into program structure has been evident from student reflections written at the end of each semester. Many of the students describe the initial self-doubts they had concerning their ability to become technology-literate. However, technology training sessions, individualized tutoring, and the completion of projects requiring the application of technology skills empowered the graduate

students with technology. Comments like the following testify to the fact that the program component of ongoing technology training and application greatly enhanced the students' competencies and positive attitudes concerning the use of technology for their professional development as well as in their classrooms.

"I enjoyed the library research this semester immensely. I have implemented several ideas in my daily classroom schedule that were discovered in the articles...My students gained quite a bit from my library research - whether they wanted to or not...The time spent learning about the various computer programs was extremely beneficial...I feel much better about the technology presentation we will be doing next semester." Renee

"Another exciting project I worked on this semester was a PowerPoint presentation. After taking all the computer classes last semester I was able to easily present my project findings to the class." Felicia

"Over the past two years, I have gained many important technology skills that have proved useful to me in this program and in my classroom too." Thomas

"With the presentation of my research using PowerPoint..., I provided professional leadership and continued my personal professional growth." Barbara

"Learning to use the computer system at WSU, ERIC and LUIS were important first steps in completing our first literature review... At first using WSU's library seemed like torture!! But now I feel much more confident about being able to walk in and access the information I need to research a topic." Evelyn

Summary

This paper discussed how one Master of Education program successfully incorporated learning experiences to advance inservice teachers' acquisition of technology knowledge and skills identified in the ISTE foundation standards. It explained how lab activities and university training sessions are used for group as well as individual technology knowledge and skills tutoring. It also discussed the various types of performance assessment, required as part of the coursework that provides a venue for the students to demonstrate these competencies.

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Computer Technology in Foreign Language Teacher Training

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ABSTRACT: The rapid changes in language learning involving technology of the last decade are having a great impact upon efforts at supporting up-to-date teacher training for language instruction. Due to tremendous advances in Multimedia-Based Content (MBC) and Technology-Enhanced Language Learning (TELL), especially those involving the World Wide Web (WWW), learners of foreign and second languages are pursuing self-paced, interactive study in the context of formal instruction. This paper presents background information, outlines important developments, and discusses problematic issues in language learning technology as they have an impact on teacher training.

INTRODUCTION

Owing to the extremely rapid, widespread deployment of computer technology in such a relatively short time, there have been few publications to date which discuss the changes necessary in teacher training programs due to this remarkable transformation. The references presented in this paper do show that the current research on technology in language pedagogy is enlivened by the creativity of individual practitioners, who then reflect upon their use of MBC and TELL. This paper builds on the two most recent and valuable contributions by Kassen & Higgins (1997) and Scott (1998). The ideas offered here are the synthesis of practice and reflection, which itself is a key component to training teachers to effectively use technology. Reflection on practices improves them (Kassen & Higgins, 1997). Kramsch & Andersen (1999) put the challenge of MBC in perspective by emphazing that MBC requires even more mediation and interpretation by the instructor to facilitate student understanding. The very important process of mediation means that the role of the teacher in instruction is not endangered by the rapid deployment of MBC, but rather, that the need for the teacher to effectively mediate learning materials is even greater with MBC.

Language learners of today – both in the environment of traditional instruction and by independent efforts – are increasingly computer literate. Two labels accurately fit this audience: they are visually literate and entertainment-oriented. This generation is capable of working well with MBC and in a TELL environment, but also demands much of the materials, in terms of graphic user interface (GUI), help functions and navigational ease, and of the instructor mediating them (Gölz, 1999). Although CALL materials have existed since the 1960's (Levy, 1997), the tremendous leap to multimedia and internet-based resources is having a greater impact. An expanding amount of interactive materials on the WWW, MBC on CD-ROM or DVD, and exciting TELL options, are transforming the ability to learn a foreign or second language effectively (Bush, 1997). Because today's language learners are so technologically sophisticated, they respond to materials and methods that give sensory stimulation and genuine feedback.

Growing from a basis in CALL, recent MBC and TELL materials, including resources in the WWW, will continue to transform the role of teacher and empower interactive, learner-centered language learning. While the practical advantages of MBC and TELL lie both in the presentation of culturally rich materials and in interactive feedback, the next generation of teachers needs to find adequate means of acquiring technological knowledge and skills, within specific language training programs leading to teacher certification or graduate language programs, in order to work most effectively with students. This discussion assumes that the current task-based instructional paradigm, which seeks meaningful contexts for speech acts, to be a viable theoretical basis for language learning (Savignon, 1983; Hadley, 1993).

One ever-present question is the appropriate starting point for this discussion: are the new technological options really necessary for students to learn in the most pedagogically effective manner? In

one well documented case, students using a multimedia computer-assisted language learning system (MCALL) at the Universiti Malaysia Sarawak, with absolutely no instructor help, earned significantly higher TOEFL scores, at a reduced cost to the institution, than students who were in conventional, instructor-led classes (Soo & Ngeow, 1998). Although the results of teacher-mediated MBC are still dramatically challenged by some scholars (Roche, 1999), the effectiveness and enjoyment of MBC involving an instructor in the language learning process is claimed by both students and teachers in many surveys and studies (Bush, 1997). The best argument for implementing MBC and TELL lies in its unique strengths.

THE STRENGTHS AND CHALLENGES OF MBC AND TELL

The strengths of MBC are that sound, still image, video and hypertext are superior to a course based on a textbook, because the learner has the visual and aural input of real speech in a context (Pennington, 1996; Levy, 1997). The use of interactive exercises in a TELL setting, which give better, immediate feedback based on the learner's answers, is also superior to the completion of material which must be evaluated later. Self-paced learning with MBC and TELL, within the successful task-based instructional paradigm involving interaction with an instructor and other students, has become an effective course format. Examples of beginner-level MBC materials include video clips of dialogs and interviews, which a learner can use repeatedly, and often have many "help" features that explain the language the learner sees, hears and reads. Such features can be specific lexical items, such as providing an accurate translation for the given context, grammatical explanations, such as noting the use of the subjunctive form of a verb, or contextual notes, such as explaining that the use of a given slang term is perhaps only appropriate with friends or family. This pattern of repetition, combined with meaningful help on demand, is extremely effective in improving listening ability (Joiner, 1997). Examples of effective cultural resources include hypertexts illustrating the unique traditions and values in a given culture, as well as biographical and historical materials. The material which governments, organizations and businesses place in the WWW can also be adapted for language learning (Green, 1997; Glatz, 1998, Walz, 1998).

Multimedia materials are especially helpful with intermediate level learners, because progress at the level beyond beginner seems slow and student frustration is often high. Hypertext for intermediate level learners is a dramatic advancement, because it allows learners to hear passages, to see the related images and to use the extensive help features. The result of hypertext usage is rapid acquisition of vocabulary (Chun & Plass, 1996) and an improved ability to read (Martinez-Lage, 1997). Reading is an important vocabulary builder (Roche, 1999) and greatly accelerates the ability to comprehend speech, a factor in communicative competence. The entertaining aspect of multimedia is also motivating for learners. Both group – shared learning – and independent individual learning are options with hypertexts.

MBC learning experiences are culturally rich, visually oriented and less frustrating than the traditional, textbook-based instruction. The positive results of MBC materials include an increased ease of oral comprehension and reading ability, an emphasis on speaking in context, as modeled for example in video clips, and grammatical information integrated into the useful passages presented as hypertext. The use of MBC also lends itself to cooperative learning. Concentrated work on specific vocabulary, with which students have difficulty, is possible. The greatest benefit is in the use of better, immediate feedback in TELL, which helps to maintain continued interest in learning. Learners who use MBC and TELL materials are truly a new generation.The new MBC and TELL instructional options challenge students and instructors with many exciting, difficult and unresolved issues involved in converting traditional pedagogical methodology to effective practices mediated by computer technology. These issues relate to two areas of language instruction: (1) presenting of course content to the learner, (2) enhancing each individual's learning processes with feedback. New teachers must become aware of the MBC and TELL materials available for their given language of instruction and **fluent in their practical use.**

EVALUATING MBC AND TELL MATERIALS

The challenges of implementing MBC and TELL materials must be preceded by active involvement in exploring and evaluating MBC and TELL materials, both in regard to technical and to

pedagogical concerns (Kassen & Higgins, 1997; Scott, 1998). Such questions as to whether the given materials are able to account for diverse learning styles, or offer an array of "help" options, or have a range of level-appropriate scenes or exercises, must be given equal weight with questions as to whether the graphic user interface (GUI) is logical and inviting or whether the video clips can be effectively interrupted and repeated (Plass, 1998). In the process of learning to evaluate MBC and TELL materials, students training to be instructors attain the necessary level of technical comfort with computer operation. Knowing whether a program or a computer is not functioning correctly can be very important, especially if the number of computers or the time for student use is limited.

A teacher training model suggested by Kassen & Higgins (1997), which they label the Language Learning Technology (LLT) module, stresses that learning to teach with MBC and TELL materials involves five distinct phases: preparation, familiarization, exploration, integration and synthesis. Underlying each phase is the important opportunity for reflection on theory and practice, yielding both knowledge and skill. The end result is technological options integrated into the learning experience for students, from which the instructor can better evaluate other MBC and TELL materials for possible selection. Scott (1998) emphasizes that graduate teaching assistants (TAs) would do well to relate the technological capability of MBC or TELL materials to underlying pedagogical theories. Scott correctly views three basic learning modes, the sequential, the relational, and the creative, for each of which different materials are designed. It is also recommended that teachers in training develop research skills for studying how students react to MBC and TELL and their performance with various learning environments. Such inquiry is still quite unevolved, but will influence the development of future MBC and TELL materials (Chapelle, 1998). Scott's analysis compliments the ideas of Klassen & Higgins, also finding that the need for reflection in adopting technology to be crucial. The following points are meant to focus on those pedagogical concerns which future teachers confront in both evaluating and implementing MBC and TELL materials, followed by the more difficult area of creating such materials. Each area not only involves a keen concern with the *how* of technological options. It should be emphasized that teachers must also reflect on the *what* and *why* of the materials in a learning environment (Tedick & Walker, 1995).

MEDIATING THE SOCIAL CONTEXT OF MBC

The need for students being trained to teach a foreign or second language to understand the problematic creation and implementation of multimedia is extremely important (Kramsch & Andersen, 1999). Because MBC is itself a mediated social context for language learning, altered and interpreted by the attempt to depict language usage, the crucial role of the teacher to explain and amplify the full cultural background of the material is not diminished, but increased. Although MBC is a much more improved starting point for productive classroom interaction than textbooks, it offers much more detailed material to the student and can therefore be overwhelming. The student enters into an exploratory mode of learning which must be mediated by the instructor for full understanding. Practical examples of successfully mediating the social context of MBC include: (1) interpreting the appearance and actions of people, (2) interpreting the patterns of interaction between people, (3) interpreting locations and living spaces, and (4) interpreting important objects. Meditation of these four aspects contributes to the acquisition of information in order to compare and contrast both the cultural and socio-economic background of the MBC with that of the individual learners. What may be depicted as common or ordinary, special or unusual, must be explored for its contextual background ***and*** language usage. Understanding the language used by the people in the given MBC, while the primary goal of the learner, is but one part of the material. The language is made living, but subject to even greater scrutiny. The competent teacher learns how to use the entire offering for positive learning by exploring with students all the nonverbal material that MBC provides. In focusing then on language usage, which is best understood in terms of this larger contextual background (Frommer, 1998), the teacher has mediated this material and related it to the specific language used.

THE ROLE OF INDIVIDUAL LEARNING STYLES AND COOPERATIVE LEARNING

The nature of an individual student's reaction to any learning environment reflects their unique and often complex motivation and personality, and the fit between classroom dynamics and the individual

student's learning style can influence language acquisition (Meunier, 1998). While learning style preferences vary and reflect personality differences, MBC and TELL materials are actually a means to bridge the learning style preferences of various learners in a class. An instructor using MBC and TELL materials can balance activities that involve linear and concrete thought processes with those that are more interpretative and open-ended.

Although the use of TELL materials is at times more problematic, as the nature of the given interactive exercise and feedback may not fit well with an individual's learning style, the key to effective use of MBC and TELL materials is to assume that any given computer activity is only one of many learning tools in working toward a specific goal. Some learners will indeed find TELL in general more effective for them than others, just as some learners will respond more positively to a certain type of TELL activity than another (Levy, 1997). Practical examples of successfully accommodating individual learning styles include: (1) stressing target vocabulary items by means of activities involving all four skills, (2) supplementing difficult grammatical points with additional oral practice, and (3) introducing tasks which involve negotiating meaning, bridge information gaps, and have many possible means of completion or allow creative answers. The challenge of MBC and TELL materials for the instructor is not so different from that of traditional methodology: to be able to monitor student progress toward language acquisition and provide additional material or activities when necessary.

The practical implementation of MBC and TELL provides rich opportunities for cooperative learning, whereby students work as partners or in small groups on tasks involving not only listening and reading, but also speaking and writing (Beauvois, 1998). The product of such work can then be taken up in classroom activities. Approaching MBC as a learning environment for students in isolation, alone at a workstation, fails to play to its strength as an engaging and entertaining medium, which allows productive partner and group activities that help all participants. Partners and groups, separated geographically, could in fact meet solely in the context of the same cyberspace learning environment (Hoven, 1999).

Beyond the real world limitation of perhaps not having enough workstations for each learner, which could then be made into an advantage, the use of cooperative learning strategies reinforces the mediated nature of MBC, owing to the interpretative nature of video clips and images. Practical examples of successful cooperative learning strategies include the following: (1) adopting techniques from the use of video in the classroom, such as previewing activities and description activities of images or video clips without sound, (2) basing role-play activities in small groups on the given situations introduced in MBC, and (3) adapting dialogs and interviews presented in MBC for team writing assignments. Many assignments for individual completion can be the basis of cooperative learning activities. The dynamic contexts of MBC naturally provide excellent material for subsequent class discussions.

CREATING MBC AND TELL MATERIALS

Few instructors or creators of multimedia have the personal experience of extensive language learning in such interactive, visual environments which are now available. Many teachers have also never been trained to evaluate and implement MBC and TELL materials. There is still, in general, a lack of institutional support for such training. The perception that authoring software is very difficult also remains a stumbling block. Multimedia is often not integrated into the curriculum and outcomes, but fulfills a supplemental role. Although rapid changes in hardware and software do occur, the stability of the WWW is a bright spot for development efforts. Digitizing existing materials (pictures, slides, music, texts, etc.) for use as language learning resources on the WWW, especially on cultural topics, has been a realistic goal for many instructors and programs, although substantial efforts do require the use of an advanced relational database (Pusack & Otto, 1997). The effort at creating cultural resources on-line, and directing learners to authentic materials on the WWW, is already highly developed (Green, 1998; Glatz, 1998; Walz, 1998). The creation of more comprehensive multimedia materials, with advanced interactive exercises giving useful feedback, is an on-going challenge. The need for future teachers to learn to be fluent in the creation of MBC and TELL materials can be best addressed in a course format which combines students with a technical background with language students. A good introduction to the process of design grows from evaluating MBC and TELL materials and should continue by offering practical experience in placing materials on the WWW. The ingredients for success would be an emphasis on incorporating various learning styles into the group projects and designing projects of an appropriate scope.

SUMMARY

The need for more MBC directed at target audiences based on age, level of instruction, and incorporating diverse learning styles, is crucial. The need exists for detailed analysis of learning patterns in order to improve materials (Chapelle, 1997). Because the need for language learning is strong in the highly mobile, communication-oriented world of the Information Age, and the important advancements in multimedia resources and technology suitable for language learning are greatly helping to meet the challenging requirements of language learners, the teachers of the future must master the technological palette available. While the need for students being trained to teach a foreign or second language to understand the problematic creation and implementation of MBC and TELL is extremely important, technology will not endanger the role of teacher. Empowering interactive, learner-centered language learning brings even greater challenges, but also greater rewards. New teachers, fluent in the materials available for their given language of instruction and in their practical use, will not simply passively implement commercially packaged content and interactive exercises. Well-trained teachers, who understand the theory and practice of mediating the social context of multimedia, the role of individual learning styles and cooperative learning, and the basics of creating their own content and interactive exercises, will be able to meet the challenges of technologically sophisticated learners. While the practical advantages of MBC and TELL lie both in the presentation of culturally rich materials and in interactive feedback, the next generation of teachers must critically adapt these technological options to the needs of their specific language program.

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Implementing The Virtual Campus Learning Community for Teacher Education at George Fox University

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Abstract: The George Fox University Virtual Campus Learning Community (VCLC) is an internet environment designed on-site by professors to serve adult distance education students in professional programs. The VCLC is a grass-roots alternative to traditionally designed on-line course delivery systems. Internet course delivery systems are often conceived and implemented institutionally, driven by administrative goals of greater control, uniformity, and cost efficiency. VCLC is instead conceived and implemented "in house", directly accountable to the needs of teachers, students, and other stakeholders. This paper will describe the rationale for undertaking grass-roots on-line course development, followed by a description of the VCLC's technological and pedagogical framework. VCLC is more cost effective, and and is better suited to needs of our professors and students than commercially available systems. The paper concludes with a narrative history describing the VCLC implementation to date, including "lessons learned" and recommendations for those considering grass-roots on-line course development.

The Education Department at George Fox University delivered web-based instruction for two years using "George Fox Online University," a web course system designed by an external vendor and implemented by institutional initiative. The on-line system was plagued by high cost, required high-end user hardware and software, and designed and implemented with administrative needs in mind. Most crucially, however, the on-line system created dependency on a rigid, centralized technology structure, frustrating and disempowering faculty members and students. These factors combined to create an intractable situation for professors in our department committed to meeting the needs of professionals studying at a distance.

VCLC is an alternative model developed by George Fox University Education Department professors on-site. VCLC is relatively low-cost, uses "mid-range," widely accessible software and hardware and is structured specifically to meet the needs of adult professional programs. It also enables professors to independently and creatively implement web-based tools which facilitate and support teaching and learning, communication, service activities and scholarship.

VCLC implementation began in Spring 1999 and has progressed gradually to include 6 professors teaching 12 web-based courses with approximately 120 students. The cost of development (about $5,000) has been absorbed by regular department budgets and a small community development grant. Training of professors has consisted of mentoring relationships with peers, combined with a once-weekly short meeting to share concerns, questions, and experiences. VCLC is continuously being evaluated and modified by the stakeholders whom it is designed to serve. While VCLC implementation has not been free of difficulties, the heightened ownership inherent in our "grass-roots" approach to development has effectively empowered our department to use the internet for quality teaching and learning.

Exploring a Blind Alley: Lessons Learned

In 1996 George Fox University undertook serious study of the potential benefits of using the internet to deliver distance education. The initiative, "George Fox Online University," (GFOU) was conceived by top administrators as a efficient way to generate tremendous financial revenue for the university. Despite a faculty study group recommendation, based on the experiences of other institutions, that on-line course delivery does not provide significant financial gain, university administration pushed the plan forward. Rather than using on-site technical personnel to develop an on-line system, programming and hardware support was outsourced to an external vendor, isolating professors and students from the process of system design. By 1997 $250,000 had been invested in the On-Line University, with a commitment to about $400,000 more over the next several years.

In mid-1999, GFOU was discontinued after a substantial investment. A case study (Ankeny, et al, 1999) describing the rise and fall of GFOU lists several factors contributing to its failure:

- The financial estimates were based on marketing the system to undergraduate students (the largest population), not graduate and adult students as suggested by professors. Enrollment figures indicated that cost-effectiveness was only realized where the system was used to deliver graduate courses.
- Administrators mistakenly believed the GFOU would be a more efficient method of delivering instruction. In fact, it was less efficient for faculty, in that they needed to devote more time to online teaching than in face-to-face classes due to the interactive nature of the medium.
- The impact of disempowering faculty and students by outsourcing the technical design and implementation on the GFOU was underestimated drastically. The result was a system whose design and functionality failed to match the needs of students and faculty, and was intractable to change. As described in the case study (Ankeny, et al, 1999),

> "[the system designer] seemed to be enamored with technology and didn't clearly understand how faculty taught. He thought the conversion of normal courses to online courses simply involved turning materials over to technicians who would then scan them into a digital format." (Ankeny, et al, 1999).

- The culture of dependency created by the top-down nature of the GFOU made it impossible for professors to actively participate the creative use of technology:

> "Now that [faculty member's] pages were built, he ran into his first major institutional roadblock: getting access to a web server. This was where the collision of ideologies about institutional approaches first came clear to [faculty member]. He was told that only administrators had accounts on the (singular) web server. Further, he was told that since these pages were accessible to the world, every page had to be reviewed for content and appearance by one particular administrator in the institution... Her office was clearly a bottleneck in the institution" (Ankeny, et al, 1999).

After, the GFOU was discontinued, it became the responsibility of individual departments and units on campus to implement on-line course delivery as desired/needed. For the Department of Teacher Education, implementation was not a question; it was absolutely necessary in order to meet the needs of many students enrolled in programs at a distance. Can a department with limited technical means develop its own on-line course delivery system? What follows is an account of the process of our department went through to develop its own "skunkworks" for delivering distance education on-line.

Grass-roots Design and Implementation: Building a Skunkworks

After the demise of GFOU, the George Fox University Department of Teacher Education was left to its own devices to continue serving students at a distance. The department was afforded a unique opportunity to design and implement a system based on educational objectives and needs as seen by faculty, students, and administrators working together as a team. The model for planning and development has proceeded organically, a product of the input of shared voices and concerns. On-going development of the Virtual Learning Community (VLC) has led not

only to empowerment of department professors, but a shared sense of mission for all stakeholders. This process was referred to by a colleague as the building of a "skunkworks," a reference to its "learn-as-we-go," unofficial formula for action.

Laying The Foundation

A key consideration in the design and implementation of the distance education delivery system is an assessment of the needs and characteristics of faculty and students. It is important to determine the educational objectives of the teacher and learners and the teacher's basic assumptions about the learning process prior to the development of the delivery system. As Chang (1998) pointed out, technology must be consistent with the existing values of faculty members. Faculty members must see that there is real educational value in the use of technology, not that a technological system exists for the sake of technology alone. This section presents the rationale for accepting faculty input as a key step in the distance education implementation process. In addition, student-centered learning will be examined, as well as features desired by faculty in the distance delivery system.

Meeting Faculty Needs

While much has been made over the last several years about the need for distance education development to be a team effort, the faculty member is key to the success of the distance education program. In fact, as noted by Parisot (1997):

> Faculty are crucial to implementation of any new technological change. However, little has been done to understand the changing role of faculty in adapting to technology and the changes in the psychological and physical environment promised by distance learning. Therefore, a more thorough understanding of the faculty experience in the distance learning environment is important to the formulation of institutional policies designed to guide the diffusion of distance learning into the teaching process (p. 1).

Policies related to the marketing and delivery of distance education programs must take into consideration the needs and characteristics of the potential teachers. Institutional desire to implement distance education often centers on concerns of finance and competitive advantage (see Levin, 1998; and Lawton and Bonhomme, 1998). A typical approach for an institution in implementing a technological innovation is to purchase a "system" and make it available for those that want to try it out. Faculty members may or may not be involved with identifying features and functions of a system that they would like to have to enhance the teaching/learning process. "Unfortunately, many academic institutions are swayed by the bells and whistles embedded in a fancy software package and do not consider what the learner can receive and handle as part of the learning process" (Palloff and Pratt, 1999, p. 63).

When faculty members have had the opportunity to describe important considerations in the functioning of distance learning delivery systems, the technological details are not cited as the primary concern. Needs and objectives of the participants are often the decisive factors for faculty members. Factors considered key for faculty members preparing to teach at a distance include: a) an ability to adapt teaching styles and methods (Lawton and Bonhomme, 1998: Chang, 1997), b) a working knowledge of the technology used to deliver the distance education program (Miller and Carr, 1997; Parisot 1997), and c) skill at facilitating learning (Knowles, 1993).

Faculty members need to be prepared and supported in the distance learning experience. What works in a classroom environment does not necessarily work in an electronic teaching environment. Having an appropriate virtual environment to work in is a key part of that preparation and support. There are a number of considerations in building an online teaching space. Faculty members seek technology that supports teaching and learning. Palloff and Pratt (1999) described elements of effective courseware for distance learning. An effective delivery system is functional, simple to operate for teacher and student, and user friendly. These characteristics speak to a transparency for the courseware that allows for the participants to create content, interact, move in and out of the learning space and troubleshoot problems unhindered by the technical system.

In addition to functional courseware, faculty seek opportunities and support in professional development related to distance education and resources appropriate for supporting their efforts at teaching in the distance environment. Support for teaching not only includes technical support, but support related to accomplishing their educational objectives in a new environment.

The Need for Student-Centered Teaching and Learning

Distance education researchers (e.g. Lawton and Bonhomme, 1998; Chang, 1998; and Harasim, et al., 1995) have pointed out that a traditional pedagogical model of teaching and learning is not well supported in a web-based learning environment. Internet-based distance learning seems to be supportive of a particular framework for education, one that features a student-centered approach. This section examines foundations for student-centered teaching and learning in the virtual environment.

Smallen, (quoted in Van Dusen, 1997) described the ideal learning environment. This environment contains subject engagement and interaction. Interaction is defined as, "consistent opportunities for students to interact with other students and the instructor, to test their own ideas and to learn from the ideas of others" (p. 15). While Van Dusen stated that learner-content interaction can be enhanced in internet based teaching, due to the variety of ways content can be conveyed, learner-learner and learner-teacher interactions are problematic. However, other distance educators (e.g. Machanic, 1998; Riegle, 1996) pointed to the possibilities of building *strong interaction* with students in internet-based courses.

Strong interaction leads to new possibilities for learning. Parisot (1997) pointed to a unique aspect of distance education. Distance education tends to democratize the educational experience. The web-based distance education program seems to operate best when the teacher assumes the role of a facilitator of the learning experience, as opposed to being an authority who transmits knowledge to the student. This creates a number of questions for the teacher and the delivery system. Are faculty members ready to give up a traditional transmission and control mode of instruction? Are faculty ready to abandon the traditional pedagogical model and adopt a different mindset, that of the facilitator? If, as Knowles (1993) suggested, the students' ability to take responsibility for their own learning is an important variable for success, than the teacher's ability to release that responsibility to students is also very important.

From Pedagogy to Andragogy

Although a number of models of teaching and learning could be considered in preparing distance education programs, adult education theory is especially important to consider. Knowles (1993) is noted as the developer of the *andragogical model* of adult learning. The assumptions of this model are that the learner is increasingly self-directed, the learner's experience is a resource for learning of self and others, readiness to learn comes from life tasks and problems, problem-centered approaches have the most meaning, and motivation for learning is internal. Knowles stated that the most important variable to be considered in working in the andragogical model of education is the level of the learner's skill in taking responsibility for his or her own learning.

Building on the assumptions of andragogy are process elements that describe the procedures involved with delivering educational experiences. Table 1 describes the process elements of a course and a description of that element in the usual pedagogical contrasted with the assumptions in the andragogical model.

Process Element	Pedagogy	Andragogy
Climate	Top-down	Collaborative, trusting, supportive
Planning	Teacher driven	Mutual planning by teacher and students
Needs Assessment	Teacher prescribed	Mutual assessment
Setting of Objectives	Fixed	Negotiated
Learning Plans	Uniform	Contracts, projects
Learning activities	Objective	Inquiry projects, independent study
Evaluation	Normative	Criterion referenced, expert and peer validation

Table 1: Description of elements in the andragogical model.

Considerations of these process elements should help in making decisions regarding the delivery system for distance education. If the assumptions of the andragogical model are accepted, then faculty members would seek a delivery system that would foster an environment of trust and mutual support. The system would allow for flexibility and joint control on the part of the faculty members and students. The system would allow for easy access and ongoing interaction.

When viewing internet-based distance education as an opportunity for developing a student centered approach, faculty members' assumptions about the learner and the teaching learning process lead to particular types of activities and an ongoing interaction among the participants. The delivery system must allow for the functions and processes desired by faculty and students.

Raising The Walls

The VLC's goal is to empower, giving maximum freedom for both students and professors to create their own teaching and learning environments on-line. To accomplish this, the department faculty as a whole worked to develop a flexible course template, in which the needs of technological beginners would be met, along with allowing expert users to use the space in creative ways.

The VLC Shell

At the core of VLC are CGI scripts that professors use to create a hollow course "shell," or template. The VLC "shell" can be recreated independently by faculty members, who are then able to configure their own virtual classroom using the shell's functions. In some respects creating a VLC course resembles an old-fashioned barn-raising. The community provides the energy and work to erect a functional, but empty, course-space. It is up to the professor and his/her students to create within this hollow shell a functioning learning community based on the needs, talents, and desires of the group.

VLC Functions

The VLC supports features that map strongly to many of the assumptions and elements of the andragogic model, as well as meeting many of the previously cited faculty needs (Table 2).

VLC Function	Element(s) or Assumption(s) Supported
Asynchronous Access	• Subject engagement on the student's own terms
Idea Container: Professor-configured Message Boards	• Development of supportive collaboration and interaction • Adaptive to unique teaching styles and methods • Course Interactivity • Peer validation
Webliography: Dynamic, annotated link library that students and professors can build independently	• Student initiated learning • Democratization of the learning environment • Peer validation
Learning Journal: Private discussion space accessible only to professor and individual student	• Supportive communication and availability • Mutual assessment • Negotiated setting of objectives

Table 2: Mapping VLC Functions to Andragogy

Living in the VLC

In Fall 1999, four members of our department including one off-campus adjunct faculty member taught courses involving nearly 100 students using the VLC framework. A short weekly meeting was held to provide an opportunity to share concerns about current courses and to suggest changes for "VLC 2.0," the next iteration of the system. The total cost so far, absorbed by standing department budgets, has been less than $5,000. One faculty member summarized the difference between VLC and its predecessor GFOU:

"The Online University System had functions I found to be attractive, but it was a closed system. What I mean by closed is that I could not alter the appearance or functions of the system. I had to alter my goals or activities to fit the existing structure. The system was also closed in the sense that any suggestions I had for altering the system had to have the approval of administrators and technical consultants who advised me on the unavailability of programmers or the high cost of altering the system to address my concerns. The system was difficult to navigate in and didn't coordinate well with other software that I wanted to use. What I have found with the current VLC is that I have immediate access to the technical consultant, one of my faculty colleagues, who can either change the system to suit my needs, or instructs me in how I can make changes myself. The system allows for easy creation of content files and interactive space. We regularly meet to address concerns and make changes. I feel like I am a co-owner of this space, whereas with the previous system I felt like I was a sharecropper who was subject to the owner's mercy for addressing my concerns." (Professor Interview, 11/99)

Ironically, the VLC system is very comparable technologically to GFOU, utilizing many of the same programming tools and functions. The key distinction between VLC and GFOU is instead one of politics and flexibility. VLC professors enjoy being *sharers* and *leaders* in the development process, able to take creative initiative in developing and teaching their on-line courses, as well as contributing to the ongoing development of the larger system. Politics, unexpectedly, may be the crucial design factor in developing and implementing internet course delivery technology.

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Active Learning Environments Prepare Teachers for Technology

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Abstract: The Technology Assistance Program (TAP) of the Southwest Educational Development Laboratory (SEDL) is currently involved with the *Applying Technology to Restructuring and Learning* project that involves 150 teachers in six site schools located in SEDL's five state region. The primary purpose of this study is to document how teachers and their teaching practices change as they integrate technology into their classroom. Another important part of this project is the design, development, and implementation of staff development sessions that model constructivist learning environments supported by technology. This paper will describe the development issues that faced the TAP Team when designing these professional development sessions, some of instructional strategies used in the sessions, various classroom management models, and the effectiveness of the professional development for helping teachers successfully integrate technology into their classrooms.

Introduction

Utilizing technology in teaching and enabling students to implement technology in their learning are two of the greatest challenges in today's classroom. Consequently, professional development for in-service teachers is one of our nation's top priorities — especially professional development that emphasizes the effective integration of technology into the curriculum. Current research shows that technology curriculum-integration rather than technology skills training should be the primary focus of technology-centered staff development. Instruction should focus on and illustrate how technology can support educational objectives via instructional environments such as collaborative problem solving and cooperative learning activities. And most importantly, activities should be designed that engage teachers both intellectually and professionally. (Brand 1998).

A recent national survey of teacher's use of digital content (Education Week, 1999) shows that "curriculum-integration" training seems to have a greater impact on teachers than "basic technology skills" training. Results of this study show that twenty five percent of teachers who had only basic technology skills training within the past year say they rely on digital content to a "moderate" or "very great" extent for instruction, the same percentage as among teachers who had no training at all. However, for those teachers who had only curriculum-integration training, the number of teachers who use technology for instruction increases to thirty seven percent. Fifty one percent of teachers who had eleven hours or more of basic technology skills training within the past year say they feel "much better" prepared to use technology than they did twelve months ago. However, sixty five percent of teachers who received eleven hours or more of curriculum-integration training say they feel "much better" prepared to use technology than they did twelve months ago. In practice, however, the average teacher receives less curriculum-integration training than basic technology skills training. Overall, some forty two percent of teachers had six or more hours of basic technology skills training within the past year, compared with just twenty nine percent of teachers with six or more hours of curriculum-integration training.

An analysis of most technology training curriculums for classroom teachers reveals that technology skills training is frequently the primary focus of these sessions; that is, training for basic word processing, draw/paint, database, spreadsheet, classroom management tools, multimedia and presentation applications, digital cameras and scanners, and telecommunications components. Effective curriculum-integration activities are often minimal. And when they are included, the most common strategy is to have participating teachers create a lesson plan that includes the use of technology. The weaknesses of this approach are that the teacher often does not implement the activity, it creates a false notion that a single technology activity is "integration," and the selected technology becomes the purpose of the classroom activity. In general, teachers are left on their own to figure out effective technology implementation strategies (Sun et al. in press).

Establishing a Theoretical Framework

Constructivist learning principles were the anchor for the *Applying Technology to Learning and Restructuring* project. However, during the initial planning stages it became apparent that team members held differing views of constructivist learning theory, how it played out in a classroom, and how technology supports the construction of knowledge. While "constructivism is not a theory about teaching but is a theory about knowledge and learning" (Brooks and Brooks, 1993, p.vii) it was important for the TAP team to develop a framework of understanding and explore the implications of these issues for teaching.

Over the course of several weeks, the TAP team reviewed the literature (Brown, Collins & Duguid, 1989; Duffy & Jonassen, 1992; Brooks & Brooks, 1993; Duffy & Cunningham, 1996; Jonassen, 1996; Maddux et al, 1997) and arrived at a common understanding which resulted in the following six principles of constructivism. These principles become the foundation for the *Applying Technology to Learning and Restructuring* project. (1) Learners bring unique prior knowledge, experience, and beliefs to a learning situation. (2) Knowledge is constructed uniquely and individually, in multiple ways, through a variety of authentic tools, resources, experiences, and contexts.(3) Learning is both an active and reflective process. (4) Learning is a developmental process of accommodation, assimilation, or rejection to construct new conceptual structures, meaningful representations, or new mental models. (5) Social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning. (6) Learning is internally controlled and mediated by the learner. By developing and sharing this common belief of how learning occurs, the TAP team was able to create more meaningful learning environments throughout the professional development series.

Design and Development Strategies

A common problem that faces staff developers in public schools is "efficiency." That is, how to teach large numbers of teachers in the shortest amount of time. A review of delivery strategies for technology strands reveals that a three-hour or six-hour workshop is a popular and commonly used approach. In most cases a particular workshop will have a single technology focus, be led by a facilitator skilled with that technology, and be conducted in a computer laboratory setting. Just as with any teaching method, a workshop is helpful for some but not for others. Frequently workshops become professional development "events" and do not have the follow-through necessary to create impact over time. Sometimes they tend to be too long, create information overload and fail to engage the attention of participants (Sun et al. in press)

Because TAP's goal was to model authentic learning environments in its staff development sessions, it chose to create activities that used limited numbers of computers rather than having a computer available for every person. The logic was that if teachers had to teach with a limited number of computers, it would be more meaningful for them to participate in sessions with limited computers. The object was to help them learn how to manage limited resources instead of becoming an "expert" in any single computer application. If the TAP team had chosen to conduct all of its professional development sessions in a computer laboratory setting, it would contradict the teams' belief that learning is enhanced in authentic situations, promoted through collaboration, and is learner-centered rather than instructor-centered.

This strategy was successfully used in the early sessions that promoted team activities at computer learning stations. However, when the TAP team was faced with the need for participants to learn a specific technology in more detail, it was tempted to use a traditional instructor-led lab setting approach. However, since some of the labs available for use either in the teachers' school or school district were either too small or were not adequately equipped, the team couldn't take the "easy way out." The TAP team was faced with designing a different way of delivering training with a technology focus. To do this, the team found that it didn't need to abandon its original goal of modeling authentic learning environments with limited numbers of computers. The following section describes three models that don't require a lab setting to teach technology rich activities and can be replicated by teachers in their classrooms.

Constructivist Learning Environments Supported by Technology: Classroom Models

The design and development of sessions for the *Applying Technology for Learning and Restructuring* project evolved over a period of several months and strove to accommodate a variety of computer skill levels,

different learning styles, curriculum interests, and varying available hardware and software at the six site schools. Constructivist learning environments supported by technology promoted collaborative learning activities in a variety of group configurations. The models below describe some of those group configurations. The TAP team found that the type of grouping didn't necessarily assure success in completing a project, solving a problem, or learning new skills. Having an engaging activity with an overarching structure and clear expectations, along with defined roles and responsibilities, proved to be key to the success for collaborative projects.

The *Active Learning Stations* model was designed with a thematic focus — "Your Community." The teacher/facilitator presents the activity and then functions as a "consultant" for the remainder of the activity. With the goal of the project explained, teams of four to five rotate through three different "learning stations" to gather data and information. One station uses a digital camera to gather images, another station uses a simple electronic spreadsheet to analyze data, and a third station uses printed materials about the community. Each of the stations has roles for each of the team members as well as instructions for completing the tasks at that station. While the "learning station" approach is commonly used in K-6 classrooms, it is not as commonly used in the middle and high schools. However, once they had seen how it worked and actively participated in it, several middle school teachers in our project were able to use it successfully in their classrooms. The teachers who used this model report that it required advance planning and organization. They also caution "first timers" to focus on a manageable or simple project. A team of five middle school teachers used this model for a collaborative project but found that they planned too many activities. However, they also found that student interest and energy were high and they will definitely use this approach again — but next time on a smaller project.

The *Navigator Model* is another team approach designed by the TAP team. This model is more technology intensive than the *Active Learning Environments* model. This model was designed so that participants can learn to use a software application while learning a new educational concept. (One of side benefits of this model is that it helps to alleviate the problem of technology-competent teachers who "hog the keyboard" in team sessions.) Several teams of four are given a different part of a concept to explore within their team. To do this, they are asked to create a "concept map" using *Inspiration* software. While the team carries out its initial discussion, one person from each team attends "Navigator" training. Navigators are those teachers with medium to high computer skills and are selected in advance for that role. The facilitator spends approximately fifteen to twenty minutes with the Navigators teaching them the basics of *Inspiration*. Once they are trained, the Navigators return to their team. They then instruct the rest of the team on how to use the software. The Navigator has to abide by one specific rule … they can only give instruction and cannot touch the keyboard. The rest of the team rotates using the keyboard so that everyone has a chance to use the software. Several teachers have found that the "Navigator" model helped them learn to resist putting their hands on the keyboard while they are helping students do work on the computer. They also found it very beneficial for managing those students who want to do all of the computer work for their classmates. By appointing these students as "Navigators," the students are more conscious of their behavior with the "no hands rule."

The *Expert Model* is very similar to the *Navigator Model*. However, in this model there may be several "Experts." When using the computer, the Expert can be doing the work on the keyboard. The role may rotate to other members of the team. This model is useful for carrying out more complex projects that require different skill sets and levels of expertise. The Expert is not necessarily the team leader or facilitator. When TAP carried out this staff development session, it pre-assigned teams and distributed the technology skilled teachers across all of the teams with the designation that they would be the technology expert for that team. Teachers report that in their classrooms, student technology "experts" seem to occur naturally. Those with the interest and skill come forward. However, they report the tendency of some of the less skilled students becoming dependent on these more skilled students.

Summary

While many of the 150 teachers in the six project site schools for the *Applying Technology to Restructuring and Learning* project initially expected technology-skills training, they instead received a much richer technology curriculum-integration learning experience through active learning environments. Computer skills were learned in context through meaningful authentic learning experiences and greater control was placed in the hand of the learner. Each of the staff development sessions in the series is characterized by the following: (1) supported by constructivist learning theory and takes into account teachers' understanding and beliefs about how students learn, (2) utilizes inquiry, problem-based teaching and learning, (3) uses commonly available

software found in classroom settings, (4) includes two or more instructional strategies for managing a constructivist learning environment supported by limited amounts of technology; and (5) through reflection activities at the end of each module, asks teachers to judge how the different instructional strategies could be applied to their own classroom setting. Overall, each module exemplifies instructional strategies that reflect a constructivist learning environment; includes a link to computers through hands-on experiences, links to curriculum competencies, collaboration among participants; and small group and/or whole group reflections.

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Modeling Technology Use in Special Education Teacher Training

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Abstract: This paper summarizes a discussion of techniques for teacher educators to use for modeling technology use in credential program courses. While university faculty typically have access to sophisticated platforms and programs, few K-12 teachers have or will have such access. If, instead of exclusively using university systems, faculty use or model a variety of K-12 software programs, teachers may more readily see the usefulness of technology in their own classrooms. Such modeling often takes less instructional time, shows applications in action, and facilitates discussion of other uses of technology in all content areas and grade levels.

It seems obvious that the breadth and depth of available technology is rapidly increasing. At the same time, a teacher shortage and related political climate are encouraging university faculty to condense preparation programs and turn out trained teachers as fast as possible. Whether a credentialling program requires specific technology classes to cover technology standards or the program follows an infusion model in which students demonstrate competency of specified standards, class time is tight: It is steadily becoming more difficult to adequately cover concepts, applications, and evaluation of technology in special education teacher credentialling programs. Recent studies seem to document that technology applications are neglected in teacher training programs (Basinger, 1999; International Society for Technology in Education, 1999).

One simple and modest alternative may be for the instructor to increase the modeling of effective techniques in the delivery of the college course itself. Such a design would use principles of modeling as the instructor conducts the course using techniques and materials themselves readily available to most K-12 teachers. The instructor may also perhaps briefly discuss the technique or software program and other potential uses or generalizations. While many college faculty are trying to increase their use of technology both instructionally and to support their own work efforts, we often do so with recent software and high-powered institutional platforms not readily available in nor suited for public school classrooms and teachers. For example, while most faculty have access to very sophisticated test generator programs, local school districts generally do not. If course examinations are constructed using the university's package, the students may not easily see or really believe how test generator software can be of use to them. On the other hand, if a software program such as *Teacher's Helper Plus* is used to make the test, the instructor can also take just a few moments to share with the students how easily the test was made, state that the software is less than $50 for either Mac or IBM platforms, and discuss how K-12 teachers might use such a program for tests, quizzes, study guides, or worksheets.

Some other opportunities to model K-12 software in teacher training may be in the areas of instruction or course management. The present discussion includes only a few possibilities in each area. These general examples could be used in courses ranging from an introductory course on inclusive education to methods of instruction for students with learning disabilities to advanced behavior management and so on.

Instruction

In the broad instruction area, regardless of what the specific course content is, technology for use by K-12 teachers can be modeled in assessment, assignments, instructional techniques, and materials preparation. The test generator example discussed above is just one such example in assessment. Another assessment example relates to portfolio assessment which can be very useful in special education and is also increasingly common for credential candidates as part of their own professional development. Electronic portfolios such as *Grady Profile* or *Portfolio Assessment Kit Supreme II* are available for K-12 students and could be used by teacher candidates to prepare their own professional portfolios.

Other course requirements and assignments can be written to require students to use or include technology content in their responses. For example, virtually any class could include an assignment to find and review an Internet site related to the course topic. K-12 teachers could use a similar assignment by giving a menu of sites for their own students to review. A slightly more sophisticated assignments might be:

> Specify a question or topic related to this course's objectives. Investigate Internet sites on that topic and prepare an annotated list of three which are new to you and which specifically answer your question. Include an introductory paragraph on why you selected these 3 sites and how, as a whole, they answer your question and will support your future professional development.

Other assignments may require a student to use *PowerPoint* in making an oral presentation or to submit assignments electronically to the instructor and classmates. Common K-12 software such as puzzle generators (for example, *Crossword Companion*) or cloze generators (for example, *Word Link*) can be used to make a study guide for a chapter or other course handout. Again, a moment can be used to describe how the worksheet was made or for class brainstorming on how a similar technique could be used in their K-12 classes.

Credential candidates may be required to develop websites, often using something like *Dreamweaver* (Macromedia) or even HTML. It may be more effective to create sites using *Site Central* or *HyperStudio* which are more likely to be found in K-12 programs. An even simpler and more accessible option for K-12 teachers is to use TrackStar or another education website template site.

While faculty commonly use *PowerPoint* to prepare overheads, we can also model materials preparation with common word processors or graphics programs. It takes only a moment while presenting the content of the course to mention that "This overhead was made with X program and could also be done with something such as Y program. You could make similar worksheets for use in your classrooms."

Course management

Technology can be used and modeled by faculty as they manage their university courses including tracking student grades, maintaining frequent communication with students, and developing syllabi and grading rubrics. Many if not most universities automatically provide faculty with sophisticated grade book programs. Alternatively, faculty can use a program such as *Easy Grade Pro* to keep student grades in a class on assessment. At midterm time or a little later, faculty may use the programs parent report options and easily prepare a family report for each student just as K-12 teachers can use that option to send home frequent progress letters.

Using email to distribute study questions before a lecture may increase a student's motivation to use email. Email or a course listserv can also be used to distribute announcements such as job openings, campus events, newspaper articles or television programs on disability issues for which classtime might have other wise been used.

Faculty frequently make assignment rubrics using word processors or spreadsheets. While such utilities are available to K-12 teachers, so are programs such as *Teacher Timesavers* which has added features of specific school examples in the documentation and subprograms such as flashcard generators. An instructor can also demonstrate how he/she used a spreadsheet program to make the course schedule and show how a K-12 teacher can use a spreadsheet to make rubrics and schedules.

A great source for technology support to faculty is *The Electronic Scholar* (Edyburn, 1999). While research productivity is Edyburn's focus, many of the tools he describes are potentially useful in K-12 classrooms. For example, faculty (or K-12 teachers) could use ED Tech Tools to make interactive quizzes for their students whether the course content is advanced management theory or Harry Potter.

Other techniques

There are also some other simple and relatively passive techniques which special education faculty may use to increase the visibility of technology in teacher credential programs. Textbook selection is perhaps the most significant consideration. In addition to selecting a text by how well the content meets course objectives, texts may also be considered by how technology is represented in that content and how much technological support is available. For example, virtually all programs have some sort of generic introduction to disabilities course. Watson (1999) described 10 such texts but concluded that only 6 of 10 included any mention of technology. On the other hand, Lewis and Doorlag's (1999) text includes extensive discussion of

technology, assistive technology, and educational software. Over 35 software programs are listed in the index and Internet sites are plentiful throughout the text. Another aspect to textbook selection is to use supplemental texts such as "Technology for inclusion: Meeting the special needs of all students" (Male, 1997) in introductory courses or beginning methods classes.

The number of texts with publisher-run websites is increasing. These websites typically include links to other Internet resources, text based quizzes, and chapter study guides. Using Internet references in course required readings or reference lists also models the use of a variety of media in instruction. The number of sites with full text information is increasing.

Requiring electronic collaboration in fieldwork and other classes also models a technique teachers can use throughout their career. Requirements may also include subscribing to a professional listserv, newsgroup, or chat room (Birnbaum, 1999).

It is also important to continually keep "low tech" possibilities in mind. Fax, phones, voicemail, and snail mail are all increasingly easily accessible technologies with applications for K-12 teachers (Carlson, 1999).

Conclusion

There are many technological resources and techniques which work effectively for college teacher trainers while realistically modeling and discussing what a local classroom teacher can also do. As faculty, we can consciously use the techniques we teach in the delivery of our own course content. Taking time to specifically mention the techniques and materials we use may motivate our students to use more such materials and techniques with their own students.

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An Effective Model for Professional Development in Using Technology to Learn

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Abstract The Virtual Learning Technology Community (VLTC) is a collaborative technology professional development model that supports k-12 students, k-12 teachers, university faculty, university preservice teachers, and instructional technology staff developers at local service agencies. The ***mission*** of the VLTC 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 ***vision*** of the VLTC is to provide assistance to additional PK-12 schools seeking support for improving the use of technology to help students develop competence in [a] finding and evaluating information and ideas, [b] using available learning tools, and [c] communicating effectively. The VLTC has impacted 400 teachers in 27 schools, 6,000 students, and 20 preservice interns. The long-term impact of the model is enhanced by dissemination activities, archiving and sharing successful strategies and institutionalizing essential support structures.

Introduction

Over the next ten years, more than two million new teachers will need to be hired and trained to use technology. Yet, most institutions of higher education do not adequately prepare teachers to use technology. Teacher education institutions, state education agencies, and school districts are further challenged to meet the technology staff development needs of experienced teachers. Thus, new models of support in which educators at all levels (university teacher educators, k-12 teachers, preservice teachers and k-12 students) learn together must be developed to make use of scattered expertise and limited resources.

The Virtual Learning Technology Community (VLTC) is a three-year project, which began in November of 1997 funded by the University of Wisconsin System. The VLTC model creates a virtual community where teacher educators, k-12 teachers, preservice teachers and k-12 students communicate, share, and learn together through a variety of activities, thus improving technological literacy and skills of all participants. The community develops new and spin-off projects that expand the impact on learners (e.g., k-12 teachers, k-12 students, university students and university faculty instructors for student teachers and graduate students in the k-12 schools). The VLTC supports communication, collaborative learning and sharing, and efforts to generate new resources. To date, the VLTC has reached over 260 teachers and approximately six thousand students across 30 schools.

Description of VLTC Goals and Activities

Phase I VLTC activities focused on establishing the model, working on communication strategies and identifying teacher needs. Personnel were identified, roles and responsibilities were defined, and assessment strategies and tools were developed. The VLTC web site was established as a resource base and communications tool (http://www.uwec.edu/Academic/CI/vltc/vltc.htm). The coordinator identified schools where staff development could be conducted, recruited teachers to participate and lead activities, and identified classrooms where teachers were already beginning to integrate technology into instruction. Concurrently, teacher educators began recruiting interns and developed technology support packages (laptop, software and communications tools, video conferencing tools, and scanners) to ensure access to some advanced tools.

Phase II emphasized building links between the VLTC and Regional institutions. Interns were placed at three different schools sites to (a) supply some technical expertise, (b) work with teachers to explore new tools (e.g., video conferencing) and develop new strategies for using technology, and (c) provide release time for the teachers to attend and lead staff development. VLTC teachers began attending and teaching workshops, revising curriculum, and identifying advanced staff development needs. UWEC and UW Stout responded with a series of graduate offerings including ITV Instructor Training, Computers in Education: On-line Communications and Information Retrieval, Information Literacy, Instructional Design and Development, Technology in Science and Mathematics instruction, Creating Multimedia Productions, Distance Learning Networks, and Web Design. Initial efforts reached 52 teachers and approximately 1,000 students in fourteen small districts.

Phase III (Strengthening links among Regional PK-12 Schools) activities emphasized strengthening the social context to support high-risk activities associated with changing long-held teaching and learning paradigms. Through a variety of face-to-face and electronic mechanisms, VLTC participants shared their developing knowledge of current regional projects, established new ways to communicate, and publicized ongoing efforts. Participants were encouraged to think about technology as a tool for learning subject matter rather than just learning about technology. Projects ranged from introducing desk top video conferencing into classrooms and using asynchronous learning environments such as NiceNet and Lotus Notes Learningspace to building class web pages to using video editing tools and graphics design tools.

Three current projects focus specifically on context building. Each project took a different approach to bring together educators from different places and levels to focus on common goals. The *Technology Mentors* program uses a multiplier model to support k-12 staff, university and high school students, and preservice teachers as they work to redefine curriculum, instruction, and assessment in technology-rich classrooms. During the first year of the program, nine master mentors participated in technology staff development and leadership activities to prepare them to work with other building teachers. Each teacher worked with two additional teachers to build a network of 27 teachers prepared to support others and to serve as hosts for preservice teachers. The design for the second year required that each master mentor and building mentor work with two additional teachers (thus supporting 54 additional teachers). The success of year one activities was so high that 42 new teachers applied for the Mentors program. By the end of the project, the original target of 81 teachers will be surpassed. Over 160 teachers will receive advanced staff development aimed at increasing their ability to integrate technology into instruction. Fifty-one teachers will participate as staff development leaders by conducting training, presenting model integration strategies for peers, and coaching teachers in classroom settings.

You're I.T. (Integrating Technology into the Curriculum) blended 70 VLTC and Technology Mentors staff and teachers in a two-day symposium and staff development series in March 1999. The symposium began with a dinner and debate examining the pros and cons of bringing technology into classrooms. Participants were divided into teams one month before the symposium and assigned the task of finding evidence from the literature to support their argument. Listservs were set up to facilitate team planning and sharing of information. The debate was moderated by an area School Board President. The following day, a series of breakout sessions provided opportunities for the Technology Mentor teachers and VLTC teachers to share strategies with an audience of invited teachers, university educators, preservice teachers, and k-12 students. Sessions were structured to emphasize integration strategies and discussions of successes and failures rather than just showcasing technology. The symposium closed with an evaluation session and discussion of networking strategies to ensure that participants were able to connect with presenters and each other. *You're I.T II* will extend the success of the first symposium by including additional participants, increasing staff development responsibilities of mentor teachers, and showcasing projects completed by student teachers and interns.

FastforWord (involving 6 K-12 students, 30 undergraduate students (preservice teachers), 1 graduate student, 1 university faculty member and 1 K-12 teacher) assesses the validity of a CD-ROM and Internet based program that claims to improve the language skills of children with specific language impairments, and specifically, dyslexia. The focus of FastforWord is evaluation of commercially developed support technology. Participants will conduct research to determine if the program improves the temporal

sequencing deficits that cause specific language impairments and dyslexia. FastforWord provides an opportunity for teachers and students to take a more critical stance toward the integration of technology into learning by testing developers' claims against independent evaluations. Consequently, teachers and students will develop a clearer view of the time, processes, and resources needed to assess the impact of technological tools on student development.

Phase IV (Supporting New Projects Impacting Students In VLTC Schools) activities emphasize (a) extending participants opportunities to work together, (b) institutionalizing new groups, courses, and connections, and (c) disseminating the VLTC model. VLTC will continue phase III activities, particularly the FastforWord, You're I.T. and Technology mentors activities. In addition, several new projects such as small grants for teachers, and advanced graduate studies drawing on Phase III activities, have been introduced.

Phase IV also includes evaluating the impact of VLTC. Tracking the influence of VLTC activities on teacher knowledge, classroom practices, and student learning is complicated by the very nature of the project. As the variety of activity increases, tracking impacts on practices becomes more complex and difficult to document. Table 1 at the end of this document illustrates the links among project goals, activities, outcomes, and assessment strategies. Current activities include collecting post data using survey instruments, assembling portfolios of teacher and student work, and conducting exit interviews with students and teachers. Each data set documents ways the project influences practices and helps identify new questions deemed important by the participants. A sample of teacher projects, complete analyses of survey and workshop interview data, shared presentations at conferences and descriptive data illustrating patterns of participation will be archived through the VLTC web page.

Using Outcomes to Support the Transition to a Self-Sustaining Model

When the VLTC project began, we envisioned a set of small districts developing links with each other, and with regional agencies and Universities. The partners would work together to increase the amount and quality of student learning through a variety of uses of technology. During the course of three years, the community has grown from an initial set of six schools to include more than 30 small schools and one large urban/suburban district. By the end of the 1999-2000 school year, 300 K-12 teachers and their students will have been impacted in some way by the community activities. Twenty teaching interns will have completed semester-long experiences focused on different ways to enrich student learning through technology. VLTC established a regional technology staff development symposium drawing 75 - 100 participants, supported teacher development in the use of distance learning technologies, and draws participants from preservice teachers, university teacher educators, K-12 teachers, and K-12 students. We face significant challenges, though, in moving from an externally supported to a self-sustaining community. Several important transition issues are highlighted below.

Maintaining a teacher-driven model. While the initial impetus for VLTC came from a small collaborative group, the identification of teacher development goals rests mainly in the hands of the participants. By respecting participants' changing perspectives and helping them develop better ways to learn from each other, the community is internally driven. One indicator of the success of the internally driven approach is the sheer increase in participants in VLTC activities at a time when teachers are inundated with technology-oriented staff development opportunities through graduate courses, service area workshops, and other local, regional, and state-supported opportunities. The need remains for participant-driven development that offers something different from the "shopping mall" available to educators. We are challenged by demands on participants' time, changing expectations about costs/benefits of participation, and just getting lost in the total volume of opportunities.

Institutionalizing community activities. A second important element is securing and maintaining institutional support for community activities. Two new courses initially funded by VLTC now exist as regularly offered on University summer and academic year schedules. Two distance education initiatives are now attracting internal funding; interest and hardware/software resources generated through the VLTC experience provide a sufficient base for continued pilot project development.

Large scales summer staff development opportunities have sufficient history and visibility to attract some institutional support, but are more difficult to sustain. Competition for larger amounts of institutional resources may limit the long-term feasibility of such initiatives, especially as educators are faced with more and more choices for investing their time.

Five schools now contribute $4,000 per intern to bring advanced preservice teachers into their districts to complete student teaching and work with classroom teachers to integrate technology into teaching. The interns complete a technology integration project in the host school. They provide release time for supervising teachers to attend staff development, work with other teachers, and engage in resource development. Hardware/software support for the interns and their supervision will continue through University funding. However, as more projects offer internships and compete for quality preservice teachers, we face limitations in the number of qualified preservice teachers available to fill the slots offered by schools. Without continued successful placements, K-12 districts will shift resources to other projects.

Our experience clearly highlights the need for a coordinator who is a recognized, active member of the school communities where staff development is occurring. The coordinator is in a unique position to identify linkages and common needs across buildings and districts, and make the "people connections" necessary to create and sustain the conversations needed to bring groups together. The current coordinator position will be continued with support from a regional agency.

Summary

The VLTC has achieved the goal of creating a community that is driven by internally-defined goals, includes a variety of learning opportunities and communication possibilities, and brings together educators at all levels. The project web site provides an archive and "one-to many" communications tool. Sharing mechanisms such as You're I.T. highlight the gains in technology skills and instructional integration made by community members and help sustain connections among participants.

Sustaining the community concept requires that the participants have gained sufficient value during the project that they begin assuming responsibility for the costs and organizing activities required to bring people together. As the VLTC funding cycle ends, we are working to develop strategies for sustaining the community concept. Our success in shifting some grant-supported activities to institutionally supported events is encouraging. However, we will need to develop more strategies to sustain links among VLTC teachers, foster new staff development projects, and help teachers make increased use of distance learning technologies.

Table 1
Links among VLTC Goals, Outcomes, and Assessment Activities

Goal	Key Activities	Outcomes	Assessments
Phase I: Establish the Community	1. Coordinator hired 2. Monthly meetings at different sites 3. First K-12 sites and activities identified	- Coordinator will be sustained at CESA 11 at reduced level after project ends - K-12 districts commit teachers and $$ to intern projects	Technology Needs and Practices: Large scale pre-post survey to track changes in teachers knowledge, use, and confidence with technology
Phase II: Establish links with Regional Institutions	1. Interns placed at three K-12 Districts 2. Staff Development activities offered through CESA 11 3. Partnership with U.W. Stout's Nakatani Center 4. UWEC Graduate Courses offered	- Increased staff development at Intern schools - Twelve workshops for 52 teachers in 4 districts impacting 1000 students - Three new courses offered for the first time supported by Universities	Intern Interviews Post workshop surveys, exit interviews with evaluator
Phase III: Strengthen links among Regional K-12 Schools	1. Technology Mentors VLTC partnership links teachers in two regions 2. You're I.T. brings K-16 educators together in common forum/workshop 3. Expanded staff development activities through CESA 11 4. Distance Ed. Activities extended to CESA 10 Districts 5. Video-conferencing across districts 6. Collaborative Presentations to a variety of audiences 7. Continued intern placements	- CESA 11 teachers worked directly with Eau Claire School Teachers and staff development team - You're I.T blends 70 educators and students across all levels - workshops for 260 teachers and 6000 students in 20 districts - Nice-net and Net meeting projects in elementary and middle schools - Distance education facilities used for content and practice with D.E strategies - Three national, seven State/Regional and three local conference presentations	Exit surveys, group interviews, number and type of presentations at workshops Exit surveys, interviews with teachers and students
Phase IV: Support new and ongoing classroom projects; disseminate model; shift support to regional institutions	1. Small grants for K-16 teams 2. Advanced graduate study by a cohort of teachers 3. Continued Staff development through CESA 11 4. Rotated Intern placements to support new projects 5. You're I.T. The Next Steps 6. Continued Presentations	- Opportunities for 6 – 10 small group projects linking University and K-12 educators - Workshops will be maintained at current levels with increased school/CESA funding - Teachers will present curriculum projects and strategies	Project summaries and artifacts, Examples of revised curriculum Post workshop surveys Number and type of presentations Technology Needs and Practices Post Survey

Where Do I Go When I Don't Know What to Do: Using the Internet to Create a Virtual Learning Community

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Abstract: This paper presents a case study describing the efforts of teachers to improve communication among their colleagues at their respective schools, an elementary school and a college of education. Frustrated by the lack of time to collaborate with fellow teachers the creators used the Internet to improve communication and to work toward developing a community of learners among teachers. Still in their infancies the two sites are constantly changing as their use suggests improvements, but the goal of the endeavors has been reached: the creation of learning communities among teachers, replete with a true sense of communication and collaboration.

Introduction

A great deal of research is currently available describing on-line communities of learners created via the Internet. Many of these "virtual communities" are created to connect students to teachers, students to students, and teachers to teachers. Kowch & Schweir (1997) defined learning communities as "collections of autonomous, independent individuals who are bound together by natural will and a set of shared ideas and ideals, and who are engaged by influencing each other within a learning process." A whole new dimension has been added to the creation of learning communities with the use of technology. Virtual or online learning communities are materializing on the World Wide Web. A virtual learning community works in the same way as the nonvirtual community to extend the participant's professional community, but it can extend the reach of the community far beyond the walls of a classroom (Dyrli, 1998). A review of the literature reveals evidence of learning communities being established at all levels, elementary school through higher education (Jorn, Duin, & Wahlstrom, 1996; Kowch & Schwier, 1997; Tinto, 1997).

As new learning communities are established, learning goals need to be determined, and specific tasks to be completed must be created. To do this successfully Jorn, Duin, and Wahlstrom (1996) suggest that the perspective participants must be the focal point of

consideration. It is their belief that a learning community will be effective only if the participants want to interact and communicate.

Background

The lack of time to collaborate with her fellow teachers while attending to the many daily responsibilities assigned to elementary classroom teachers frustrated a fourth/fifth grade social studies teacher. As the social studies chairperson she spent a great deal of time locating resources for other teachers and wishing for more hours in the day to be able to really help her colleagues. This frustration inspired her to use her personal Web site as a means of connecting the teachers at her school to social studies resources.

The idea for this Web site was inspired when the teacher was invited to co teach a graduate level general methods course. In preparing for the course, she was referred to a Web site created for faculty. In an effort to enhance consistency in course material, delivery of content, and communication among the large number of faculty who teach the two general methods courses in the undergraduate and graduate programs at a state university a virtual learning community among faculty had been created.

The courses were developed to address the needs of beginning teacher education majors and graduate students seeking initial certification. As the courses are requirements for certification, there are many sections offered each semester to accommodate the large student population. As such, there are numerous instructors, including adjunct faculty, who teach the courses. The Web site is designed to create a learning community among the disparate faculty.

When an individual, like the social studies teacher, accepts the responsibility of teaching one of the general methods classes he/she is directed to the Web site instead of a generic course syllabus. The new faculty hire may still be in different state, but thanks to the virtual learning community created by the Web site, he/she is instantly connected to all faculty who teach the course and many resources available to help plan and teach an exciting semester of work.

Elementary School Web Site

Creating a Web site for the faculty at the elementary school was easily initiated by expanding an existing Web site. The social studies teacher used a personal site she created for sharing school information with students and parents. Her learning goal was accomplished by adding a link for communicating with other teachers at the school. Here other teachers can find links to the Sunshine State Standards (required on all lesson plans), the National Geography Standards, sample lesson and unit plans, and Internet resources. She has organized these resources into two categories, teacher resources and resources for use with students. As she locates interactive things for student use like crossword puzzles, seasonal stories and jokes, or music to coordinate with themed work, she connects the locations to her site.

Thinking ahead for summer work on the Web site, the elementary teacher plans to survey her colleagues to receive their ideas and suggestions. She wants to be certain that the Web site continues to be designed with the perspective participants as the focal point of consideration. One suggestion thus far has been to write and include lesson plan ideas for all

grades at the pre K – grade 5 school. In the future she hopes to connect her faculty site to the Florida Council of Independent Schools Web site so that all member schools will have easy access to the information. She is also exploring software that will allow her to establish chat rooms to facilitate online communication in two directions for the teachers.

University Web Site

The university site is made up of several different components. Essential course elements comprise the first component. Information contained in this component is linked with other sites where instructors can access specific authors and information associated with a particular topic. There are links to Internet sites for faculty use and a separate listing for links for student use. Some of the sites are local, like the link to the university library's site, Beyond Yahoo! Finding Everything on the Web. This site explains how to conduct successful interest searches. Other sites are more global in nature. ERIC Clearing House on Assessment and Evaluation is found under the heading of assessment sites. Links to other sites are grouped by the course content, like a methods and approaches site, a multiple intelligence theory site, and a teaching tips site. Each is easily available for faculty perusal.

Within Instructional Strategies, the second component of this Web site, can be found the methodologies recommended for curricular inclusion. These strategies will be linked with corresponding researchers and authors. Plans are also being made to secure videotaped examples of different methodologies and to incorporate them within this Web site. Thus, a variety of strategies can be observed while online. It is hoped that viewing an actual strategy being implemented, with literature discussing the strategy will enhance faculty understanding and eventually facilitate student use of each strategy.

Because of the large number of students who are enrolled in the college of education, consistency among all sections of this course, in content and delivery, poses a major challenge. Some semester there may be as many as sixteen sections of the course offered. As a response to requests by new instructors for access to course materials created by veteran colleagues, the Web site will also include faculty-developed materials and activities. A generic syllabus as well as black-line masters of transparencies and assessment instruments is available. Instructors using one of the recommended textbooks will be able to access chapter outlines of that text. The availability of microteach documents, such as lesson plan formats and evaluation forms, will greatly facilitate the incorporation and execution of microteaches, a time-consuming but integral component of this course. A supply of highly successful, instructor-generated activities will also be made accessible by means of this Web site. As the list of videos for this course can become quite cumbersome, a video bibliography will be included. Each video will be linked to sites dealing with the main topic of the video, thus enhancing the depth in which material can be delivered.

Finally, in the Resources/Assignments/Activities component of the Faculty Web Site, a Professional Portfolio link has been developed. Because the portfolio is an entrance requirement for student teaching, it is imperative that education majors receive accurate, consistent, and timely information regarding the portfolio format and content as well as portfolio submission and evaluation from their professors. A link delivering current portfolio workshop and training session content has been developed and is accessible via the Professional Teaching Practices Faculty Web Site. As this course is the forum within which the introduction to the professional portfolio is to be effected, it is vital that faculty teaching

the course have access to the most current and accurate information regarding this college of education requirement.

The Professional Teaching Practices Faculty Web Site is viewed as a vehicle to facilitate curricular design, enhance consistency of content and its delivery, and expedite communication among faculty members. The Web site will also consist of a component that will allow faculty to communicate with one another, both online as well as via a listserv. Direct email links are listed on the first page of the Web site, which connect to regular faculty members who teach the course. The adjunct faculty members who are not assigned office space on campus, and who often work full-time away from the university campus, especially appreciate these links. The adjunct faculty have easy access to request shared materials, or simply ask a question.

Conclusions

The full potential of these two Web sites as a means of communication and in the dissemination of information has yet to be determined. Currently in their infancy states, the sites are being continuously updated and expanded as teachers/instructors contribute new materials, resources, and knowledge of possible links. It is anticipated that once the Web sites are fully developed and faculty are informed of their existence and trained in their usage, the objectives for these sites will be realized. We hope to enhance consistency in course material, incorporate resources and activities within the course curriculum and improve communication among faculty. Regardless of the numerous modifications made to the Web sites as they undergo construction, our ultimate goal remains unaltered: to create a learning community, replete with a true sense of communication and collaboration among its members.

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Metaphoric scaffolding: Using digital video techniques to overcome teacher apprehension about new approaches to learning

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Abstract: This paper is a work-in-progress report on an approach to help teachers break the traditional barriers to learning that occur under transformative learning conditions. Teachers typically want to be taught innovative new techniques using the learning approaches that they have successfully used in the past. Introducing unfamiliar new learning approaches coupled with often-intimidating new technologies seems to be at odds with the objective of helping teachers apply constructivist methods including modeling the desired learning outcomes through their own examples. The authors explore the use of a metaphoric scaffolding technique that disguises much of the learning environment in order to give teachers a more familiar and comfortable realm in which to achieve learning success. As success is achieved, the teachers are led back through the metaphor to understand how they have used the new technology to produce tools that will be of direct benefit to them in the classroom.

Introduction

A recent study by the American Association of School Administrators (AASA), titled "*Preparing Schools and School Administrators for the 21st Century*", identifies guidelines that schools must recognize in order to prepare students to succeed in the new millennium, beginning with the premise that the definitions of "school," "teacher" and "learner" are reshaped by the digital world. In this paper, we are primarily concerned with both the definition of teacher and the role of teacher-as-learner:

"In the past, many have considered the teacher's primary role to be a dispenser of information. Great teachers have always far exceeded that expectation. In the 21st century, students have increasing access through the Internet and other sources to as much or more information than their teachers. That means teachers will take on a mantle of even greater professionalism, serving as orchestrators of learning and helping students turn information into knowledge and knowledge into wisdom" (Withrow, F. et al, 1999, p. 66-72).

According to the study, the 21st century will require knowledge generation, not just information delivery, and schools will need to create "a culture of inquiry." "We talk about lifelong learning for everyone in society," says futurist/forecaster Marvin Cetron, a member of the AASA study. "We need to be sure we offer lifelong learning for our teachers, as well. Our teachers need to be the catalysts in setting a culture of academic excellence," he adds{Uchida, Cetron, et al., 1996}.

In order to prepare teachers for this environment, the first and most difficult hurdle to get over is the idea of accepting change. Accepting change is an individual process in which the "acceptance time frame" is going to vary with the staff. Understanding that a total buy-in is rarely achievable at the beginning of a change effort will also keep the teacher from labeling a behavior, response or attitude as "resistance to change."

In this paper, we relate our efforts at using the metaphor of movie production as the scaffolding 'prop' to expedite the learning process of teachers in a graduate level multimedia design course. We began

by examining teacher's apprehension about learning how to integrate technology into instruction. We observed that teachers who were predisposed to learning experiences that offered immediate "use it tomorrow" applications, were equally committed to (but often anxious about) learning experiences that required greater risk-taking.

While most teachers are eager to learn how to apply technology to help students learn more effectively, others have continued discomfort with technology and believe that computers are not necessary to do their job (Stone, 1998)..."Computers apparently have not really changed the way we teach." Even the most receptive teachers often want to be taught the latest technology integration techniques the same way that they have always been taught. The teacher's prior experience of being a student, and the cultural expectations of the teacher's role greatly influence the acceptance of new instructional strategies (Stigler & Hiebert, 1998). Strategies that vary significantly from familiar, traditional methods may produce stress that ultimately becomes a barrier to the learning experience. The use of metaphor served as a substantial bridge to link teachers' comfort level with predictable learning experiences to the "professional stretching" level of transformative learning experiences.

The learning paradigm from the past has usually consisted of traditional instructional delivery techniques: set and listen lectures, show and tell workshops, and a variety of other teach-by-telling methods. These traditional approaches greatly influenced the design and use of early computer technology applications such as the tutorial structure of computer-assisted drill-and-practice programs and brought a degree of rigidity to technology integration. Today's new paradigm for professional development is based on the goal of preparing teachers to transform their thinking, teaching and learning. At the same time teachers must be able to "coherently combine curricula, tools, and standards...the process must be ongoing, acknowledging the gradual nature of change and respecting teachers' needs to maintain control of their evolving professional goals and commitments" (Grant 1999). The "gradual nature of change" presents the greatest challenge to innovation and the notion of gradual is inconsistent with the need to expedite the infusion of technology into instruction. The situation is exacerbated by the need to produce more and better teachers. "Over the next decade we will recruit and hire more hire more than two million teachers for American's schools. More than half the teachers who will be teaching 10 years from now will be hired during the next decade (National Commission on Teaching and America's Future, 1996).

At least 20% of the teachers in the pilot course are highly uncomfortable using approaches other than those that they identify with successful outcomes in their own past learning experiences.

Metaphor strategy

The development of a metaphor strategy evolved from answering the question: What type of learning experience will allow teachers to embrace change and break away from their traditional reactions to transformative learning experiences? The answer lies in admitting that in order to embrace something new it is often necessary to either remove or realign something already in place. Ineffective or inappropriate teaching practices needed to be gently replaced with a "user friendly" learner-driven model of instruction that could be easily replicated in any teaching-learning environment. The use of a metaphor allows combining the novel with the familiar and serves to lower anxiety while raising interest.

An effective strategy at the beginning of any change effort is to acknowledge four basic assumptions : 1) previously used traditional methods are not wrong but are not matched to the instructional goals of the program; 2) teaching is a strategic act of engagement that requires both teacher and student to understand the learning dynamics; 3) changing how a teacher teaches takes more than conveying information or presenting activities; and 4) learning to change a teaching style is as difficult as learning to change a learning style (Bellanca 1998).

Until teachers are comfortable using and accessing information with technology, there will be no significant change in instructional practices in the classroom. When questions and concerns are addressed in a compassionate, professional manner, there is a high likelihood that the new technology will be adopted successfully. A preservice teacher shared this insightful remark: "The way you are taught in college is the way you will be apt to teach when you begin your career in teaching. I'll be more comfortable to use this type of instruction in my classroom now that I have experienced it in my graduate courses."

The metaphor experience was piloted in a multimedia graduate course and grounded on principles of a constructivist approach to pedagogy for technology integration. The course incorporates scaffolding techniques that encourage teachers to model desired outcomes with students in a project-based learning environment. To overcome anticipated apprehensions, the pilot class of 12 graduate students (practicing K-

12 teachers) applied a meta-instructional model: using the methods being taught in order to model the instructional process, applying appropriate scaffolding and leading the teachers through the same process the graduate students will be using with their K-12 students. We chose the metaphor of producing a digital video "movie" as something that was intuitively familiar to most teachers. Giving the teachers a familiar metaphor within which to consider their own learning experience proved to greatly help the scaffolding process and lowered the barrier to learning. The metaphor reflects the scaffolding construct that anchors its use and transforms the learning experience.

Scaffolding strategies are reflected in the instructor's "diagnostic" discussion with each student to determine the level of skill and degree of apprehension that could either strengthen or compromise course activities. Students are then placed into teams designed to support members who may oppose change or be overly anxious about using unfamiliar technology. Support comes from knowing that someone on the team knows about the anxieties produced in the face of change and understands how to provide a learning 'safety-net' to reduce stress and increase confidence. One project in Kentucky created an alternative "techno-academic" classroom where support and encouragement for efforts to try the untested facilitated the transition from passive to active learning. The environment continually reinforced actions and ideas that broke away from traditional roles of teaching and learning. While learning new technology, questions could be asked and doubts could be vocalized.

Based on the Vygotskian notion of making abstract processes more visible, scaffolding can take a variety of forms – teacher can model strategies and provide suggestions. Scaffolding can also be provided in the form of prompts and questions that help students understand the process involved in learning (Krajcik, Soloway, 1998).

Using this approach, the instructor takes the role of director, the teachers in the class become the actors--mastering their roles under the guidance of the director, in a teaching environment that is facilitated by the producer... an expert in the new technologies being used. The producer provides appropriate technology support and scaffolding to ensure a successful learning experiences for all participants. The use of pedagogical roles allow teachers to create and evaluate new instructional techniques and "gain insight into teaching approaches and further their knowledge of technology (Deal 1998)."

To further support this metaphor, the class uses actual digital photography and editing techniques, producing case-related video material that, at a minimum, becomes part of the electronic portfolio produced by each of the teachers. The motion picture industry provides a good analogy to help understand production in many media. The areas of photography, art direction, sound editing, special effects, lighting, screenwriting and adaptation, directing, editing, and all other stages of pre and post-production provide a media model with a century of success upon which to draw. The global public has developed a level of expectancy from every screen that begs attention. No matter that the screen is 70mm Imax or 15-inch Compaq the audience/students usually expect at least the level of production quality they commonly see on their home television sets.

Applying the metaphor

Fortunately, it is now reasonable for K12 schools and graduate programs to produce high quality digital video sequences, which can be distributed on film, CD-ROM, or streamed Web video. The cost of digital camcorders and desktop video editing systems have dropped dramatically in the recent past. Achieving the potential of media in our future means "unlocking its power through understanding." At this stage, leadership may turn out to be the most important single factor in advancing the social and industry understanding of media and the new telecommunications world. Dwight D. Eisenhower used to demonstrate the art of leadership with a simple piece of string. He would put the string on the table and say, "Pull it, and it will follow you anywhere. Push it, and it will go nowhere at all." Producers should lead by example and inspire by mastery of their craft. A traditional producer must be "a creative administrator…a judge of creativity" who guides and supports others toward a common purpose. (Houghton, 1991) Similarly, the teacher may be producer and/or director of the learning experience and fully responsible for providing the wisdom of an off-stage sage and at the same time guiding students to create their own technology rich productions.

In the context of leadership in producing new and better programs, media communications can create richer, more elaborate relationships and enhance education. Now, the strategies must be right and practitioners must understand the "why" as well as the "how" of media production. It is no longer enough to produce by rote or formula. One must understand media psychology to produce well in media. People are

driven by their emotions when they are correcting a deficiency, engaging in personal development or simply having fun.

Outcomes

In many graduate technology courses, students collaborate on project-based teams, and create a formal "production" guided by a set of rubrics. In one course, the product is a CD-ROM containing one or more lessons incorporating the technology and learning approaches that have been integrated into classroom instruction. The teachers, as part of the production company, have contributed to a common resource and have developed instructional strategies to be used with their own students. In another course, teachers create web-based learning modules to deliver both synchronous and asynchronous mentoring.

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The Alliance for Catholic Education (ACE): Integrating Technology into a Holistic Teacher Education Program

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Abstract: *The Alliance for Catholic Education (ACE) at the University of Notre Dame endeavors to develop a corps of highly motivated and committed young educators to meet the needs of some of our country's most underserved elementary and secondary schools. In this paper, we provide a brief overview of the nature and history of the ACE initiative, its partners, and its interface with the AmeriCorps National Service Initiative. We next explore the role of technology in the current program, followed by description of recent adjustments. We look at a needs-analysis in progress, including a technology survey of schools where the ACE participants are situated. Results of the needs analysis will be shared at the SITE conference.*

Overview of the ACE Program

The Alliance for Catholic Education (ACE) at the University of Notre Dame endeavors to develop a corps of highly motivated and committed young educators to meet the educational needs of some of our country's most underserved elementary and secondary schools. ACE combines the efforts of the Institute for Educational Initiatives (IEI) at the University of Notre Dame, the National Catholic Education Association (NCEA), the Departments of Education at the United States Catholic Conference (USCC) and the University of Portland. Founded in 1994 by Fr. Timothy R. Scully, C.S.C., and Sean D. McGraw, ACE recruits, educates, places, and supports talented, committed, and professionally trained recent college graduates as K-12 teachers to serve in under-resourced Catholic school systems throughout the southern United States.

ACE has become an innovative and successful model of teacher formation, targeting gifted and service-oriented applicants from a broad variety of undergraduate disciplines and representing a diverse set of ethnic and cultural backgrounds. To prepare and guide ACE teachers through the challenge of this two-year immersion experience, the program is founded on three central pillars: professional education, community life, and spirituality. Such emphasis on the holistic development of new teachers has resulted in high retention rates 92%) and high principal approval rates (97%) over the life of the program.

ACE participants include recent graduates from the University of Notre Dame and Saint Mary's College, as well as a number of other select colleges and universities. These graduates teach in approximately 90 parochial schools throughout the urban and rural Southern United States. To carry out its core teaching

mission, ACE recruits talented graduates from a broad variety of undergraduate disciplines, representing a diverse set of backgrounds and experiences, and provides an intensive two-year service experience encompassing professional development, community life and spiritual growth. These three components are at the heart of the ACE initiative. Its aim is to provide excellence in education and to maximize opportunities for personal and professional growth for program participants. Students accepted into ACE and the Masters in Education (M.Ed.) program are provided with the opportunity for a high quality master's degree experience, which builds on their solid undergraduate academic backgrounds in their disciplinary majors. The program leads to a Masters in Education, 2 years of experience as an instructor of record in a school system, and an initial teaching license.

From its inception, ACE has made every effort to insure that its members are prepared for the rigors of teaching, leading, and serving in a challenging classroom environment. ACE teachers experience an intensive teacher education program designed and administered by the University of Notre Dame. Under the direction of Dr. Michael Pressley, the ACE professional training spans two years and integrates graduate-level course work with an immersion experience in teaching. Over the first two summers after admission to the program, ACE teachers live and study together at the University of Notre Dame. The summer sessions combine an innovative teaching curriculum taught by seasoned practitioners and select faculty from the University of Notre Dame with supervised field experience in both the public and Catholic elementary schools of the greater South Bend, Indiana area, and in the Upward Bound program at Notre Dame.

At the completion of the first summer training component, ACE teachers travel to needy parochial schools of the South and Southeast to serve as full-time teachers during the regular school year. In addition to the support of mentor-teachers in the parochial schools where they teach, all ACE teachers are brought together twice during the school year in a retreat setting to deepen and enhance their commitment to becoming professional educators. Upon completion of two years in the ACE program, participants have fulfilled the requirements for a Master of Education degree, and have provided an urgently needed presence in the lives of our nation's most needy school children.

ACE teachers live in community, sharing the challenges and rewards of beginning teachers. Each local ACE community becomes a mutually supportive environment, forming part of the local parochial and neighborhood school community. The program offers an ongoing evening seminar during the summer session, as well as two workshop-retreats during the regular school year, to provide participants with skills to live a healthy community life. In addition to the support ACE teachers receive from one another, local diocesan resource personnel and Notre Dame Club members assist the teachers in establishing an effective presence within the local communities

ACE and AmeriCorps

ACE is a member of the AmeriCorps National Service Initiative. AmeriCorps is the national service program that allows people of all ages and backgrounds to earn help paying for education in exchange for a year of service. AmeriCorps members meet community needs with services that range from housing renovation to child immunization to neighborhood policing. The Alliance for Catholic Education enjoys a unique association with the Corporation for National Service and AmeriCorps. In 1994, the Corporation for National Service selected ACE, in a highly competitive national competition, as one of 11 National Demonstration Programs. Through the Corporation's Learn and Serve America: Higher Education and AmeriCorps departments, the corporation has provided both program funding (including the innovative summer teacher-training and service-learning program) and a substantial education award to all qualifying ACE participants, who are thereby considered full-time AmeriCorps Members.

ACE and Technology

In keeping with its continuous improvement goals, ACE has initiated an effort to enhance and further integrate the role of technology in its year-round teacher training. In addition to their summer coursework, ACE teachers installed in the various dioceses assume additional coursework throughout the academic year

via distributed learning. Online courseware (Web-CT), listservs and e-mail are utilized as primary or supportive technologies. With some exceptions, listservs were the primary tools used for course discussion. ACE faculty observed problems stemming from e-mail accounts coming from various sources, use of listservs, etc. Two educational technology consultants were hired in the spring of 1999 to evaluate Internet issues and begin to explore avenues for integrating technology into the curriculum, including the intensive summer pedagogical experience.

Some of the Internet concerns were addressed during the summer of 1999 by determining a standard delivery and response mechanism (including Web-CT, listservs, and the Netscape Communicator with its various e-mail, browser, and chat features) supported by the University of Notre Dame educational and technology support services. All new and returning ACE participants received training in Web-CT, an online courseware tool. Interested faculty members were also trained in this application, with additional faculty training slated for small group and one-on-one training through the year. Listservs remain in heavy use by faculty.

Faculty poll: The 1999 summer faculty were polled to determine what types of software and hardware applications they used/would like to use and what types they taught/would like to teach. The summer faculty elected to use mostly current Mac or PC desktops or laptops. Many of the national faculty brought their own equipment. The great majority of faculty used integrated software applications such as Microsoft Office or ClarisWorks. Many supplemented their instruction with one or more Internet applications. Some were quite sophisticated using a range of tools from Web-CT to Hypermedia.

Instructors were also asked to identify what aspects of their content area they would like to explore for technology infusion? Some faculty coordinated student training in PowerPoint and WWW search/evaluation of lesson plans and instructional sites with ACE technologists. Each training session was oriented to a specific course. Students were required to integrate their newly acquired skills into their assignments. Other faculty delivered their own introductions to relevant software, arranging "hands-on" computer sessions for one or more class sessions. Many modeled use of technology infusion with software applications relevant to course material.

Survey of ACE schools: A survey was developed to evaluate the level of technology in the various schools where the ACE participants are serving. Mailed in August 1999, survey responses arrived intermittently throughout the fall. A total of 53 of 90 possible schools responded to the survey for a response rate of 59%. Analysis commenced in November and is ongoing.

The survey was developed in accordance with established principles and precepts (Babbie, 1990; Dillman, 1978; Krathwohl, 1993) and somewhat similar to various technological survey formats (QED, 1999; Becker,1995). The survey is comprised of a mixture of closed and open-ended questions. Respondents were asked to select some responses from a list provided by the research form. Respondents fill in a numeric or text response according to direction), dichotomous response questions or ("yes/no"), multiple choice questions (respondents choose from several options), checklist questions (respondents choose as many as may apply). We devised two extensive open-ended questions and several opportunities to describe "other" options in questions groupings. These permitted some freedom in answering the questions and an opportunity to provide some depth in the response.

Quantitative survey data was collected in Microsoft Office 2000 Excel in compliance with the coding structure developed from the survey form. The results were imported into SPSS 9.0 for Windows for data analysis. Frequencies were calculated for all coding categories. Some preliminary results are discussed in the following paragraphs.

Of the 53 schools that responded to the survey, 11 were elementary only, 27 were elementary plus middle schools (K-8), 4 were middle/secondary schools, and 11 secondary schools. More than half of responding schools were K-8. Many of the elementary and K-8 schools also contained pre-kindergartens as well. Fifty schools responded to the questions about number of teachers and students in each school. Of these, they

reported 1,226 teachers and 18,009 students for an average of 26.7 teachers and 360.2 students per school. The overall teacher/student ratio is 1:14.4.

Schools participating in the ACE program reported a strong orientation toward PC platforms, although there was some Macintosh usage in elementary or K-8 schools. Where used, the Macintosh computers are dated. Macintosh use in secondary schools is rare. The quantities of computers reported in Pentium I or II category are larger than the combined totals of computers in all other categories. Factors contributing to this predominance were not collected for this study but may reflect price and performance considerations given the constrained resources of the many of these schools.

Type and Location of Computer Access in Schools				
	Computer Labs	Instructional Rooms	Library/ Media Center	Offices/ Administrative
Pre Power Mac (Apple II GS, LCs, etc.)	3.3	3.6	0.2	0.2
Non-G3 PowerMacs	0.6	0.6	0.2	0.1
IMac/ Mac G3	0.6	0.1	0	0
Pre-Pentium (PC 386, 486)	9.3	6.9	0.9	1.2
Pentium I, II	17.1	10.7	2.7	5.5
Other	0	0.1	0	0.1

Table 1: Type and Location of Computer Access in Schools

Ninety-four percent of responding schools reported some form of Internet access ranging from dial-up modem to ISDN. The most common forms of connections were T1 or ISDN. Those schools without Internet access intend to hook up by 2002 or earlier. Eighty percent of the responding schools had a library/media center with at least one computer and Internet connection. Eighty percent of the respondents reported a computer lab, 72% of these were connected to the Internet.

We also wanted to explore school access to a variety of instructional equipment. The results are displayed as percentages in the Table 2. Please note that this information does NOT reflect quantities of equipment. Instead, it indicates whether the schools have access to equipment in a computer lab, an instructional room, or a library/media center. For example, a school might report access to a TV/VCR, but one TV and/or VCR may be shared among many rooms.

The majority of the instructional rooms have access to an overhead projector (78%), a television (82%), and a VCR (67%). More than 40% of the schools reported classroom access to some type of printer (42-46%). Nearly half of schools (49%) reported access to CD players instructional rooms while only 21% had access to a laserdisc player. There is very little access to digital cameras (4%), video cameras (9%), or fax machines (3%). Classroom communication equipment is constrained by very moderate access to cable TV/Satellite dish (24%), telephones (17%) and fax machines (3%). Graphing calculators were not widely available, although many of these skills can now be acquired using existing, available computers.

Understandably, a much larger percentage of schools reported access to various types of equipment in the computer labs and the library/media centers than in instructional rooms. Laser printers were more like to be available in computer labs (63%) and library centers (38%). Nearly half (45%) of the computers labs had access to scanners; approximately one third benefited from telephone access. Library/media centers afforded more access to communications equipment and image capture equipment: telephones (70%), cable TV/satellite dishes (48%), video cameras (34%), digital cameras (17%), and fax machines (4%). Percentages of access to scanners, TVs, and VCR were similar to corresponding classroom access figures.

There was no reported access to assistive or adaptive technology for instructional rooms. Only one school had assistive technology accessible in a computer laboratory. Two schools noted access within a library or media center. The ACE program will begin to address this issue as part of a new exceptionality initiative at the University of Notre Dame.

Percentage of Schools Owning Equipment: Types of equipment available by Type of room (Criteria: At least One Item of Equipment in at least one Type of Room)			
	Computer Labs (by %)	Instructional Rooms (by %)	(Library/Media Center (by %)
Fax machine	4	4	10
Laser printers Black /white	63	15	38
Other Black/white printers	48	42	40
Color printers	35	46	50
Computer Projection Devices	15	29	15
Graphing calculators	4	3	04
Overhead Projectors	28	78	56
TV	44	82	81
VCR	37	67	80
Scanners	46	23	23
CD Players	30	49	45
Laserdisc Players	11	21	15
Cable TV/Satellite Dish	15	24	48
Telephone	35	17	70
Video camera	13	9	34
Digital camera	2	4	17
Assistive/Adaptive Devices	2	0	4
Other	0	0	2

Table 2: Types of equipment available by type of room in Schools using ACE pre-service teachers.

As may be seen in Table 3, virtually all schools reported access to extensive integrated software packages such as Microsoft Works, Microsoft Office, ClarisWorks, etc. Approximately 25% of the schools also reported access to word processing applications in computer labs, instructional rooms, library/media centers, and administrative offices. A smaller percentage reported access to presentation, database, or spreadsheets instead of or in addition to integrated software packages. Overall, 24% of the schools indicated access to at least one hypermedia application such as Hyperstudio in their computer labs. Only 16% of secondary schools, however, reported access to a hypermedia application.

Percentage of Schools Reporting Software Titles in at least One Room By Category of Software Applications by Kind of Room				
	Computer Labs	Instructional Rooms	Library/ Media Center	Offices/ Administrative
Integrated software	90	76	88	98
Word processing	29	24	31	29
Presentation	20	12	10	10
Database	24	12	14	28
Spreadsheet	24	12	16	28
Hypermedia tools.	24	2	8	4
Image Manipulation	28	8	8	22
Reading software	47	45	41	4
Science software	39	41	24	6
Math software	39	51	24	4
Other	8	8	6	0

Table 3: Percentage of Schools Reporting Software Titles in at least One Room

28% reported access to image manipulation software in computer labs. Nearly half of the schools reported that computer labs and instructional rooms had one or more software titles for mathematics, science, and/or

reading (range of 39%-51% by type and location of software.) These elements, in conjunction with evaluation of relevant technology trends across the nation and a review of pertinent literature, will be incorporated into a cumulative needs assessment report. Since 46% reported access to scanners in the computer labs, it would appear that the respondents might not have considered the software applications that usually come bundled with the scanners.

Conclusion

We expect to further define and explore the acquired survey data by identifying and aggregating appropriate combinations of variables. These elements, in conjunction with evaluation of relevant technology trends across the nation and a review of pertinent literature, will be incorporated into a cumulative needs assessment report. Some aspects of needs assessment are already under consideration.

- The introduction to educational technology should be tightly focused on immediate usability, given the brief, intense duration of their summer training component. Wherever possible, short-term assignments should be coordinated with other faculty to reinforce and model integration of technology into the curriculum. One project and/or several substantial assignments, due after the ACE students have initiated their professional practice, would reinforce and enrich their summer introduction in technology.
- Given the preponderance of the PC platform, it appears prudent to focus additional hours in technology instruction to develop their skills on the PC platform. To assure that students can function on whichever platform available to them in their assigned schools, we will continue to provide crossplatform training. Since the integrated software applications are nearly ubiquitous, pre-service teacher training might be best served by focusing on the goals of teacher productivity and methods for integrating word processing, spreadsheet, database, and presentation software into the curriculum.

Additional efforts will include recommendations for hardware, software and procedural modifications relevant to technology and its integration across the curriculum within the ACE program. We plan to share our findings to date with peers and colleagues at the Site 2000 conference and invite their comments, suggestions, and constructive criticism.

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CTER OnLine: Providing Highly Interactive and Effective Online Learning Environments

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Abstract: New computer and network technologies have opened the possibilities for practicing teachers across the world to update their teaching skills and engage in lifelong learning activities. Online courses and programs are growing in number, yet some early reports have stated that students are not satisfied with the quality of these courses. Many colleges and universities are recording lectures; transferring their syllabi and multiple choice tests to the web; and expecting students to listen, read, and learn with little instructor feedback. Using a different, highly interactive model, faculty at the University of Illinois created an online Master of Education program. We will report on this model, including an in-depth evaluation of its effectiveness in providing an online learning environment for practicing K-12 teachers and administrators.

Introduction: CTER OnLine

Beginning in the summer of 1998, the College of Education at the University of Illinois revised several graduate level courses into an online format and currently provides practicing teachers the opportunity to complete a Master of Education degree that focuses on Curriculum, Technology, and Education Reform (CTER). http://cter.ed.uiuc.edu A series of eight courses taken over a two-year period includes topics such as: (a) Using technology in a classroom setting, (b) Revising curriculum to include the use of technology, (c) Addressing issues related to classroom management, ethical, legal and school policies dealing with educational technologies, (d) Assessing and evaluating the use of educational technologies, and (e) Changing classroom and school practice to enhance learning. In this paper, we report on the process of developing highly interactive and effective online learning environments.

A combination of synchronous and asynchronous technologies is used in these courses. Course descriptions, syllabi, grading procedures, student participation and expectations are available on the web. A variety of communication tools have been used depending on the type of interaction needed. At the present time, instructors use the WebBoard® conferencing system for asynchronous discussions and synchronous chat sessions. Individual email and group reflectors are also used for one-to-one or one-to-group correspondence. RealPlayer® is used to stream audio and video files. Text translations of audio files are provided for hearing impaired students. Audio narrated PowerPoint® presentations have been created for some topics. TappedIn, a multi-user object-oriented environment (MOO) coordinated by SRI, International provided interactions between the CTER students and educators across the country. A specialized tool, known as CTERbase/TEbase, was developed to help faculty provide individual feedback to students, grade assignments, and publish exemplary work on the web (Levin, Buell & Levin, 1999). In each course, the instructor first determines the type of interaction he/she wishes to have with the students then picks the technologies that best handle the interaction.

CTER OnLine instructors combine multiple methods of instruction to enhance student learning (Levin, Levin & Waddoups, 1999). The framework developed for online asynchronous discussions allow students flexibility to participate on their own time. Students currently teaching in K-12 and college settings are given the opportunity to implement their coursework into their classroom practice. Simulations are used to provide experience when dealing with sensitive topics and issues. Various grouping arrangements have allowed students to learn from one another. These multiple instructional methods have

been used to also demonstrate how current theories of learning can be incorporated into educational practice. Indeed, many students have incorporated these methods into their teaching practice.

Dimensions of Effective Online Teaching and Learning

The dimensions of effective online teaching and learning have been developed over the two-year-long formative program evaluation. Data has been collected from all students including pre- and post-surveys and university course evaluations. Case studies of four students were also conducted during the same period, and included interviews, site visits to the practicing teachers' classrooms, and collection of their electronic communication and completed assignments. Many have discussed the need to address issues of quality and effectiveness of online teaching (Campbell, 1997; Findley, 1997; Powers, 1997). We think the dimensions of effective online instruction are particularly relevant for providing educational opportunities for K-12 teachers, but perhaps have wider application.

Relevant and Challenging Assignments

We have found that students in an online program have more of a consumer orientation. Repeatedly, students ask that the assignments, discussions, and readings be relevant to the work they are doing in their schools and classrooms.

One of the hallmarks of good teaching, regardless of medium, is helping students connect learning to their lives. Relevance is important to the students in the CTER program because they are practicing teachers who see their participation in this program as an extended professional development opportunity. Relevance in the online context should be thought of as helping teachers prepare curriculum and develop practices directly relevant to their teaching while also expanding their ideas about what is and should be considered relevant in their professional practice.

The most popular instructional activities in the CTER Online program are the assignments that ask students to create curriculum projects that can be used immediately in their own classrooms. Survey and interview data indicated (81% or 18/22) that the projects they developed or evaluated for their own professional practice were the most useful. This captures the idea of relevance in its most basic form.

One course in the CTER sequence focused on educational reform. In this course, small groups of CTER students worked together to write proposals to implement some form of educational change in their school or district. One group of students working at the same school put together an implementation plan to create a community school. The objectives of this plan included "creating a learning center to involve parents, students and community members coming together to enhance the neighborhood ties". They continued: "Our newest project will be the creation of the Publishing station. Students, faculty, community members, and alumni at this elementary school will write and publish their created books. Each book published at the publishing station will become a permanent part of the elementary school library. This is just one of many examples of how CTER students created curriculum activities in their CTER courses that they immediately implemented in their own classroom and school.

Additional evidence of quality in online instruction can be found when students expand their notions of what is relevant to their professional practice. The Internet provides a particularly helpful environment for connecting practicing teachers to other educators to collaborate on ideas that are relevant for K-12 teachers.

Many teachers in the CTER online program were initially content to focus on curriculum projects for use in their classrooms. However, in the CTER Online program we have provided them with opportunities to engage in activities that have expanded their notion of what is relevant for their teaching activities. Assignments are not relevant simple because teachers can use them in their classroom, but because teachers can see that engaging in the assignment will provide an opportunity to engage in practices and develop skills that may be relevant for a teacher's professional practice. In the CTER Online program, we have included assignments that are not directly applicable in the classroom, but engage them in learning activities that extend their thinking of what it means to be a teacher.

An example of expanding the notion of relevance can be found in a simulation that was used in a course about Ethical and Policy Issues in Information Technologies. A fictitious student named Suzie created webpages containing materials that would be considered improper for a school setting. CTER students were asked to reflect on how they would handle the situation and to discuss issues raised with their

peers. While controversial at times, the activity heightened their awareness of information on the Internet and its potential impact on a school setting. For their final project, students developed a set of Educators' Guides on a number of issues centrally affecting the ways in which new information and communication technologies are changing schools today. The topics include: Access Issues, Credibility and Web Evaluation, Free Speech vs. Censorship, Privacy, Commercialism, Intellectual Property, Copyright, and Plagiarism, and Computer Crime and Technology Misuse. These guides are available online at: http://lrs.ed.uiuc.edu/wp/.

Constructing seamless online learning environments

In addition to relevance, students expressed the desire for classes that are clearly organized so they do not have to search for the assignments and wonder whether they are following the schedule. This is particularly important in online courses, because students can follow the class only to the extent that there is a relatively clear structure that has some level of cohesion. What this typically means is making it more explicit how the class fits together and making an overt attempt to address issues of organization to the students. Being more explicit can be as simple as placing dates throughout the syllabus instead of using more generic terms such as Week 1 or Week 2 and using consistent headers and terminology when using multiple software tools.

What we are suggesting is that a seamless learning environment is one in which the threaded asynchronous communication tool, the syllabus, and the homework completion system are connected. The first week's topic described in the syllabus should be directly linked to and easily identified in the asynchronous communication tool used for discussions for that week and instructions for the assignment should be clear and concise.

Another element of a seamless online learning environment is providing technical support. We have found that there are three levels of technical support needed in an online course for both faculty and students: development, training and ongoing support as shown in Table 1.

Levels of Support	Faculty Support	Student Support
Development	Deciding which tools are most appropriate to use in the course and assisting in the development of the course in an online format	
Training	Initial training in how to use the tools	Initial training in how to use the tools and access course content
Ongoing	Assistance when using some communication tools	Technical support with access, hardware and software issues during courses through email, telephone, and voice mail.

Table 1: Kinds of technical support for faculty and students to create seamless learning environments.

First, there are a number of decisions that an instructor faces when moving to an online environment. The instructor must consult with other instructors and technical support staff on which tools are currently in use and which would be most appropriate for the type of course offered. Once tools are selected, an instructor must gather and create the course materials. Often, technical support staff is needed to convert files from one format to another, digitize video and audio segments, transcribe audio files for students with hearing disabilities, and create usernames and passwords for student access. We have found that online students tend to have more of a consumer mentality and ask to see all course materials available at the beginning of the class so that they may pace the workload according to their own schedules. This is very often different than the way most university professors prepare for face-to-face instruction normally done just prior to each class meeting. Not only are professors changing the way they prepare and teach, but also they are learning how to use these new tools. This preparation and training takes a considerable amount of time.

Instructors also need ongoing support when using some of the latest technology tools. When audio or video streaming is used, technical support staff must be available to set up equipment, manage the cameras and microphones, and be on-hand in case of a technical failure. Even when synchronous chat is

used, the instructor is busy discussing course content and relies on the support staff to handle other questions through a "whisper" command that provides private conversations during a chat session.

Students also need to learn how to use the software tools that will be used throughout the program. For CTER OnLine, this support is initially provided in a face-to-face orientation meeting just prior to the beginning of the first course. Technical support continues throughout the program dealing with a variety of issues from access to consultations about hardware purchases and software upgrades. This type of support is provided through a combination of email, a technical support help line, and voice mail that can be accessed by the support staff in the evenings and on the weekends. Providing technical support throughout the program is essential to handling day-to-day problems that arise with the use of technology.

Providing a seamless online learning environment also involves developing a sense of community between the instructor and students. If provided with some face-to-face interactions throughout the program, faculty and students get to know one another on a more social level which alleviates the sense of isolation that is often felt in distance education courses.

Providing adequate and timely feedback: Teacher-student interaction

We have found that providing adequate and timely feedback to students is another important element of online teaching. Because students are remote, it is important to develop mechanisms that provide feedback to students on their progress. There are three levels of feedback that are necessary in the online classroom. These include online office hours, instructor response to individual and groups work, and feedback on individual assignments. To successfully provide these layers of feedback in the online course the instructor must have, or develop, a good facility using different types of communication technologies.

Conducting online office hours is one way in which student-teacher interactivity can be accomplished. In the CTER Online program, we have utilized two-way synchronous chat spaces and a combination of one-way streaming audio used by the instructor and synchronous text chat used by students for the purpose of office hours. Office hours are used as a time for students to interact with the instructor in real-time, to ask questions about the assignments, or to clarify a topic in the readings. While the questions tend to be specific, the entire office hour is archived and all students can view the chat discussion at a later time. Students have responded that the consistent use of online office hours has helped them feel more connected with the instructor.

We have noticed two patterns of instructor response related to individual and group assignments and discussions. One form could be described as just in time response and the other as archived response. Just in time response refers to the instructor responding to individual assignments or discussion messages from students as they occur in the ongoing discussion. Archived response is used when the instructor reads all the students messages (for the day or week), then replies to the entire class in one message addressing the points he/she would like to make.

Instructors provide individual feedback on student assignments through a specialized tool we developed called CTERbase. Students submit their assignment or enter a URL pointing to their assignment, and the instructor can review and reply back to the student on what they might want to consider changing before submitting the final version. Instructors can also provide feedback in a more public forum, like WebBoard, so that all the students can see the instructor's comments and modify their work accordingly. This second method of instructor feedback is more efficient for the instructor by providing adequate feedback for students, however, some students have reported their preference for individual feedback.

Constructing rich environments for student interaction

Another indicator of quality in an online course is the creation of highly interactive learning environments for interaction between and among students. In the CTER Online program we have used a variety of methods to organize group and one-to-one student interactions.

Three methods we have used to form groups include student-selected, topic-selected, and instructor-selected groups. Each method offers both positive and negative results. Student-selected groups allow students who know one another or work in close proximity to work together on group activities. When students are able to choose their own groups, they have arranged meetings at a member's home or

local pizza restaurant to work on assignments. On the other hand, students who are constantly given the chance to self-select group members tend to pick friends or individuals they know which actually narrows their scope of learning, minimizing opportunities to share ideas with students in other geographic areas. Some instructors have allowed students to choose a topic of interest and formed groups based on that topic. Depending on the course content, topic-selected groups can produce a mix of interests among the group members or narrow their scope of learning as in the self-selected group. Instructors have also assigned members to groups to ensure that each group have a particular mix of interests. While this grouping method can provide a wide range of expertise among its members, it can also lead to more tension or personality conflicts. We have found that using different methods for selecting groups throughout the course provides a good opportunity for students to work with different students to minimize negative group dynamics.

To maximize communication in an online environment, it is important to provide online conferencing space or conference call opportunities for each group to communicate among themselves. Instructors can provide simple group assignments in the beginning that build upon subsequent assignments and become more challenging toward the end of the course. Another effective strategy includes heavy instructor involvement in group activities early in the semester with less involvement as time goes on.

Research on distance education has repeatedly pointed to a high drop-out rate related to students feeling isolated from a social setting (Keegan, 1980; Kember, 1989). We have attempted to address this issue by providing a number of activities that foster student to student discussion. Students enrolled in our online courses come to the university for a three-day face-to-face orientation prior to their first online course. This time is provided to train students to use the software tools needed to participate in the program while offering time for students to socialize and get to know one another. Students share common goals, strengths and interests with other classmates in face-to-face and online activities. Chat and online conferencing space is provided so students can interact on a social level throughout the course. Students are also encouraged to provide peer reviews throughout the program.

Fostering anytime anywhere teaching and learning

Many students registering for online distance education courses are interested in the flexibility this medium of education provides. Therefore, another important element of quality online instruction is the careful balance of asynchronous and synchronous communication--to foster anytime anywhere learning. For an instructor this means choosing the appropriate technologies for the task they are trying to accomplish. Indeed, the technology and task fit is an important principle for those designing and delivering online distance education courses. One model we have used successfully combines the use of asynchronous technologies to facilitate much of the classroom interactions and synchronous communication to facilitate small group interactions and course office hours.

Of course, the right balance between flexibility and the need for interactivity will vary with each course. In some cases, an instructor may use all asynchronous communication for classroom and group communication and limit synchronous interactions to online office hours. At other times, weekly real-time video or audio conferencing may be most appropriate for the topic.

Another consideration to anytime, anywhere learning can be described as anytime, anywhere teaching. Both synchronous and asynchronous communication can be accomplished effectively by instructors regardless of location. This is most evident when instructors travel to conferences to report on their research instead of providing a substitute instructor for the course. They can now pre-record an audio or video presentation for the students to view at their convenience. With a laptop computer and telephone line, instructors can continue to respond to student email or online discussions away from their office. In addition, these new technologies offers the flexibility universities sometimes need to hire adjunct faculty to teach online courses or more easily involve experts in a particular field to participate as a guest lecturer or discussion participant.

Conclusion

The Internet and communication technologies provide educators with a wide array of educational tools to create highly interactive and effective learning environments. The question for many is how best to utilize these technologies. In this paper, we have reported one model for developing an online learning

environment that promotes high levels of interaction among K-12 teachers as they learn to integrate technologies into their classrooms. We have suggested that there are many issues to consider including making assignments relevant to teachers' experiences, constructing seamless learning environments, providing timely feedback, creating rich environments for interaction, and providing for flexibility by fostering anytime anywhere teaching and learning. Paying attention to these dimensions has led to the creation of robust learning environments for K-12 teachers to become leaders in the use of educational technologies in their classrooms, schools, and districts.

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Using WebCT to Extend Learning in Graduate Educational Technology Courses

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Abstract: This paper examines the use of WebCT in two graduate level Educational Technology courses. The paper briefly describes the content of both courses and the ways in which WebCT was used in each course, and the reasons for that usage. Data on how WebCT has enhanced or extended the learning of course material has been collected from reflective e-mail responses from all the students in the Fall 1999 class, from bulletin board postings, and from taped interviews with three students who were registered in both classes. This data has been interpreted to address specific features of WebCT responsible for this enhanced learning. Of particular interest is whether WebCT is an effective learning tool and medium by which and through which graduate students can more effectively learn course content.

What is WebCT?

WebCT (or Web-based course tools) is a software program that generates a course template. It is especially useful for busy professors, to enable them to create "sophisticated web-based learning environments" (http://www.uregina.ca/webct/facultyintro.html page 1). WebCT can be used as a complete on-line course, with no face-to-face contact, as in the WebCT version of Math 101 at the University of Regina (see http://www.math.uregina.ca/MathOnline/) or it can be used as a course supplement. The WebCT program has a variety of tools, divided into four main groupings (communication, study, personal account information, and quizzes and surveys). People developing courses using WebCT select the tools they require for their course. In both of the WebCT courses discussed in this paper, the major tools selected were the communication tools (bulletin board, private mail, calendar of course events, and on-line chat), in addition to icons for the course outline and course content.

Why Use WebCT?

My reasons for using WebCT in any form in two Educational Technology graduate courses are four-fold:

1. The provincial education department, Saskatchewan Education (http://www.sasked.gov.sk.ca/) is increasing its use of WebCT for distance education of classes in rural parts of the province.
2. I was part of a proposal in 1998 which received $24 000 to create an on-line version of Mathematics 101 (a first year mathematics course). I have followed the development of this course and the success of students taking this course (for more information on this course see Weston, SITE 2000).
3. A number of professors at the University of Regina are experimenting with different features of WebCT for course development.
4. The graduate students in my classes are mostly teachers or consultants and are likely to come into contact with a course being offered using the WebCT format, or they may wish to create a course using this format. They should therefore have some idea of the features of WebCT and of how to mediate the learning experience.

The First Education Technology Course

This course, offered in May-June 1999, can be located at http://webct.uregina.ca:8080/ Click on course listing, then on "Classroom Computers: Advanced" (the title of the course) and then enter guest as

user ID and password. This was a new course and was therefore run on an experimental basis; it included eight graduate and eight undergraduate students. Explored in this course were advanced features of Power Point, Internet searching, Hyperstudio, web design, how to teach in a one-computer classroom, how to use e-mail effectively in teaching, and so on. Students in the course were expected to create integrated curriculum projects using multiple multi-media tools, to regularly participate in bulletin board postings, to respond to numerous readings, to participate in the chat room, and to do class presentations.

An instructor-directed organization was visible throughout all the material posted on WebCT and most of the activity that occurred on WebCT. Students were given a user ID and password and accessed and used WebCT features only as students. All the content to be taken in the course was presented to the students on the first night. Their feedback was welcomed and any suitable modifications became a part of the course. All course content was organized into modules and posted on WebCT at the above address. Course readings were organized by module and distributed to students in advance. For each topic I created a forum for WebCT bulletin board discussion.

Within the above structure there was opportunity for students to exchange ideas, help and encourage each other, present to each other, learn from each other, and in general be a community learning together. WebCT, specifically bulletin board discussions, played a crucial part in this exchange of ideas. The boundaries between the graduate and undergraduate students merged. The undergraduate students excelled in their technology skills and in the creation of multi-media products. The graduate students excelled in their ideas of how to apply the technology to their classroom learning environments and in how to integrate the technology to the curriculum. Each group needed the other to attain a holistic idea of how to use technology effectively in classroom-appropriate ways. Each group was impressed with the knowledge base of the other.

Each week students formed reading groups (4 students to a group) and were responsible as a group for reading and responding to all of the readings. One member of each group was responsible for posting on the bulletin board a summary and critique of one reading assigned to the group. Others in the same group could respond to that summary and critique. Members of other groups could also respond. The articles for each week formed a topic and this topic was assigned a bulletin board forum; not only were the readings relating to that topic discussed, but the conversation among class members evolved to discuss the topic in more general terms. It was very exciting for me as the instructor to read and participate in the conversation of the different groups of students discussing a topic.

The Second Education Technology Course

The second Educational Technology graduate course was offered in the Fall 1999 semester. This course can be located at http://webct.uregina.ca:8080/ Click on course listing, then on "Internet and Curriculum Integration" (the title of the course) and then enter guest as user ID and password.

This course had a significantly different focus from the one offered in May-June. It was designed solely for graduate students who are familiar with basic computer-related technology skills and concepts, and their pedagogical appropriateness in the K-12 classroom. Specifically, the course was designed to explore effective and appropriate integration of the Internet into the curriculum. Students examined different ways in which the Internet can be organised, with frameworks such as:

- Virtual Architecture [the work of Judi Harris--see Harris (1998, 1999, and the Virtual Architecture website at http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/)].
- Virtual Environments [the work of Chris Dede -- see Dede (1991, 1998)].
- Filamentality [the work of Bernie Dodge and Tom March -- see Dodge (1995) and the original WebQuest home page at http://edweb.sdsu.edu/webquest/webquest.html].

Students explored these frameworks in order to develop a conceptual understanding of possible ways that the Internet can be effectively used in the classroom and integrated into meaningful curriculum-based activities. In conjunction with the above exploration students were immersed in learning theory, where they examined different learning theories such as:

- Cognitive apprenticeship and situated cognition (Lave, 1989; Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991)
- Communities of learners (Rogoff, 1994)

We also explored different world views about teaching and learning (e.g., objectivism and constructivism). From an examination of the world views and the theories, groups of students compiled charts which looked

at the world views and the theories according to the commonplaces in education--role of the teacher, learner, subject matter/content, and milieu (Schwab, 1978). Technology use was a part of each commonplace. The purpose of this exercise was to determine (1) if different views of teaching and learning would alter the commonplaces and affect how each commonplace would 'use' technology and (2) if we could see emerging a best use practice for using technology, especially the Internet, in pedagogically appropriate ways. For more information on this see Fulton, Couros and Maeers, SITE 2000.

WebCT, and the learning involved in creating pathways and posting topics, was an important but *secondary* part of the course. All students were expected to regularly access and use the bulletin board and chat room features of WebCT. In addition, all students were given instructor access privileges to the WebCT course. This enabled them to explore all the features of WebCT in the event that they may need to develop a WebCT course in the future. The students (in groups) were expected to create the content of one of the course topics, and, thereafter, to post it on the WebCT home page.

This course was not structured for the students in advance. At the beginning of the course (in September, 1999), the students and I examined the overview of the proposed course content with its emphasis on exploring learning theory and the work of Seymour Papert, Internet organizational frameworks, and critical literature. *Student input* into both the course content, and course development was *welcomed and incorporated* into the overall course structure.

I *mediated* both the structure of the course and the course content. I *enabled* (with some expert assistance) students to post topics on WebCT. I distributed *some* readings appropriate to topics studied, but they also brought readings. Readings for future topics were discussed in class and each person responsible for any reading explained the purpose of the reading and if and how a summary and response would be made. Some *external experts* related to some of the course topics were invited to share their work with us. We also heard from *students in the class* who are experts in their work. The sharing of this expertise was encouraged by *everyone*. It is important to note that students recognized and celebrated this individual expertise and learned from each other. The students (in groups) created and posted course content modules on WebCT (this will be completed by the end of the Fall 1999 semester).

Investigating the Use of WebCT in the Above Courses

Because I had used WebCT in different ways in each course I was interested in finding out how students had learned through the different WebCT organisations. I designed a questionnaire which was e-mailed to all students in the Fall 1999 class, asking them about how WebCT as an element in the course enhanced their learning of course content. I also interviewed three students who were registered in both classes and I examined bulletin board postings for any indication of how the actual process of using the bulletin board affected learning of course content. In addition to these procedures I also had my own notes on the use of WebCT in each course. All the above information was examined for recurring themes that related to the use of WebCT. These themes are outlined below. Unless otherwise indicated all comments relate to both classes.

Findings

Skill Development

Some of the Fall 1999 students initially experienced frustration with the skill component of accessing and using WebCT. This frustration related to locating the part of WebCT they wanted to use, reading, responding to, and posting 'articles' on the WebCT Bulletin Board, and to creating and posting the course content There is a steep learning curve in using this course tool technology. Although the students realized that WebCT was being used as a course supplement, and the focus was not on learning *about* WebCT, the students felt that more skill-based modules about *how* to use WebCT features would have been beneficial. University experts on the use of WebCT came to class and took us through a summary of how to use WebCT as instructors, and how to create and post course content. For most of the students, this instruction came too early and was presented too quickly. When it came time to 'post' course content material they had forgotten most of the earlier instruction.

Course Content Modules

As stated above, the actual posting of the course content modules proved to be a difficult and somewhat frustrating experience for most of the students. But, once posted, everyone appreciated having the entire presentation of the content, and all of the links, available at one place on the WebCT homepage. All the WebCT content postings looked professional and contained up-to-date and very interesting material. Most students reported that they have revisited the content modules and their corresponding links a number of times.

Bulletin Board

The class met every Tuesday from 4-8 p.m. Monday evening and during the day on Tuesday saw the most activity on the bulletin board each week for both classes.. Students in both classes stated that the bulletin board was their most popular feature of WebCT. All class members in the Fall 1999 class reported that their use of the bulletin board enhanced their learning of course content. The following are what the students reported as the main advantages of using the bulletin board. This information addresses the use of the bulletin board in both classes.

Fora and Organization

In the role of instructor students were able to create a bulletin board forum if one didn't exist; as students they could select an existing forum into which they could post their 'article.' Some students in both classes were avid composers, making comments in almost every forum and about every presentation. Others chose specific fora or specific 'articles' to respond to. Each group of students in the Fall class was responsible for monitoring one forum (the one created for the course module they created). Monitoring involved posting to the forum, reading and responding to other postings in the forum, and writing a summary of the 'conversation' of the forum. The students generally liked being in charge of a forum, but the fora were not all created at the start of the class. They were created at the time of the group module presentation. Thus, if a module was presented in mid November, there would not be as much 'traffic' in that forum as in others that had been created earlier. The discussion around the presentations was disappointing for the presenting groups in both classes, as it occurred mostly around the time of the presentation. Some students suggested that all the fora be created at the start of the class and that students be assigned a forum and be expected to post one 'article' to the forum very soon after the start of class. Another idea was to give the bulletin board more structure at the start of class and have each student responsible for a topic throughout the class. Although the articles were threaded, there appeared to be few main threads running throughout the course. Some students stated that some articles were quite long and perhaps should not have been in the bulletin board, but perhaps part of an 'article' pathway, or maybe have a separate forum for longer articles and even a forum for article summaries. The students said that at times the bulletin board was like a chat room to get to know each other, to ask (dumb!!) questions and that perhaps a separate chat area or more informal forum be created where students could conduct more informal dialogue. Other students felt that all the articles should be organized according to the forum most related to the article topic.

Time to read and Digest Material

All the students stated that having the bulletin board was a great comfort and anxiety-reducer. A lot of the course content material was new to the students, was controversial, exciting, dynamic and at times quite overwhelming. Being able to discuss the ideas in class, read about some of them in hard copy articles and/or electronic articles, and then having time to digest the material and respond to it on the bulletin board, and to read the responses of others, helped the students have a much deeper understanding of the material and a greater respect for the opinions of others.

Busy Lives—a Class Beyond a Class

All the students in the Fall 1999 class, and half of the students in the May-June class are teachers, consultants, or principals--very busy people. Some said that the bulletin board helped them to stay on top of things, keep up to date with what was happening in class, stay up to date with what others were reading (and thinking)--all at home in their own time outside of class hours. The class was like 4 hours on Tuesday and at least four more hours on-line, reading bulletin board comments and/or visiting websites recommended by classmates. The students were all very conscientious about keeping up with the bulletin board postings--it was almost like they didn't want to miss out on any part of the conversation about the

course content. One student reported "I find, especially at the graduate level, that a classroom discussion does not end after an hour--it does physically, but mentally it does not; my mind keeps on mulling over the topics that have been discussed. Using the bulletin board as a place for ongoing reflection, during the week (as opposed to only during class time), has extended/expanded the range of reflection. Further, I can respond to the reflections of others and add to the group discussion/reflection."

Clarify/Stimulate Thinking

Because much of the course content was new, and many new and quite different ideas were presented continuously, the bulletin board became the depository for at least a summary of the class content and offered the students a place to go to (at leisure) to review and reflect on the ideas discussed in class. One student reported "it stimulated many thoughts on how I would apply the learnings to areas within my own school and professional environment. The postings provided me an opportunity to spend some time reflecting on situations and events I was experiencing or had experienced in schools." Another student stated that "the bulletin board was a good way to keep conversations going between classes. It provided us a chance to 'clarify,' ask questions if needed, and to exchange ideas."

Sharing Websites, Books, Articles etc.

It was very difficult to take class 'notes' as new material and ideas were constantly being explored. Note taking would have resulted in missing part of the conversation. It very quickly became clear to the students that the bulletin board was the perfect environment to share great websites, new search engines, books that have been read and reported on in class, journal articles, sites with on-line articles, electronic journals, class power point presentations, and so on. Knowing that everyone would have immediate access to most of what was happening in class took the pressure off taking notes and enabled students to focus on understanding and thinking critically about what was being presented.

Learning from Peers

Most students reported that anything they posted on the bulletin board was an idea in progress to be shaped by responses from others. Some students felt uneasy about posting content that they did not feel completely grounded in and thus felt they were taking a risk in being challenged. All students found at least one topic that they felt comfortable with and knowledgeable about to post and respond to. The bulletin board became a place for all the students to read about what others have been reading and to learn from others. Individually, each student did a vast amount of background reading and research both for their course module and for their public presentation.

Bulletin Board vs Chat Rooms

Some students compared their use of the bulletin board to the chat rooms, and also to some experiences we had with Tapped-In, a virtual environment or MOO at Pepperdine University. While some (who are fast keyboarders) quite enjoyed the chat rooms, others stated that they much preferred the relaxed style of the bulletin board. One student stated "I found the chat line frustrating. I can't type, read peoples' comments, and think all at the same time. It was too rushed for my liking. I hate making mistakes in front of other people. The bulletin board is more my style where I can think about things and post it at my convenience." In both classes the chat room features were formally used on two occasions--in class, but the main advantage in having chat rooms is to use them when we are NOT in class. Students recommended that specific chat times could be established for discussions, and specific questions be posed.

Personal Reflections

In the Fall 1999 course, in retrospect, I made assumptions about the students' ability and interest in pursuing and using a variety of WebCT features with minimal help. As stated earlier, the purpose of this course was not to teach students how to use WebCT either as students or instructors; it was not to *learn* WebCT, but rather to *use* WebCT to learn. In the May-June course I created the WebCT content, with the assistance of an expert WebCT planner sitting beside me walking me through every step. The students used WebCT only with student privileges: they were not expected to post course content, create pathways, student lists, passwords, and so on. Because WebCT was new to all the students in the May-June class (and also quite new to me) I did spend some lab time teaching the students how to compose 'articles' for the

bulletin board--and assign these 'articles' to the appropriate forum, how to enter information in the calendar, how to access the course schedule, and so on. The student use of WebCT is not very difficult. But the instructor use is quite complex, even for the few features that we focused on. Having a number of 'instructors' working in groups, all working on different computers, in different locations, using different design software (e.g., Hyperstudio, Power Point, different websites) and then coming together in the lab to merge and post all their work proved to be a major undertaking. I have since discovered that many professors do not even attempt to create and post their own course material directly on WebCT. They usually create it on an Office application, perhaps as an HTML file, and then an 'expert' WebCT designer will upload that content and create the course in WebCT. It has become quite clear to me that if students are to learn how to use WebCT as students perhaps a number of short introductions to the use of various features is fine, but if students are to be expected to become familiar with a variety of tools as instructors, they need a lot of assistance at many points throughout the course. Naturally, the students all experienced some frustration when it came time to post their course content. One student reported, after reflecting on a WebCT presentation, "The initial explanation of how the WebCT worked was mind-boggling and gave me the feeling that I wouldn't ever know how to do anything on it. That discussion now (at the end of the course) would be quite a bit more useful."

For all the reasons stated above, students would not have had time to read everything that was discussed in class (thus summaries really helped), nor would they have had time in class to engage in the extensive and substantive dialogue that occurred on the bulletin board. At times this bulletin board discussion was fragmented as the students kept developing new areas of interest and new topics to discuss. Within the bulletin board feature of WebCT there was need for more initial structure and guidance for the students in how to start and maintain discussion on specific topics.

From the survey questions completed by the students and from the interviews with three students it is clear that the use of the bulletin board on WebCT played a crucial role in extending the learning of the content of the course. The students have a much deeper understanding of how technology can be meaningfully integrated into the curriculum and much of this understanding can be attributed to what they have learned from each other through the bulletin board.

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Targeted Instructional Staff Development Project: An Evaluation

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Abstract The goal of the professional development project was to facilitate the integration of instructional technology in the classroom. Twenty-five teachers in grades 3-5, from 9 different schools, participated. The project consisted of four workshop modules on technological training and five modules on development of interdisciplinary thematic units for integrating materials to achieve the Mathematics, Science and Technology, and English Language Arts New York State Learning Standards. Effectiveness of the project was determined by giving all participants a General Pre-test to determine baseline measures for each of the aspects of the Project and a General Post-test. Results indicated that the project was highly successful, although teachers did identify several limitations that need to be considered for future professional development activities.

Introduction

The Targeted Instructional Staff Development Project was a professional development project to facilitate integration of technology in the classroom. The ultimate goals were: to empower students to use technology in all phases of their education, to facilitate teachers as learners, and to achieve the New York State Learning Standards by developing interdisciplinary thematic units focusing on Mathematics, Science and Technology, and English Language Arts. At the same time, the project attempted to facilitate integration technology into the curriculum. The one-semester project consisted of nine separate workshop modules. See Bauder, Rossi, & Mullick (in press) for a description of three of the technology oriented modules.

The purpose of this paper is to describe the evaluation procedures used to determine the effectiveness of the project. Literature suggests that one major limitation of action oriented research has been the particular research designs employed. In 1997, Bauder, Carr, Mullick & Sarner reviewed research techniques employed in evaluating effectiveness of programs and found that few employed sound research designs.

As a result, the authors developed a set of guidelines for researchers that were adopted for the current study. A pre-post test design was employed. This design is particularly appropriate for assessing both formative and summative information. Because each subject acts as his/her own control it minimizes any random influences of extraneous factors and determines the effects of the project on changes between pre and post-tests.

Previous research by Ely (1990) and Bauder (1993) has shown that there are a number of conditions that facilitate or impede implementation of educational technology. An additional goal of the evaluation aspect was to determine the effects of the project on changes on some of these perceived barriers to integration of educational technology into the curriculum.

The Evaluation of the Project

All participants were given a General Pre-test to determine baseline measures for each of the aspects of the Project. Upon completion of the nine workshop modules, a General Post-test, consisting of many of the same items, was administered to the participants. These questionnaires provided summative information regarding the overall impact of the various modules on teachers' responses. In addition, pre-test and post-test questionnaires were administered for each of the individual modules. The individual results were used for formative information and allowed the procedures and information being presented in each of the modules to be monitored. The results were also used to refine the activities during the modules and to refine questions asked on subsequent surveys. Only the results of the General Pre and Post-tests will be presented in this paper.

The Questionnaires

The Pre and Post questionnaires had four common parts. Part I contained demographic information and examined frequency of use of hardware and software, perceived importance of these technological aspects in achieving the New York State Learning Standards, and the teachers' degree of comfort in using each of the items. Part II examined teachers' experience with technology including the use of technology in the classroom and the specific activities for which students used technology. Part III examined the extent to which teachers integrated technology into the classroom and Part IV tapped teachers' perceptions of barriers that impeded integration of technology into their classroom instruction. The Post-test included a final section that asked teachers to rate each of the modules on three dimensions. These responses provided an overall summary of the teachers' experiences throughout the project.

Results

Demographics

Twenty-five teachers from 9 different schools participated in the Targeted Instructional Staff Development Project. Of the 25 teachers, 80% were females who taught grades 1 through 5. The minimum number of years of teaching was 1 and the maximum was 30 with an average number of years of 12.84. Approximately 82% of the teachers had five or more years of teaching experience. Therefore the participants were relatively experienced teachers.

Pre-Post Changes to Determine the Effectiveness of the Development Modules

Part I : Frequency of Use and Degree of Comfort Working with Hardware and Software

For summary purposes, Total Indexes were developed by summing the ratings for the subsets of items related to frequency of use of hardware, frequency of use of software, comfort in using hardware and comfort in using software on both the pre and post-tests. Table 1 shows the average scores for each Total

Index. In general teachers rated the items higher on the post-test than the pre-test. The only exception was average comfort in using the hardware items. For that item, the average on the pre-test (52.00) was higher than on the post-test (49.96).

		Mean Pre-test Index	Mean Post-test Index
Frequency of use of	Hardware	32.09	47.87
	Software	47.22	69.87
Comfort in using	Hardware	59.48	49.96
	Software	52.00	84.30

Table 1: Mean scores for the indexes for total frequency of use and total comfort for hardware and software items.

To examine the data more fully, t-tests for dependent (paired) samples were performed using the Total Indexes as the dependent variables to determine if significant changes in teachers' responses occurred as a result of their participation in the project. The findings from the analyses of the t-tests for the Total Index for frequency and Total Index for comfort of use of hardware and software are displayed in Table 2.

Post test – Pre test	Mean differences	t	df	Sig. (2-tailed)
Total frequency of use of hardware	15.78	6.76	22	.000**
Total frequency of use of software	22.65	5.33	22	.000**
Total comfort of using hardware	9.52	1.73	22	.098
Total comfort of using software	32.30	7.32	22	.000**

** $p < .01$

Table 2: Summary of the t-tests for dependent samples on changes on indexes for total frequency of use total comfort in using hardware and software.

These results show that comfort ratings for using both hardware and software, were higher at the completion of the project than at its onset. Only one t-test failed to achieve significance. The t-test for changes in the teachers' overall ratings of level of comfort in using the hardware was not significant. This finding is not surprising in light of the fact that the types of hardware used during the project tended to be the same types that teachers reported having experience with prior to the project. However, it is important to note that their frequency of use of hardware did significantly increase by the completion of the project.

Part II: Changes in Experience wit Integrating Computing into the Classroom

Changes in responses dealing with experiences involving technology in the classroom yielded similar results. All of the t-test achieved significance. These results indicate that teachers believed they were better able to implement technology into their curriculum at the completion of project. They also believed that they were better able to integrate technology into their curriculum and into specific units, guide students in the use of technology and, at the same time, accommodate different levels of expertise. In addition, teachers were better able to relate technology to curriculum objectives and to student achievement. Finally, the teachers indicated that upon completion of the project, they felt more confident in developing materials for student management using instructional technology and in preparing materials to be used by students in the classroom.

Part III: A Comparison of Perceptions of Teachers Use of Computers in the Classroom Compared to Students

Part III of the Post-test compared teachers' perceptions of frequency of various activities involving the use of technology in the classroom by the teachers themselves and by their students. Teachers believed they used computers more frequently compared to their students for organizing and storing information, for e-mail and for retrieving information from the Web. However, no significant differences are perceived between teacher and student use on text editing, creating non-visual graphics, developing Web pages and performing calculations.

Part IV: Changes in Perceptions of Barriers to Integrating Technology into the Curriculum

Part IV of the post-test was designed to examine the teachers' perceptions of some of Ely's (1990) factors that impede their ability to integrate technology into the classroom. In addition to examining changes for each of the individual factors, a Total Index of Perceived Barriers was developed for both the Pre and Post-tests. The results of the t-test analyses in Table 3 indicate that participating in the project did significantly effect the teachers' perceptions of the extent to which the factors act impediments to integrating technology into the curriculum.

All of the analyses yielded significant results, except for one. In the pre-test teachers believed that Technology integration is a high priority within their school and therefore did not act as a barrier to integrating technology in to the classroom. The result in row 6 of Table 3 supports this perception. Even after participating in the project, teachers still perceived their school's commitment to integrating technology as a minimal barrier. In all other cases, the perceptions of degree of impediment of integration of technology into the classroom significantly decreased. This change in perception may have occurred because as teachers gained more confidence in their abilities to work with hardware and software and as they learned new ways for integrating technology into their curriculum, they also perceived these factors as less of an impediment.

Perceived barrier Post – Pre test	Mean Difference	t	df	Sig.(2-tailed)
Not enough or limited access to computer hardware	-4.09	-7.27	22	.000**
Not enough computer software	-3.57	-6.16	22	.000**
Lack of time in school schedule for projects involving technology	-3.83	-5.76	22	.000**
Use of technology not integrated into curriculum documents	-2.87	-4.33	22	.000**
Not enough teacher training opportunities for technology projects	-3.83	-7.57	22	.000**
Technology integration is not a school priority	-.61	-1.14	22	.256
Difficulty in finding substitutes in order for teachers to attend training	-3.87	-5.86	22	.000**
Lack of technical support	-1.57	-2.37	22	.027*
Lack of instructional support	-1.78	-3.19	22	.004**
Lack of other supporting materials	-2.78	-4.49	22	.000**
Total Index for Perceived barriers	-28.91	-9.13	22	.000**

** $p < .01$
* $p < .05$

Table 3: Changes in perceived barriers after completion of the project.

Part V: Overall Evaluation of Each of the Modules of the Project:

In order to obtain summative information for the impact of each of these individual modules the last part of the Post-test asked teachers to evaluate each of the models by: giving an overall favorability rating to each, indicating the extent to which they believe that each Module would be beneficial in achieving the New York State Learning Standards and, indicating the extent to which they expected to apply information from each of the module in their future classes. These responses provide an overall summary of the teachers' experiences throughout the project.

The results show that teachers had a favorable impression for each of the modules. On a nine-point scale where a rating of 9 indicates high favorability, the average rating ranged from 6.48 to 7.88. The average ratings of the extent to which teachers' believed each of the modules would help to achieve the New York State Learning Standards were also highly favorable with mean ratings ranging from 5.84 to 7.6. Ratings of the extent to which the teachers expected to apply information from each module in their future classes showed a similar pattern of results. The mean rating for each module ranged from 6.4 to 8.0. In all cases,

Three separate Analysis of Variance analyses for repeated measures using teachers' overall ratings for the modules as the within-subjects using the overall ratings were performed. None of these analyses achieved significance. These findings indicate that although the teachers' overall ratings of the individual modules were not significantly different from one another. All modules were rated consistently high.

Overall Evaluation of the Entire Project

Three items were included in the General Post-test to assess the respondents' overall evaluation of the entire project. On the item that asked them to indicate the overall evaluation of their experiences in the entire Targeted Instructional Development Project, the average rating was 8.70 out of a possible 9.0. When asked if the teacher would recommend this project to their colleagues, the average rating was 8.65. The final question to determine the overall evaluation of the project asked teachers to indicate the extent to which they agreed or disagreed with the statement "If given the opportunity, I would participate in a project like this again". The average rating for this response was 8.35 indicating a strong degree of agreement. Taken together, these results clearly indicate that the participants had very favorable experiences in the project and believe that the knowledge and information they gained will be helpful to them in integrating technology into the classroom. The results also indicate that teachers would be willing to participate in similar projects in the future.

Open-ended Responses

On each post-test, teachers were asked to indicate the single most valuable feature of the module/project and the weakest feature of the module/project. A review of these statements indicate that teachers liked the interaction with other teachers, hands-on activities, learning strategies for integrating technology into the classroom and the ability to create materials that could be used in subsequent classes. The most common responses regarding the weakest feature tended to focus on lack of technical support; lack of equipment, connections and software; and the feeling that there was too much material covered in too short of a time period.

Conclusions:

The Targeted Instructional Staff Development Project was highly successful. The analyses of the results of the questionnaires indicated that the experiences of the participants were indeed favorable and that the project had a significant impact on the teachers' ratings.

There were three major sets of findings. First, the teachers' responses indicated that as a result of participating in the project they were using both hardware and software more frequently in their classrooms than they had prior to the project. Second, teachers believed that these activities helped them to learn new ways to integrate technology in the classroom and they felt more confident in using technology themselves and in guiding their students in the use of technology at the completion of the project. The third major finding was the significant change in perceived barriers to the integration of technology in the classroom. Factors that had been perceived as barriers prior to participating were seen as significantly less of an impediment as teachers gained new experience and knowledge about technology and learned new strategies for integrating technology into their curricula. This finding is particularly interesting since few of the activities within the project addressed the perceived barriers directly.

The duration of this project precluded the opportunity to conduct a long-term follow-up to determine if changes actually were integrated into the teachers teaching strategies and lesson plans. However, the Post-test did ask teachers about their future intentions of implementing these changes. Teachers indicated that they expect to apply the information they learned in their future classes. They also indicated that they not only would be willing to participate in similar projects in the future, but they also would be willing to act as resource persons to other teachers in their school.

Participants did identify several limitations of the project. Specifically teachers felt that the activities were too concentrated and there was too little time to deal with the material adequately. They also indicated that a severe limitation to integrating technology in the classroom is the lack of technical support when they returned to their schools. Finally, they felt that a major problem to participating in the project was the difficulty in finding substitute teachers to free them up from their classroom obligations. Future projects should therefore address these concerns.

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Designing Learning Practices as Professional Development for Teacher Educators

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Abstract: Since 1997 the Amsterdam Faculty of Education (EFA) has the status of experimental teacher-training programme. To support the experiment several research projects take place, aimed at providing the EFA with data that can guide the innovation process. As part of one of these projects a model is developed that can support teachers in developing innovative learning environments. The function of the model is bipartite. It is expected that the use of a model will lead to the development of learning environments that correspond to the innovative ideas of the EFA and at the same time fulfil a role in the professional development of teacher educators. In the study a method of development research is used. In several cycles of development and formative evaluation a definitive design model will be developed and tested. In this paper the specifications for the design model and a description of a first prototype are given.

Introduction

In 1997 the Amsterdam Faculty of Education (EFA) was awarded the status of experimental teacher-training programme by the Dutch Minister of Education. In the same year the institute started to develop and implement a new dynamic curriculum to replace the traditional static curriculum. Important parts of the dynamic curriculum are Learning Practices (LP's). LP's are learning environments in which students develop competencies essential to the teacher profession. In LP's students independently accomplish complex authentic tasks that must lead to a meaningful product. EFA has named this approach *productive learning*. Anticipating the importance of Information and Communication Technology (ICT) in the future profession, all LP's have an ICT component. Furthermore it is important that an LP consists of more than only physical facilities. It should contain the main characteristics of the professional practice, such as, feeling responsibility for the quality of your work, a necessity to work together in a group, the need to search for new information and a stimulus to call upon expertise (Wielenga, 1998). In the vision of EFA the dynamic curriculum must enable students to shape their own learning processes. The students must also have more freedom to organise themselves the evidence they want to present to prove that they possess the necessary teacher competencies. It is expected that the dynamic curriculum, will enable EFA not only to respond more accurate to the rapid changes in the field of education, but also that student teachers will be better prepared for their teaching careers (Dietze, Snoek & Wielenga, 1998).

From the start the EFAs' teaching staff has been involved in the innovation process. The opportunity was given to all EFA teachers to participate in developing the new curriculum. For this reason the Expertise Centre for Curriculum Development (ECCD) was set up. During one or two months a year members of the teaching staff are relieved from their teaching duties and can dedicate this time to the design and development of

LP's. EFA sees the development of LP's as a learning process in itself and an opportunity for the teaching staff to obtain a broad variety of new knowledge and skills. For the development of *Learning Practices* the ECCD provides technical facilities and technical support. Further, the centre creates opportunities for teachers to acquire new knowledge and skills by organising workshops and training. Until now especially the development of ICT- skills was given attention because these skills were new to most of the teaching staff.

Since the start of the innovation dozens of LP's have been designed and developed by teacher-educators. However, formative evaluation revealed that some of the LP's, developed by teacher educators, show little resemblance to the concept the EFA aimed at, at the start of the innovation. The researchers also noticed that interviewed teachers-educators had not had sufficient opportunities to learn during the developing process (Voogt, Odenthal, Taks & Otter, 1999).

Both problems are not unique for the EFA, but have been reported before. A changing view to education together with the aspiration to integrate ICT in the classroom urges teachers to develop learning situations that differ considerably from traditional classroom teaching (Sandholtz, Ringstaff & Dwyer, 1997). It appears that teachers underestimate the complexity of developing such learning situations. As a result learning situations not always possess intended and necessary innovative characteristics (Voogt & Odenthal,1999; Voogt, Odenthal, Taks, Otter, 1999). The second problem reported is connected with the method of professionalisation that EFA employs. The concept shows similarities with action learning, a form of action research, which is based on the notion that we learn from our experience through cycles of reflection and action (Brook & Watkins, 1994). Revans (1982) defines action learning as learning from and with peers while tackling real problems. A condition for actual learning by solving problems is that there must be an equal emphasis on both learning and doing. In practice however the emphasis is more on solving the problem and therefore on doing. Also people do not know innately how to learn from their experience and should be supported with it (O'Neil, & Marsick, 1994).

In this study a combination of an instructional design model and an action learning model is developed and tested. In the first part of the study the emphases is on the development of an instructional design model that fits the needs of teachers-educators developing innovative learning environments with ICT. In the second part of the study the main focus is on combining action learning with the design model.

The Study

In the study the method of development research is used. In development research a researcher works with a group of practitioners to define a problem, and then experiment with potential solutions to the problem. Data are collected on the results of the experiment and fed back to the group. If it is determined that the solution was not successful, the researcher together with the practitioners redefines the problem, further experiments are developed, and again and again the group cycles through this process of experimentation and reflection. The main role of the researcher is to guide data collection and analysis (Brook & Watkins, 1994). The research method of development research ensures that outcomes are useful to the practitioners and is seen as tool to support the implementation of complex innovations. The desired result of a development research is twofold,
(i) development of prototypical products, including empirical evidence of their quality;
(ii) generating methodological directions for the design and evaluation of such products (Van den Akker, in press).

This study will concentrate on product development, in this case an LP design model. The study consists of four phases. In the first phase exploration of the context leads to accentuation of the definition of the problem and specifications for the design model. Methods of data collection in this phase are study of literature, interviews with teachers-developers of the EFA, interviews with ECCD staff and evaluation of LP's. In the second phase of the study a first prototype of a design model is developed on the basis of specifications defined in the first phase. This prototype will be revised on ground of comments of ECCD staff , EFA staff and other experts. The third phase is the test-phase in which teacher-educators will test the design model in four overlapped cycles of LP development. This method is named a staggered case study (Walker, 1998). Advantage of this method is that experiences from the first case can immediately be used for improvements in the second case and so on. In this way four cases will be studied. During the test-phase data will be collected not only on the quality and effectiveness of the model but also on the learning needs that emerge from the process of development. Methods of data collection in this phase are interviews, questionnaires and evaluation of LP's. In the fourth phase is explored whether actions that are part of the design process can simultaneously be part of a learning cycle consisting of a string of action and reflection. This phase must also lead to concrete indications for

the ECCD staff how to support and stimulate the learning process of the teacher-educators during the development process.

Specifications for the LP design model

At this moment the first phase of the study is completed. Literature research and interviews with ECCD staff resulted in the first specifications for a design model. Specifications for the LP design model are based on the following assumptions.

- The LP design model has to fulfil different functions. Firstly it must support developers in efficiently developing LP's. Secondly it must ensure the quality of LP's. In the third place it must function as a communication device and improve communication between developers among themselves, communication between developers and ECCD staff, communication between developers and other EFA staff, and finally communication between the developers and students. The LP design model should therefore offer a clear communication frame.
- Development of innovative learning environments is a complex process (Richey, 1995). Support is desirable in view of the reported problems (Voogt & Odenthal,1999; Voogt, Odenthal, Taks, Otter, 1999). Prescriptions however are not advisable exactly because of the complex and incidental character of the development process of innovative learning environments and the aversion that teachers (as most developers) have to models and prescriptions in particular (Gustafson & Branch, 1997). The LP design model should therefore support the process of development but not prescribe it. The LP design model must form a heuristic basis from which the developers can begin to develop their own LP.
- A design model should consist of at least the following major activities; analyses of the context and needs; design of a set specifications for effective, efficient, and relevant materials; development and construction of all materials and supporting processes; implementation of the product and processes or anticipation on the implementation; formative and summative evaluation of the product and processes (Visscher-Voerman, 1999). The LP design model should at least consist of the above mentioned activities.
- The development process must not only result in an LP but also have surplus value for the professionalisation of the developers themselves. In complex situations where one *best* solution cannot easily be advocated, forms of action research can be a useful learning strategy (O'Neil & Marsick, 1994). Action research is the reflective process whereby in a given problem area, where one wishes to improve practice or personal understanding, inquiry is carried out by the practitioner – first, to clearly define the problem; secondly, to specify a plan of action- including the testing of hypotheses by application of action to the problem. Evaluation is then undertaken to monitor and establish the effectiveness of the action taken. Finally, participants reflect upon, explain developments, and communicate these results to the community of action researchers (McKernan, 1996). The LP design model should not only contain support for the development of LP but also provide a model for action research.
- The new curriculum of the EFA is centred round the concept of *productive learning*. In *productive learning* aspects can be recognised of contemporary ideas from the field of education such as contructivisme (Wilson, 1996) and situated learning (Brown, Collins & Duguid, 1996). In these concepts learning is seen as a process that results from a complex set of interactions between the actors within this learning space (Gustafson & Branch, 1997; Voogt & Odenthal, 1997; Wilson, 1996). In traditional design models development of instruction is generally understood as the process of selecting the best instruction method, given the desired outcomes under set conditions (Winn, 1993). In innovative learning environments however the characteristics of the learning space determine the nature of the learning process that actually will occur. The LP design model should therefore address those characteristics of the LP necessary to raise *productive learning*.
- One of the basic assumptions of the concept *productive learning* is that during the learning process students are confronted with their learning needs. The learning environment cannot be fully defined and prepared in front because these learning needs are not always predictable. Also the role that the teacher has to perform is often uncertain in advance because it is expected that the teacher meets the needs of the students (Wilson, 1996). Inherent to the concept *productive learning* and the connected concept of LP's, is therefore the continuation of the development process during the learning process. The LP design model should take into account that specific characteristics of the LP can not be specified in detail in front but should be specified

at a later point by the teacher or by the students as part of their learning process. Also, to ensure that an LP includes proper support and guidance, in the development of the LP should already be taken into account that characteristics of the LP might have to be changed or adapted several times. The LP design model must therefore reflect the iterative or recursive character of the process of LP development.

First prototype of the LP design model

On ground of specifications a first prototype for an LP design model was developed. The model consists of three related parts, a *process model*, a *product model*, and a *learning model*. At this stage the *learning model* has not yet been specified. The intention however is to insert a model of action learning. Action learning is a strain of action research and it is directed at improvement of professional practice. An action learning model includes questioning the framing of the problem, collecting data, and trying solutions (Brooks & Watkins, 1994). The *process model* has to facilitate communication between ECCD staff, EFA staff, students and LP developers. In the process model the preconditions for the development of the LP are created, such as time, financial and personnel support. The process model is therefore mostly determined by the organisational context of the EFA. Although developers and in practice can exchange information as often as chosen, the EFA demands two obligatory instants of evaluation. In the first evaluation by means of a project plan is decided whether the LP has enough potential to be developed. In the second evaluation the further development of the LP is delegated to teachers and students. After that teachers and students conduct a third evaluation, both as part of their learning process.

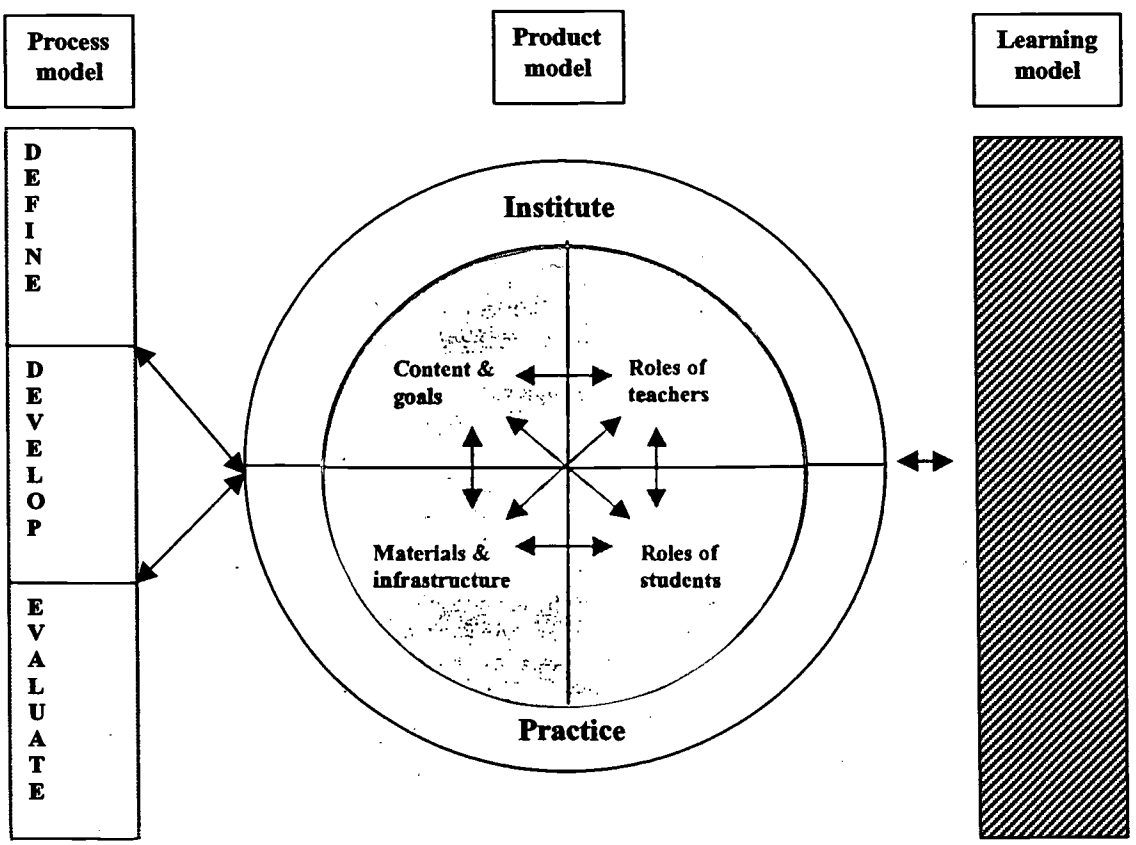

Figure 1: Prototype of LP design model consisting of a process model, a product model and a learning model.

Centre of the LP design model is the *product model*. Included in this model are the main components of an LP. These components are, content & goals, roles of teachers, roles of students, and materials &

infrastructure. In the model the LP is embedded in the institute of education as well as in the educational practice. For each for each of the components of the LP, the embedding in the institute, and in the educational practice characteristics are defined.

For the first prototype a list of characteristics of LP's was composed in co-operation with EFA staff (Voogt, Odenthal, Taks & Otter, 1999). It is the intention the list will be updated yearly on ground of state of art knowledge and results of the evaluation of LP in the preceding year. The actual development process of an LP starts with a definition phase in which for each component a first outline of core characteristics is given and for other characteristics realised in the specific LP. Important are not only which of the characteristics the LP will contain but also whether the characteristics of each of the components are in balance. For example, if in an LP students are expected to act independently, characteristics of materials and infrastructure as well as the characteristics in the roles of the teachers must support this independence. The definition phase results in a project plan that contains the first outline of LP including the characteristics the LP possess and how is it is embedded in the institute and the practice.

After the definition phase an iterative recursive process of LP development begins in which developers alternately work on the realisation of specific LP characteristics, develop materials and supporting processes for the LP and evaluate the process by comparing prototypes of the LP with the outline of the LP. This results in a LP manual which contains next to the description of the characteristics of the LP and their specifications, an instructions for the teacher and the students. In the LP manual should also be specified which of the characteristics of the LP need to be further developed by teachers and students together with indications of how these development can take place. Finally the LP manual contains specifications for evaluation of the LP and adaptations that might be necessary in practice. The development process is completed with an evaluation phase in which students and teachers test the LP.

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WE HAVE THE EQUIPMENT—WE NEED THE TEACHERS TO RUN IT

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Abstract

For at least the past decade national, state, local and philanthropic policies have focused on the goal of getting more computers into the schools and more computers connected to the Internet. These policies reflect the belief that Information Technology (IT) is a powerful teaching/learning tool and an essential skill set for future employment.

Recent surveys and state-specific data suggest, first, that the goal of providing IT access to all students is being realized and, second, that IT is not reaching its full potential because teachers are either not using it at all or using only its most limited capabilities.

This paper will discuss one masters program that is successfully preparing teachers to use the full potential of IT.

Access to Information Technology

The past decade has seen major policy and program initiatives designed to increase K_12 student's access to computers and the Internet. Wire the schools day, E-Rate, $9.9m in USDE Community Center Grants and a similar private sector program, PowerUP aimed at closing the "digital divide" in Internet access—these are only some of the programs driven by the belief that IT is a powerful teaching /learning tool and also a skill set essential for successful employment.

Following the federal lead, state budgets have increasingly included support for hardware and wiring; and individual school districts have undertaken large-scale bond issues to support increased IT in schools. California, for example, has spent over $400 on its Digital High Schools Program since 1997. The result is 19.3 students per Internet-connected computer.

Similarly, the New York State Legislature has approved $213m, $239m,and $292m over the past three years to support IT, producing a ratio of 15 students per Internet-connected computer.

These and similar efforts in other states have led to the conclusion that " a critical mass has been reached. More than half the nation's classrooms are connected to the Web, and schools have an average of one instructional computer for every 5.7 students". (Education Week, September 22, 1999)

Utilization of Information Technology

While the goals of It availability are being met, utilization of these resources by students and teachers shows a less encouraging picture. One reason for this may be the computers themselves. Of the computers being included in the availability counts, 19% consist of Apple IIe's and 386 machines that will not run recently created software or provide Internet access.

This percentage is consistent with the finding that teachers tend to underutilize the capabilities of computers at their disposal. A study conducted by researchers at UC Irvine and the University of Minnesota found that secondary science teachers are more likely to use computers for word processing and information finding than for "doing science".

Similarly, the 1998 National Assessment of Educational Progress in Reading found that student computer use in the fourth and eighth grades was infrequent at best. Eighty percent of fourth graders reported using computers either "not at all" (39%) or "once or twice a month" (41%). For eighth graders the respective percentages were 38% and 44%.

On a more personal note, I recall pushing and cajoling teachers who have the hardware and software but have their students use it as an electronic encyclopedia or search the Internet for material already available in the local library.

What Explains Underutilization of IT?

Answers to the underutilization question vary. Teachers say they do not have enough Time to learn the courseware or enough computers. Administrators say the teachers are not prepared to use computers.

No matter what the explanation de jour, the consensus points to teachers. Experts with a firm command of the obvious conclude that teachers are the key to increased, more skillful use of IT.

There is an equally strong consensus that neither pre-service nor in-service training is adequate to the job of preparing teachers for effective IT utilization. This inadequacy shows up in both the type and the amount of training. Most training focuses on operating systems and perhaps word processing. Yet teachers report that this type of knowledge/skill is insufficient to launch them as active IT users.

In terms of the amount of training experienced by most teachers, eleven hours a year is a high-end average figure.

One problem may lie in the fact that the skill levels and the time it takes to achieve these levels are not well understood or accepted. Any plan for training or assessment of training effectiveness must be based on a model or ideal of the trained professional. Most models envision four stages of development or proficiency. (See, for example, "Professional Skills for the Digital Age Classroom" www.milkenexchange.org/pec/)

Level One in this and similar schemas is basic skills—computers 101: how to operate a computer and use one or more of the big three applications, word processing, database and spreadsheet.

Level Two is adoption. At this stage teachers are developing the knowledge, skills and disposition to try out ready-made courseware for classroom use. This could be CD-ROM on some aspect of the environment, a math drill, or a Jostens reading program. This is "as is" instruction and typically does not require the teacher to change his/her style of teaching.

Level Three is adoption. Teachers at this stage are modifying and combining elements of IT to fit the needs of their students and the goals of the curriculum. Usually, the teacher will start to modify his/her teaching style at this stage. One example is a peer tutoring arrangement that involved fourth graders working with a class of first graders. The older students used PowerPoint to put up a picture and the first graders' stories about that picture—usually something about a sibling, their grandmother or their pet.

Level Four, Integration, occurs when a teacher has a solid base of technical skills, knowledge and disposition to integrate a range of IT elements to achieve a variety of curricular goals. A teacher at this level knows how to teach IT as a subject and how to use IT with her students.

A level four teacher might, for example, want to have students learn how to weigh evidence and develop theories. To achieve this goal she enlists the help of several other science teachers who are members of a listserv. All four agree to have their students build simple air quality measures and report the data to each other daily using e-mail. The data are stored in a database for several weeks. The students then develop and share theories about the way the data are behaving. "Maybe our equipment isn't working right"; "maybe air quality changes with the direction of the wind"; "maybe air quality is different at different times of the day". "Why don't we measure air quality inside?"

The students share their data and their theories, continue to gather data to support or not support the theories. They present their results to a home audience or each other using hyperstudio.

The most important point is to note the difference between level one and level four—huge. The other point is that teachers at level one can have little or no effect on student achievement. As teachers move toward level four proficiency, their impact and the impact of IT increases.

Few teachers pass quickly and effortlessly from one stage to the next. With constant effort and support, most teachers will take three years to reach level four. This is why some studies

have shown a confusing relationship between years of teaching and computer use. The expectation is that the younger teachers will show the highest levels of computer use. Often, however, these beginning teachers are at level one and will be teaching for several years before they reach higher levels—provided they have strong professional development support.

Because of the cost and time involved, progress toward a four-stage model of IT proficiency has been patchy. For example, 42 states now require some demonstration of It work as a requirement for licensure. However, only four require any documentation of continued IT training for recertification.

Nonetheless, state and federal grants are increasingly requiring budget commitments of 20 to 30 percent for training. The Literacy Challenge Grant is one example. Local bond issues are slowly starting to follow suit.

The Role of Teacher Education Programs

Teacher education programs do not generally get high marks for preparing graduates to be effective users of IT. Both the National Council for the Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) have looked at the effectiveness of teacher education programs as preparation for using IT and found serious shortcomings.

NCATE, in 1997, concluded, "Bluntly, a majority of teacher preparation programs are falling short of what needs to be done. Not using technology much in their own research and teaching, teacher education faculty have insufficient understanding of the demand on classroom teachers to incorporate technology in their teaching".

A year later ISTE surveyed 416 teacher education institutions (mine among them). Their report "Will New Teachers be Prepared to Teach in a Digital Age?" also faulted teacher education institutions. The survey found that while IT facilities were rated "adequate", teacher education faculty, by and large, did not use these facilities to model teaching/learning using IT. Further, the study found extensive evidence that while virtually all institutions reported requiring a version of Computers 101, few offered courses in curriculum integration. In terms of the four-stage paradigm, the institutions were addressing level one only.

However, it may not be realistic to expect a pre-service program to take students all the way to level four. Instead, the model educational program most likely to reach that goal is one that combines preservice teacher education, a mentored year in a school with current IT and an IT proficient faculty, followed by a masters program (or the equivalent) to complete the progression. Such a model may involve jurisdictional overlap between preservice, teaching and inservice institutions, but it may be a better way to think about how to achieve level four proficiency. The remainder of the paper will examine a masters program that functions as part three of the model noted above.

New York Institute of Technology Masters in Instructional Technology

NYIT's 36-credit masters program satisfies one requirement for permanent teacher certification. All of the students have provisional certification and are teaching full-time—not, unfortunately, all in well-equipped schools. Many come in at level one, having taken a "Computers in Education "course as undergraduates.

The courses form four groups. The first group consists of three courses (Introduction to Computers, Survey of Instructional Technology, and Multimedia Classroom Applications) and is roughly equivalent to the skills level in the paradigm. All three are lab courses.

Students learn the basic technical skills and knowledge: operating systems (MAC or PC or both), the big three applications, productivity tools like grade books, navigating the Internet and multimedia for instruction. Each of these topics is illustrated by classroom applications.

The second group of courses address adoption, adaptation and integration by having students apply the work of the course to their classroom teaching. Courseware Evaluation explores sources of courseware and develops evaluation schema for each of the students in each course. Sources of useful evaluation are compared as are specific evaluation criteria like the degree if diversity in a piece of courseware. Mostly this course works at the adoption level.

Technology for Special and at-Risk Populations identifies courseware and applications for two hard-to-reach populations. This is mostly an adoption course, but since it is often offered on line it also models the use of the Internet as an instructional medium.

Higher Order Thinking Skills focuses on sets of skills rather than a particular population. Students study courseware and applications that promote students' ability to, for example, analyze, synthesize and evaluate. This course begins to put curriculum and learning outcomes in the driver's seat. Based on their own classes, the graduate students create teaching/learning units using IT with their K-12 students.

The curriculum course—Instructional Systems Design—emphasizes integration by having students "plan backwards", starting from the skills and knowledge goals of a unit of instruction. By that time in the course the students have a menu of options to select from as they design a teaching/learning unit for their classes.

Each of the courses in this grouping is taught in a computer lab. Some are to one degree or another web based, with materials and the course outline all on line. Some courses have students submit work on-line.

The final two required courses focus on research, teaching the standard research skills as well as developing an extensive review of the IT literature in their discipline and conducting an experimental study of IT-based learning in their classroom. These courses spend one session in the lab using statistics software. Students use various Internet search engines and strategies to gather material for their review.

The two electives can be satisfied through transfer credit or two courses from the department. Examples include Networks—a lab course for computer coordinators and Instructional Application of the Internet. This course is entirely on line and models a constructivist approach to using the Internet.

While these 12 courses have helped a great many students achieve a level four proficiency, the program still needs improvement. First, there needs to be a tighter integration between the graduate students' K-12 teaching and the masters courses. As students move through their courses and attain levels two, three and four, they should have the opportunity to apply this coursework in their classes. For all the obvious reasons, this does not always happen. Having a strong district based professional development program also helps if one is available.

Another way to make this a tighter integration is to have each graduate student's curriculum available to both the instructor and the rest of the class. This would provide a broader context for curriculum development and would underscore the mantra of the program "Curriculum drives the Technology".

Second, the program needs to address the issue of assessment more vigorously and creatively. Given the dollars and the expectations behind the IT buildup, it is only natural to expect "results". Accountability at the state level generally means improved scores on standardized state tests, and the improvements should not be too long in showing up.

However, the desire for quick results is at odds with the four-level paradigm. It is not reasonable to expect improved student performance in a year or two if the time required for teachers to develop the requisite proficiencies may be as much as three. Thus our students must have a variety of alternative ways of showing results. The best approach is to show actual student work, but the masters program does not spend enough time on portfolios of student work that would demonstrate skill and knowledge development. Similarly, our students need to become familiar with the ISTE K-12 standards and be able to show that their classes are meeting these standards.

We know that curriculum is a zero-sum game. Adding work on assessment means dropping other topics. But unless we make these hard choices, we may not have the time needed to develop the fourth level of competency and the time for these skills to produce the results that justify the large expenditures and high expectations for IT.

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Technology Autobiographies in Teacher Education

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Abstract

This paper explores the impact of the integration of an online interactive website in a graduate pre-service literacy education class through an analysis of students autobiographical reflections. Students wrote their literacy and technology autobiographies as part of the requirements of a course. Through analysis of the autobiographies and follow-up interviews with students, several key themes emerged revolving around issues of teaching and learning, the responsibility of a university to adequately prepare teachers and the role of technology in the personal and professional lives of these students.

Purpose

The purpose of this study was to examine the technology lives and experiences of teachers through an analysis of their written, on-line literacy and technology autobiographies. The process of exploring their socio-personal history enables teachers to understand better and make sense of their own pedagogical positions and develop a deeper awareness of the factors that shape their teaching and learning (Schon, 1983; Friere, 1970). One outcome of this research is to encourage teachers to reflect on their technology experiences to become aware of their classroom practices.

Theoretical Framework

Richardson (1990) in calling for an "individualistic, psychoanalytic approach" to teacher education recognizes that the lack of reflection leads to "an idiosyncratic view of teachers. That is, the teacher teaches as he or she is. How then do we think about affecting change?" (p.13). Autobiography has been suggested as a possible way to help teachers alter what they do (Diamond, 1990) and is viewed by many recent researchers as critical to the process of professional growth and development (Solas, 1992; Duff, Brown and Van Scoy, 1995; Parsons and Matson, 1995). Knowles (1992) notes that we increasingly believe biography to have a significant bearing on the classroom behaviors and practices of teachers. Knowles, like Richardson, recognizes that by not adapting and dealing with the life history of teachers in preparation, future teachers are bound to become teachers who teach in the manner in which they were taught and who will be limited in the ways in which they can professionally develop. In Psychology of Personal Constructs Kelly (1955) notes that people use experience to create constructs through which they create new experiences and then verify or modify other experiences. We build each experience, then, upon experiences that are, in turn, modified through future experiences. This process is one in which we view the participants as "explorers" investigating their own historical landscapes (Pope and Keen, 1981). Autobiographical explorations can help teachers heighten their awareness of their own learning and the teaching-learning process.

This study builds on previous work that examined the literacy autobiographies of pre service and in service teachers. (Ringler and Rhodes, 1998).

Methodology

Eleven teachers enrolled in a graduate teacher education program at a major urban university volunteered to participate in this study. The participants were in their 20's, 30's and 40's and are studying for advanced graduate degrees in literacy education. They indicated varying degrees of familiarly and comfort with technology. These

levels ranged from those who had never interacted on-line either personally or professionally, to those students who identified themselves as very comfortable with email and on-line personal communications. None of the students reported using on-line communication in any of their undergraduate or graduate level classes.

As part of their course requirements, students were to write their technology autobiographies and post them on an interactive web site that we created for this course. Students were encouraged to read and respond to each other. We then conducted and designed follow-up interviews to provide insight into the specific links between autobiography and the ways in which it can impact upon the participant's current thinking and classroom practice that went beyond the information in the written autobiography.

A structured interview script was used as a basis for very broad questions. Responses from the first interview suggested the need for elaboration, and we conducted a follow-up interview to ask each participant about categories that were either not clear or sufficiently detailed. As a result we interviewed each participant twice during a two-month period.

Data Analysis

Interviews were first transcribed from the audiotape and then coded using the categories generated from the interview script. During the initial coding, we coded technology in all of its implications. During the subsequent coding, the participants' thoughts about their current philosophy and teaching practices, specifically we coded the use of technology in educational settings. Using the information from both the written autobiographies and the interviews, we identified themes. Finally, we constructed a life story for each participant beginning with their initial introduction to technology, their current views on technology and its uses and concluding with information about their current teaching philosophy and practices. We gave the participants the opportunity to read their "life stories" as constructed by the researchers for accuracy and to make any corrections or additions.

Implementation and Discussion

I set up an interactive web site so that the students in this literacy education class would have experience with such technology. I felt that during their careers as educators, they might be in the position of deciding whether and in what ways to incorporate distance learning in their classes. Several students were concerned, confused and worried that they would not learn all of the content of the course. We spent a great deal of time talking about the logistics of the course and the concerns of the students. We talked extensively about technology and its role in teaching and how this course could provide a demonstration of such a teaching/learning situation. We talked about taking risks as teachers and as learners. Most of the students agreed that this would be an interesting experience. A few said that they would never use technology in their teaching and two resented the inclusion of this component in a literacy class.

Since this was a course for future teachers, we decided to focus not only on the content of the course but also on the process of being engaged in a distance learning situation. We explored the research on teachers as reflective practitioners as we navigated through the course. Students were continually asked to reflect on their experiences as learners as well as in their role as future educators.

Results

While there were differences in the experiences of the students, there were many similarities. These similarities centered on several themes. Preliminary data analysis revealed the following key themes: A Desire to Maintain Current; Technology Talk with Little Practice; Affect of Technology on Philosophy and Practice; and The Personal Uses of Technology/Professional Uses of Technology. The following is a brief discussion of some themes that emerged.

A Desire to maintain current

Most of the participants recognized that technology would play an increasing role in their teaching and their lives overall. While three of the participants did not like this, the remainder felt that technology could be a

positive force. All, however, recognized that they must be knowledgeable about technology to be current. The following are typical of some comments made and written at the beginning.

> In order to survive, I'm going to have to deal with technology. Even though I am not convinced that it is beneficial, I have to know it in order not to be considered a fossil. I remember teachers who always seemed outdated and I do not want to be like them, they really weren't respected. (Jane)

> As a writer, I think the impact of words is vitally important in our lives and I fear that the internet will use so many visual cues and clues that words will be rendered secondary. So, therefore, I have a vested interest in maintaining the integrated of the printed word, whether it be printed on line or on paper. (Greg)

Technology talk with little practice

Leslie's concern for remaining current also addressed a limitation in the University teacher education program. Leslie and others pointed to the fact that a university should be demonstrating technology and making it a natural part of the courses. This, they felt, is even more crucial in a teacher education program.

> If I'm going to look for a job next year, I think I have to know about technology and teaching. I like hi-tech stuff and think I might be a good candidate for the incorporation of technology in my classes. The problem though, is that we talk about it in classes at Pace, but we never use it. If I'm going to be able to talk intelligently at an interview, I have to have had experience–not just at home doing fun stuff, but also experience using technology to teach and learn.(Leslie)

All of the students expressed similar concerns about this issue.

> I need to walk the walk not just talk the talk. Our school is supposed to be modeling best practice but we really don't see that. There are so few professors who are using any sort of technology. Aren't they supposed to be on the cutting edge? For some teachers, it seems that high tech is using a slide projector. I think there is a bit of hypocrisy going on here. How can you teach future teachers if you don't know the material itself? (Jeff)

> In order to teach math, we need to learn math. In order to teach technology we need to learn technology. (Sue)

Impact of technology on philosophy and practice

During the semester, I continually asked students to reflect on their emergent philosophy regrading teaching and learning. For those students who were new to technology, they often used these experiences to reflect on what their students might be going through as they study new areas and try new things. They most often related their frustration with technology to the frustrations their future students must feel when they are grappling with ideas and information which are difficult.

> As I struggle to connect on line and navigate our website, I find that I am constantly thinking of how very young children learn to read (this is, after all, a literacy course). I think I can better relate to them and the difficulty they have, then I realize, that I am a relatively successful adult, and I sometimes feel like I'd like to pack it in due to my frustration. Of course, I can, I've chosen this new career path and if it gets too difficult I can just toss it. Little kids can't just opt out of school. Computer and me is like a little kid learning to read. It's all a bit confusing and overwhelming, but I need to master it in order to function in the real world. (Barbara)

> This has been a great exercise in relating to the struggle of our students. I've always been an accomplished learner and scholar, but going through this experience has given me a keener insight into the experiences of others.(Jeff)

The personal uses of technology/professional uses of technology

Four students were not convinced that they would incorporate much technology in their teaching, but, like all the other members of the class, they felt much more comfortable with technology and much more enthusiastic about its role in their lives. The four students saw the value in internet research for their students but questioned their ability to help their students critically evaluate the sites and information on the web. The remaining students found that even during this one semester, they were using the web more, connecting with family and friends via email and seeing technology as a normal part of their lives. Jane said,

> I really feel much more comfortable. This must have been what people felt like when the telephone became prominent in people's lives. It is like a new horizon and all of us have to get on board or we'll become extinct. I found myself checking our online site each day and when I did, if I did not see any new messages or posting, I felt disappointed and disconnected. It was like when I was a teenager, sitting by the phone, waiting for one of my friends to call. If they didn't I felt sad.

Findings and Implications

Besides the themes represented above, this project enabled the students to take more control of their learning as they posted topics of discussion, interacted between and among themselves without heavy reliance from the professor and they engaged in collaborative conversations. In addition, they continually reflected on their experiences as learners and as future teachers. The data shows that this experience helped them to begin to articulate and examine their own teaching philosophies and gain a deeper appreciation of the struggle of students to learn new information and learn in new ways.

While this research is at too early a stage to draw any general conclusions, the findings support those of others (e.g. Green, 1978; Pinar, 1981; Richardson, 1990; Schon, 1983). However, we do have some preliminary thoughts. If affecting change is one objective of teacher education programs then using autobiographical material may be a way of helping teachers to understand themselves better and what they do in the classroom. The process, impact and uses of autobiography for teachers are still in their incipient stages and will, hopefully, serve as a vehicle to inform both teachers and teacher educators in the future. If teachers are successfully to integrate technology into their teaching, teacher educators must clearly do so too. By modeling behaviors and utilizing various technological activities that are natural adjuncts to our teaching we can begin to help pre service and in service teachers effectively incorporate technology into the lives of their students.

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 give students 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?
In what ways, if any, does the content or structure of the course vary with the use of technology?
What role should the teacher play in facilitating the use of technology?
How can students and teachers best incorporate aspects of telecommunications?

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TUTORPEA for Adults' Teachers Lifelong Learning

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Abstract: This paper describes an intranet developed for an international project for adults' teachers lifelong learning (TUTORPEA), funded by the Socrates program of the European Community. TUTORPEA attempts the design, implementation and use of an Interactive Tutor System, addressed to adults' teachers. The objective is not programming a course, but creating an interactive environment that fosters cooperative reflections on specific situations that adults' trainers usually face with. With the help of a tutor, concrete solutions will be given to those situations lived with some difficulty by the teachers.

Introduction

The training period does not conclude with our formal schooling, but it lasts a lifetime. With the emergence of the Information Society, everyone must upgrade their skills constantly and obtain new qualifications. This acquiring of new aptitudes and abilities should therefore no longer be limited to formal schooling (primary, secondary and higher education), but should involve all sections of society: youngsters, middle-aged and older people; people at all levels of vocational qualification; people in work and the unemployed (Delors 1996). Education and training are to play a central role in the advance towards an information society, which will be a learning society, as asserts the White Paper on Education and Learning of the European Commission (European Commission 1995). With

the Socrates program, the European Community, through its Directorate General XXII (Education, Training and Youth), is taking action in the field of education aiming at enhancing its quality, by means of European co-operation. The project described here, named International Project for adults' teachers lifelong learning (TUTORPEA), is enclosed in the Socrates section for Adult Education. The following institutions are taking part:

University of Aveiro – Portugal

SEA-AIDEA (Sviluppo dell Educazione degli Adulte – Assoziacione Italiana di Educatione degli Adulti) – Italia

CEDETEL (Center for Telecommunication Development in Castile-Leon) – Spain

Provincial Directorates of the Department of Education and Culture from Salamanca and Palencia – Spain

University of Salamanca (coordinating institution) – Spain

TUTORPEA is addressed to adults' trainers and must be understood as a training network attempting at giving concrete solutions to specific educational situations. That is, the training plan is not organized based on contents but around real experiences the trainers usually face with. Therefore, it is not intended to program a course (with a start and an end), but to create an interactive environment where these trainers cooperatively think, study and take decisions about those experiences.

The geographical structure of the training network involves educational researchers and professionals from Aveiro (Italy), Castile-Leon (Spain) and Liguria (Italy). These three regions are characterized by similar circumstances:

Adult education is programmed at regional-national level.

There is a sparse population with small localities, where the trainers are full time dedicated to this task.

There are institutions doing research in the field of adult education.

Up to twenty four trainers constitute the experimental group of the network. The intranet has been implemented in a Research Work Group called "Canalejas", constituted mainly by Pedagogues and Telecommunication Engineers from the Universities of Salamanca and Valladolid (both of them located in Castile-Leon). The research of this interdisciplinary and inter-university group is focused on "Educational Multimedia and Telematics Networks in an Educational Context", evaluating the possibilities and advantages of applying Information and Communication Technologies (ICTs) to the learning process. Canalejas Work Group is integrated within CEDETEL, a Technological Center that has leading the Spanish region of Castile-Leon into the Information Society as one of its main objectives.

Description of the Tool TUTORPEA

TUTORPEA has been developed taking into account the needs for adults' teachers lifelong learning: continuous teaching of learning units about useful subjects, and other ones required by themselves. It includes the possibility for urgent questions, real-time seminars on the net and the possibility for managing and sending big quantities of data on any kind of format (video, sound, text).

The system is focused on what we call "the learning unit". The learning unit consists on the analysis of a real situation, taking as a starting point the problems and difficulties the trainers have to face in their own educational experiences. Each country proposes some different topics (with a psycho-pedagogical nature) and the learning unit for the semester is determined by them all.

As for the real-time seminars (chat or IRC –Internet Relay Chat-), these have exclusively been designed and programmed for TUTORPEA for two reasons: the on line chat must be easy to use and it must be integrated within the whole application.

We next mention the services offered by TUTORPEA:

The first one is the SOS Service, whose main objective is solving, immediately, the most urgent questions that may arise to the teachers. Its corresponding icon will be moving in case there are questions not answered or not clarified.

In the Learning Units Service, teachers can check in the current learning unit, propose new learning units that may be of their interest, and view information of learning units that have already taken place.

With the Task Service teachers may be assigned tasks within a learning unit. Besides, it can be a meeting point for the participants to exchange information.

The Questions and Answers Service is the same as SOS Service, but without the urgent nature of the latter one.

The Participant Service lists all the participants in the learning unit. We can contact them, navigate to their personal web page, etc. and check the tasks they have already done.

In the Calendar Service different kind of events can be published.

The Discussion Service is a real time chat, a meeting point for the participants where they can exchange different viewpoints on a particular subject.

As the Discussion Service, the Seminar Service is a chat, but with a specialist tutor that supervises the discussion.

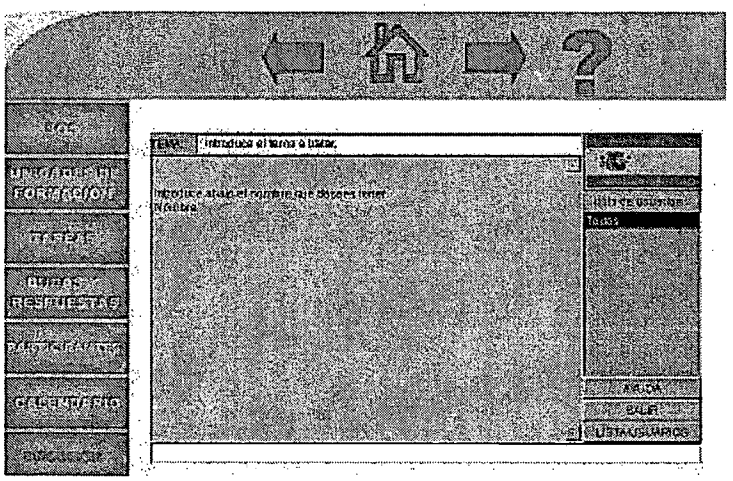

Figure 1: IRC Client in the Discussion Service of TUTORPEA.

Finally, there is a Glossary Service, that was asked for by the teachers on the very early tests. It relates different terms from different languages that might be misunderstood.

Development Process of TUTORPEA

Due to the experience acquired during the development of other projects, it has not been difficult to define the phases of the implementation process of TUTORPEA, nor to fulfill these phases with a perfect coordination between the teams of pedagogues and telecommunications engineers.

We briefly describe each of these phases:

1. Planning. In this phase, some decisions were taken:

   The application is supported by Internet, and, concretely, by the World Wide Web, due to its extended use.

   A Windows NT Server 4.0 was chosen as our server, the Web Server was the Internet Information Server (IIS) and the access to databases was accomplished through a component of IIS called the Internet Database Connector (IDC), and also with the help of ASP (Active Server Pages) when needed.

   Microsoft Access was used as Data Base Management System (DBMS).

   The modules and services that should be offered by the system were defined.
2. Design. The second phase consisted on the design of the database and the graphical interface of the whole application, including the IRC client. The data base should include data from the participants (teachers and tutors), the learning units and the seminars. The graphical interface should be an easy-to-use and intuitive interface, since some of the teachers participating in the project had never used such an environment.
3. Programming. In the third phase, the application was programmed, in the following order:

   Creation of the database.

   Development of the two modules of the application: participants (teachers and tutors) and master. This included the programming of the IRC with Java (a programming language perfectly integrable within the Web environment).

   Establishment of the relations between these two modules and integration into just one application: TUTORPEA

   Interaction of the application with the database.
4. Testing. Finally, the last phase of the development consisted on testing and checking the application with target users.

Future Lines and Conclusions

The imminent action to be taken is translating TUTORPEA into the other two languages of the participants taking part in the project (Portuguese and Italian). The teachers will be able to participate with their own language, although they should understand the other two. This is not a problem, taking into account the three languages come from the same mother tongue, Latin, and consequently are similar.

The first learning unit has not started yet; there are some proposals and one of them has to be selected. Therefore, we can not get any results yet, although an evaluation of the training network is already taking place. It includes four aspects:

Satisfaction level of the teachers

Knowledge and attitudes acquired

Efficiency in the educational experience

Interest level aroused in other teachers that are no taking part in the project.

To conclude, we would like to emphasize that the facts that the participating teachers, coming from different countries, collaborate and think about their own acts are achievements themselves. This collaboration aids the construction of a global education and a global culture. And the training process does not only consist

on increasing and improving teachers' knowledge but, as well, on raising their awareness about the importance of reflecting on their acts and training experiences.

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Integrating Technology into the School Curriculum with Thematic Units

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Abstract: According to national studies, there is an urgent need for in-service projects designed to assist teachers in learning ways to integrate technology into their curriculum, not simply to master the mechanics of the computer. Teachers have identified many barriers to the use of technology in instruction, including: poorly focused training, lack of time to revise lessons to include technology, and lack of time to share experiences and ideas on technology integration with other teachers. This paper describes one project that attempts to address these barriers while emphasizing curricular areas identified by the U.S. Department of Education as needing strengthening in the schools.

Introduction

In their 1996 "Technology Literacy Challenge," President Clinton and Vice President Gore identified four goals or "pillars" that provide the foundation for the preparation of every student in America to use technology. One of these four technology goals calls for professional development activities to prepare all teachers to integrate new technologies into the curriculum. "The creation of new content should be bolstered by continuous professional development for teachers that goes beyond the acquisition of generic computer skills to include mastery of technology applications specifically designed to improves student academic achievement. Teachers must learn to seamlessly integrate these new learning tools in the curriculum" (Steele 1998, p. 12). Despite increased emphasis on professional development, recent studies (Trotter 1997; U.S. Department of Education 1998) indicate that a large majority of the teachers surveyed continues to feel inadequately prepared to integrate technology into classroom instruction. One explanation for this lack of preparation is that professional development in the area of technology often continues to focus on the mechanics of hardware and software despite repeated calls for professional development projects designed to assist teachers in integrating technology into their curriculum (CEO Forum 1999; Conte 1997; U.S. Congress, Office of Technology Assessment [OTA] 1995). In addition to poorly focused training, teachers in these studies also identified lack of knowledge about how to teach with technology and lack of time both to revise lessons to include technology and to share their experiences and ideas on technology integration with other teachers as barriers to their use of technology (Conte 1997; OTA 1995). According to Byrom (1998), a key professional development strategy that will increase the likelihood that teachers will use technology is "to begin with teaching and learning, not with hardware and software" (p. 4).

Grant (1996) and McKenzie (1999) identify several strategies for designing effective professional development for teachers. These include: using assessment tools to guide the planning of professional development activities to match the needs and preferences of the participants; relating professional development activities to the teachers' classrooms, curriculum, and objectives; forming teams of peers possessing both common goals and interests, and diverse ideas, skill levels, and experiences; providing opportunities for collaboration with peers and experts to create cross-curricular thematic lessons for use in teaching; and supplying follow up support and classroom consultations. This paper describes a professional development project that addressed the barriers to technology use identified in the first paragraph and employed many of the strategies identified for effective professional development for teachers.

Project Description

The Teacher Education and Arts and Sciences faculties at Harris-Stowe State College actively participate in several partnerships and collaborative projects with schools in the St. Louis metropolitan area. These many and varied partnerships provided ample opportunities to learn of the professional development needs of in-service teachers. A professional development project was created to focus on mathematics, technology and content-area reading instruction in an integrated, unique plan to meet these needs. Two of the project objectives specifically address the integration of technology into curricular areas: to help teachers of third, fourth and fifth grade students develop and implement integrated thematic units of instruction for classroom use and which integrate mathematical concepts and applications, reading, technology and authentic assessment; and to increase teachers' knowledge and use of technology in mathematics and reading instruction. Three Harris-Stowe faculty members, each with expertise in one of the three areas of emphasis, worked with representatives of partner schools to develop the project. Twenty teachers from four urban schools participated in the project, which is funded through the Missouri Eisenhower Professional Development Program. The four elementary schools varied widely in the types and amounts of technology available.

Central to the project was the development of instructional and assessment activities for use in the participants' classrooms. Additionally, the teachers requested to work with curriculum materials they were currently using in their classrooms. Therefore, participants used technologies, books and materials available in their schools to develop activities. This was done in an effort to ensure success and usability of the products produced in the project. The teachers worked collaboratively in three, grade-specific teams. Key components of the project include three workshops interspersed over nine months; an intensive summer course on Integrated Methods of Teaching Mathematics, Technology and Reading in the Elementary School; on-site classroom consultations and mentoring by college faculty members; production of a booklet of the thematic units developed during the intensive course, and creation of a web site designed to support the project participants and increase the project's sustainability. Each participant developed grade-level appropriate curricula for each of three mathematical content strands, discrete mathematics, geometric and spatial sense, and recognition of patterns and relationships. Each thematic unit included daily lesson plans, materials, instructional methodology and authentic student learning and assessment activities. Activities emphasized connections across the curriculum and to real world problems and were tied to the state of Missouri's Show Me Standards (Missouri State Board of Education 1997). Throughout the course, time was allotted for teachers to work together, share resources, and discuss and critique developing thematic units. In the final session of the course, each team presented an example of the activities in one of the thematic units developed by one member of the team.

Participants learned to use and integrate a variety of instructional technologies into the thematic units. Prior to the summer course, each participant completed a survey in which the participant rated his/her knowledge and expertise with a variety of technologies. The information obtained from this survey provided a basis for the level of formal instruction and types of technologies covered during the summer course. Technologies were introduced through authentic contexts and examples related to the specific grade levels the participants taught. Because of the range of types of technology available in the four schools, tool software available in a variety of platforms was emphasized. The teachers also gained familiarity with the resources available on the Internet. Participants had opportunities for informal technology use with just in time assistance, and at the participants' suggestion, the opportunities for informal use of computers increased as the summer course progressed. The level of technological expertise of the participants ranged widely from non-users to experienced users. Experienced users regularly shared their expertise with the less experienced users during sessions in the lab.

Examples

The following brief examples provide a small sampling of the thematic units developed by teachers in this project. The description of each project emphasizes the variety of ways technology was integrated into the units.

Corliss Hinton, third grade teacher at Baden Elementary School, used a theme of "what's cooking?" for her unit. The third grade teachers' team selected this theme for their presentation in the last session of the course. The teachers demonstrated a variety of ways that technology might be integrated into this unit, including having students sample a variety of breads, survey each other on favorite bread and use a spreadsheet to illustrate the results of the survey. They also suggested having students use children's Internet search engines to research bread-making in preparation for writing a report.

Susan Oberkirsch, third grade teacher at Epiphany of Our Lord Parish School, developed a thematic unit using the story, "Cloudy with a Chance of Meatballs" by Judi Barrett. Reading objectives included increasing students' abilities to recognize and understand figurative language and to be able to use it in writing. Students learned weather terms to increase their understanding of the story. Math objectives stressed being able to complete basic operations involving money. Objectives included the ability to compute and provide the correct change in various situations. Students analyzed parts of a newspaper and the different types of articles in preparation for using a children's desktop publishing program to create a class newspaper. Students were encouraged to use figurative language in writing human-interest stories and advertisements for the newspaper. They sold the completed newspaper to students in other classrooms.

Nadine Camp, fourth grade teacher at Gateway Elementary Math, Science & Technology Magnet School, used *Justin and the Best Biscuits in the World* by Mildred Pitts Walker as the basis for her thematic unit. She used technology in a variety of forms throughout the unit. Students were introduced to western living and rodeos through a teacher-created PowerPoint presentation. The teacher developed an on-line scavenger hunt to help her students research African American cowboys, and in another part of the thematic unit, students used KidPix software to explore perimeter and area.

Joyce Barron-Hughes, fifth grade teacher at Waring Academy of Basic Instruction, based her thematic unit on disasters and tornadoes on "The Night of the Twisters" by Ivy Ruckman. Students used Encarta Encyclopedia for research on tornadoes and HyperStudio to present the findings of this research. Instructional objectives for this thematic unit related to reading, mathematics, social studies, science and technology.

Implications

Input from the teachers through on-going evaluations collected during the course helped the college faculty members be more responsive to the needs of the teachers. One barrier identified in the beginning of this paper was not fully eliminated – lack of time. While we increased available time for the teams to work together, most participants continued to request more time to work on individual curricula and in the computer lab. At the conclusion of the summer course, participants were asked again to rank their levels of expertise with a variety of technologies. Without exception, all participants who responded indicated increased levels of expertise with the technologies used in the course and rated their ability to integrate technology into their teaching as improved.

Among the best indicators of the success of a professional development project is whether participants are using what they learned and created in the project. Participants met in a follow-up workshop two months into the school year, and completed a questionnaire on how they have been able to use the information obtained from the summer course in their teaching. Responses were overwhelmingly positive. The following comments provide a sampling of the responses related to the technology emphasis in the course. "I feel more confident about using the Internet. The web sites are very helpful." "The computer information has been invaluable. I used it during the summer and am continuing to use it." "Yes, I have been able to use the technology skills more effectively." "Although I have not been able to use computers in our lessons, my attitude at the beginning of school was one of anticipation and still is even though our computers are not hooked up yet." "Yes, Yes, Yes. Many ideas I've shared with co-workers. Thank you for the experience." "I usually use thematic units to teach various modalities of learning. This summer I learned about filamentality, web pages, various web sites and I have a much better understanding of spreadsheets and other programs." "I have made a concerted effort to use technology more often and plan better around it." "My comfort level with computer usage has been greatly

improved. I can also see how helpful it can be in all curriculum planning. I feel much more challenged and anxious to make better use of our classroom and lab computers."

Did the teachers view the structure of this professional development experience positively? In the fall workshop, the teachers were asked to reflect on their experience in the course now that it was two months later and they were back in the classroom. They reported that they particularly enjoyed the opportunity to share information and work with other professionals, to create lessons using materials available in their classrooms and related to their curriculum, and to learn new strategies for integrating curricular areas. One participant concluded his evaluation with the comment that he wanted to "commend you for a job well done in providing teachers very valuable experiences enhancing our ability to provide our students the best possible education."

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Training Sessions Designed to Help Teachers Enhance Lessons with Technology

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Abstract: This paper presentation will focus on a successful model of inservice training for teachers. The model, used by a multi-school five year US DOE Challenge Grant includes five day and three day training sessions in the summer, followed by a 2 day retreat in the winter, as well as on-site inservice training and on-site coaching by both educators and technologists. The focus of the grant is to improve teaching, with a goal to engage the learner in the classroom. The training includes technology integration, lesson design, and brain research.

Introduction

"The Connections Project: Strengthening Learning Through Technology-Based Integrated Curriculum and Professional Development" has been successful in training teachers to use technology effectively. This effort is a five million dollar United States Department of Education Technology Innovation Challenge Grant, which includes four Nebraska school districts and two adjudicated youth centers as lead sites. The project is designed to improve student learning through effective teaching that included 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.

The grant summer workshop consisted of a three day multi-topic sessions, that were presented at three different Nebraska sites. Participants were recruited through mailings and were given a stipend for mileage, lodging, and participation. The workshop was divided into three learning areas: technology, brain research, and lesson design. Each day the participants were given the opportunity to spend approximately two hours in each learning area.

Throughout the workshop, the trainers modeled many teaching strategies with a variety of activities that included technology, multiple intelligences, learning styles, brain based research, interdisciplinary teaching methods, constructivist theory, and effective lesson planning. The entire workshop and the workshop facilities were set up to model ideas that were learned in the workshop.

The trainers were teachers who were currently teaching in a classroom environment. In addition, these trainers completed a five-day in depth study of technology, brain research, and lesson design followed by four additional days dedicated to polishing the strategies to be used in the three-day workshops. During the four-day planning session, the trainers prepared presentations, handouts, and activities that modeled the grant goals. These trainers were continually provided with up to date information in the aforementioned areas. The well educated trainer added to the validity of the workshops because the participants could ask for and get actual new and needed ideas to take to their classroom.

The following is a note sent to the trainers by a participant in the Summer 1999 workshop held in Seward, NE. "Thank you so very much for your motivating and inspirational presentation on Wednesday afternoon after lunch. I had been depressed thinking about school starting because after 32 years I wasn't coming up with new ideas to get myself stimulated. Thank you for giving me the boost I needed. You all did a wonderful job. I gained a lot from this workshop." In addition, other participants responded as follows: "I can actually use what was taught in the inservice." "I can't wait for school to start to apply some of these strategies in the classroom." "Best inservice in my 25 years of teaching. I didn't want to go back to school and now I cant wait."

From reading these comments, it seemed the workshops had been very successful. With teacher behaviors changing and increased enthusiasm for trying new strategies, the classroom settings of the participants changed. It was hoped that student learning had increased as a result.

Topics for the Workshops

The workshops focus on three areas: Technology, Brain-Based Research, and Lesson Exploration. The explanations for each area is included below.

Technology

An important aspect of the Connections Project was the integration of technology into the teachers lessons. Several sessions within the first two days of the workshop were spent exploring the most current educational software and hardware. The participants were given time on the third day to integrate these new technologies into one of their own lessons. Teachers were encouraged to start by using one or two new technologies learned at the workshops. As Nebraska educators began to effectively use technology and curriculum integration to promote student learning and achievement, teachers were also encouraged to communicate with other participants through technology. This technology can facilitate shared learning, expanded educational resources and barrier free collaboration across Nebraska and the United States to further the national educational goals of educational reform. The following are brief descriptions of the technology pieces used in the summer workshops.

Video Editing: Avid Cinema was the software program used in the workshops. The lessons included three parts: inputting video, clip art and pictures, editing clips and adding effects, and processing movie and sending to videotape. Teachers were given guided instruction to adding video, sound, text, and transitions to video clips. Students and teachers used the program to make videos for a variety of classroom activities.

Desktop Publishing: Pagemaker, Clarisworks, and Microsoft Office, were the software programs used to spice up old documents and create exciting new documents. Graphics, columns, borders, charts, headers, and footers were just a few of the tools that were learned in the workshop sessions.

Web Publishing: Claris HomePage was the web publishing software program used in the workshops. As World Wide Web expands, teachers are continually called upon to publish pages for educational purposes. Web publishing programs do not require users to be proficient in HTML and participants took their web publishing skills back to their classrooms and taught these skills to their students.

Presentation: Hyperstudio and Powerpoint were the presentation software programs used in the workshops. When teachers share this knowledge with their students, the students can then merge smoothly into the business world with the ability to create presentations which are enhanced with color, sound, transitions, graphics, and short video clips.

Brain-Based Research

The participants understanding of learning styles, multiple intelligences, life skills and brain functions strengthened potential educational achievement of all students, especially students who were deemed high risk. The three day workshop included interactive models of how to integrate strategies to support these theories in the classroom.

Lesson Exploration

The third part of the workshop was integrating the technology and brain-based research into practical, teachable lessons. This training focused on providing web resources, practicing lesson integration, and building new lessons. These sessions gave participants time to revise a tried and true unit of study in their particular discipline.

Application of Training

Each participant was given eleven CDs that included tutorials, presentations, bibliographies, and other information used in the workshop. The participants were asked to share the ten CDs and their newfound knowledge with other Nebraska educators. Through the sharing of the CDs and knowledge, participants were applying the new learning immediately after the workshop. Participants were asked to provide the grant director with a list of CD recipients. Many trainers continued to hear from participants who had successful changes in their classrooms because they used knowledge gained from the workshop. The success of the workshop was evidenced through the waiting list for the next two summer workshops. Applicants had to be turned away because the workshops were at capacity.

Revision and Assessment of Training

Project personnel continually seek opportunities to be trained in new technologies and remain current with teaching/learning research. The trainers meet periodically to garner new information and revise their presentations. The coordinators from the lead sites meet monthly with participants to assess, to practice and to study the newest research in these areas.

Summary

The Connections Project Challenge Grant has begun to change the way teachers teach and the way students learn. This workshop could be replicated in a variety of educational scenarios. The workshop described is available at <http://ois.unomaha.edu/connections/>, <margohir@esu16.org>, and <tamiesh@esu16.org>. As the project continues, more and more training will be provided, and student learning will continue to be impacted.

The Computer Mediated Communication Environment as it Fosters Collaborative Ways of Knowing, Teaching, and Learning

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Abstract: This paper will summarize and give examples from a retrospective ethnographic and pedagogical theory analysis of some key features of a course concerning Graduate and Inservice Teacher Education and Instructional Design. The title of the course was "Researching the Paradigms: Collaborative Ways of Knowing, Teaching, and Learning." The course involved synchronous and collaborative computer mediated discussions (CMC) as well as asynchronous CMC written conversation and full use of the World Wide Web. The goal of the course and of this report of it is to explore and push the boundaries of possibilities for addressing the web of relationships among collaborative and other forms of non-foundational graduate and teacher education; collaborative language, literacy and culture learning; and multiple literacies including those only possible in CMC and hypertext environments. The results explicate the possibilities made available by fully implementing information technology and CMC for teacher education and instructional design.

Introduction

A group of inservice graduate student instructors and one faculty member worked together to address the web of relationships among collaborative and other forms of non-foundational graduate and teacher education. Our foci were on collaborative language, literacy and culture learning and multiple literacies, including those only possible in CMC and hypertext environments. Our acculturation to a new way of thinking, learning, and teaching based on a "non-foundational paradigm" was itself both formed and expanded by the opportunities available in the CMC environment. According to this model "knowledge is a consensus among the members of a community of knowledgeable peers -- something people construct by talking together and reaching an agreement" (Bruffee, 1993). Some of the results of our mutual and class-related development of this kind of knowledge will be explored here, and the possibilities made available by fully implementing information technology and CMC for teacher education and instructional design will be illustrated using examples from the course and the data from its participants

Class Members, Course Concepts, and Research Goals

This class of advanced graduate students, who are also inservice teachers of language and literature, along with myself as the faculty member who originally developed the course concepts, became proficient in using the CMC environment as both a model and a tool for co-creating the content and the ways of knowing and learning in the new learning community that we were forming. This non-foundational and co-created paradigm led us to a learning and research space that took critical research and experiential looks at some of the characteristics, as discussed in (Bruffee 1993), of collaborative and non-foundational learning environments: 1) The active role of both teachers and learners in the educational setting; 2) The culture of the learning environment; 3) The view that knowledge is not transferred from

expert to learner but created and located in the learning community. We also added the fourth essential element to this list, namely the exploration of the effects of CMC and of using instructional technology as the vehicle for the new learning paradigm, which in fact is then essential for defining the paradigm. Indeed the CMC sessions helped us establish a discourse community, and a community of mutual help and encouragement, trust and respect, that would have been very different, if even possible, in a traditional classroom setting.

In summarizing the key elements of the ethnographic analysis and the interaction of instructional technology, CMC, and a non-foundational learning and teaching paradigm in this paper, I am expanding on topic descriptors and definitions which we as a group crystallized from our experiences. These concepts will be illustrated with examples from the class texts and the web site portfolio (http://www.coh.arizona.edu/planet-xeno/) which I will be quoting from below. The site was composed by Claudia Kost under intense collaboration with Sumru Akcan, Adrian Wurr, Lisa Jurkowitz, Judith Arbella, Paula Gunder, and myself. Both I as the teacher and the students of the class had little idea of the kind of adventure we were embarking on, as we assembled for our first class of the semester. With time and some initial guidance and insistence from me, the seven individuals together began our acculturation to a new way of thinking, learning, and teaching, based on non-foundational paradigm described above. As the class gained more and more familiarity with the theories, terminology, and especially the practices of non-foundational learning and teaching, we became members of a new, transitional knowledge community.

Each of us has recollected several important moments that highlight class experiences and processes toward new ways of knowing. These moments are crystallized in the list of nine descriptors, which capture our identity as a classroom culture, and as a transitional community moving toward non-foundational, collaborative, reciprocally interdependent ways of knowing, learning, and teaching. When we realized how different this experience was from anything we had experienced before, we decided this was like being on a different planet, hence the name Planet Xeno. Since we spend most of our time traveling back to a more foundational context during the rest of our work and learning contexts in the university, we know we aren't permanent residents of Planet Xeno, merely resident aliens. The goal of the web site we developed, and of this paper, is to bring back what we learn on Xeno to other interested educators and like-minded travelers.

Developmental Stages of Inhabiting Planet Xeno

In reflecting on the developments and experiences of this non-foundational educational encounter, we realized that we were creating a reciprocally interdependent group, where one group member's output becomes another's input and vice versa. Group members have different roles and specialties. We also realized that we had to overcome some difficult and at times downright painful resistance on the part of the students, and to a lesser extent some limits in my own powers of imagining truly non-foundational education and communication within the traditional university environment. It is after all still, in most cases and in most graduate classes at most institutions, the assumption of all concerned that the role of the teacher is the "sage on the stage," playing to an audience of avid but essentially receptive audience members, called students. Having done the work for and within myself of distancing myself from the "sage" model to one where I considered myself the "guide on the side" who accompanies the students in their own development, I had to not only convince them that this was a valid and actually more fertile model for graduate education, but also that CMC was an essential tool for us to make this happen in our own context. One of the students, who had been pleasant but quite vocal about not really seeing the virtues of using CMC ("Why can't we just talk?") eventually pointed out to us all that she was realizing that the use of computers transformed the individual experience of writing to make it a social experience as well as. Most of the students voiced concerns and difficulties that they were encountering in accepting the essential role of computers and especially CMC in our undertaking. Reshaping social and individual experience relating to CMC became a focus of the members of the course.

As we worked through our resistance, we came to a turning point at midterm in the semester. It was at that point that most if not all of the members realized how CMC sessions help us establish a discourse community, and a community of mutual help and encouragement, trust and respect. These are important values that are not often thematized explicitly in graduate course work, and we all had to re-orient ourselves to adapt to the new community which I eventually dubbed "Planet Xeno."

With growing trust among the members in our class and feeling more comfortable with each other, working together becomes easier. Students began to report that everyone enjoyed working with their partners in the CMC environment, and nobody felt overpowered or dominated by anyone else. We also experienced both pleasant and powerful communication dynamics develop in the group. One essential ingredient became known to us as "the giggle factor". The giggle factor became a running theme for us. We would, as a group, have fun, laugh, or be very serious and on task, or at best, laugh a lot and be very serious and on-task and taking risks in our safe community all at once. These were aspects of the "giggle factor" as an affective variable in our learning community. We would comment on its relative effects at any particular working session. It was always a positive aspect of our community and it was an indication of new growth and difficult developmental stages of inhabiting Planet Xeno.

Another key moment in becoming more comfortable with living on Planet Xeno was "Birds of a Feather Day". That is the day we came into class and were randomly grouped by a slip of paper telling us what kind of "bird" we were. Then we responded to one of the questions that the whole class had submitted in an asynchronous preparation session (posted on a conferencing site called POLIS) about "Assessment in a collaborative or non-foundational setting", based on the reading from (Shohamy 1998). As we used synchronous and face-to-face CMC, as made possible in the facility we call the COHlab, we discussed the difficult issues surrounding assessment, and we had an excellent and very flowing discussion. Much of what was written and discussed went further and deeper into the issues than the original article. We had a lot to say and the students were all eloquent about it all. After the day, several of the students commented on the quality and quantity of the CMC discussion--how interesting it was, and worth reading. I wrote in my own evaluation of that day: "The quality and quantity of the responses (to be foundational about it all) seem excellent today, and for whatever reason better than we've had before. I agree with whoever said, "it was good" in that response. That person also wrote, " I guess we're getting better at this COHlaborative stuff with practice! " We're over some of the shock and disconcerting moments of have been rocketed off to Planet Xeno, and now we're getting pretty good at being here. Plus, everyone seems fully engaged in being good citizens of Xeno. Thank you, one and all. I'm frankly tickled pink with these developments (even though I wasn't in the flamingo group)."

How to Launch A Group to Planet Xeno

So far I have highlighted the positive developmental aspects of this approach to fostering collaborative ways of knowing, learning, and teaching in this graduate level class. There were, predictably perhaps, also many frustrations at the beginning. Graduate students and inservice teachers taking a graduate level course are perhaps the group of learners and teachers who are most vulnerable and most resistant when confronted with non-foundational and collaborative learning. These people have, in order to be successful students sitting in the class in the first place, been rewarded for and supported in the exactly opposite ways of knowing, learning, and teaching. They have become successful at being individual, foundational audience members for various "sages" on various "stages," doing work that is solely their own responsibility (e.g. individually authored papers and exams), and for carefully considering anything they write or speak in class before taking the risk of exposing their ideas. In essence what I was asking them to do in this class was to (temporarily) discard all they knew about teaching, learning, and knowing in an academic environment, all that they had been successful at and rewarded and awarded for, to try something non-foundational, collaborative, and computer-mediated. It was a big leap, and a serious risk for all of us. It is thus not surprising that I found myself, as the leader of the group that was still very resistant and prone to sitting like an audience in each class before the midterm, very frustrated with the success of my experiment so far.

The result was that I threw a bit of a tantrum. The issue at hand was that, since the beginning of the semester, I had been urging the group to consider the possibilities of a non-foundational midterm "exam". They were asked, in writing and repeatedly in class discussion, to make suggestions for alternatives for content and form of a midterm examination. I had only declared that it was worth 100 points (a clearly arbitrary valuation that consciously reinforced the reality that we were still connected to an institution with the constraints of assigning grades at the end of a semester). There had been no response at all from the students. In my frustration, I made a CMC based and tantrum-like call for engagement to the midterm event. This call proceeded to be the initiator of an important re-thinking of the whole class

structure by all involved. This is not to say, however, that I was able to anticipate that outcome at the time I made the call. I was reacting mainly out of frustration and a lack of trust, in both myself and in the students, of being able to actually accomplish what I had set as a goal for the course. I wrote: "If there is no concrete suggestion, collaboratively arrived at by the group, as to the form, content, and grading of the midterm, I will assume this responsibility. The fact that the class members were/are hesitant, or passively resistant, or apathetic, or too overworked to have taken any initiative so far, is a matter of great concern to me. What should we do, and how shall this task be organized and accomplished by Thurs, March 4, 1999, at 2pm?"

This fairly tantrum-like moment had as the goal, and then as the result, as well, compelling the class as a learning community to commit to the idea that collaborative and interdependent learning requires learners to define their own learning needs and to take responsibility for how they will learn it. At the time I felt myself to be teetering on the edge of giving up on a non-foundational and collaborative approach to co-creating a graduate course. It seemed that this might be the end, and that none of us, myself included, were able to think or interact beyond our institutional learning and knowing habits.

In retrospect, it was just this process of hitting what seemed to be a "last straw" wall that injected enough energy into the system of our struggles toward collaborative learning to really launch it into a new arena, as evidenced by the remainder of the midterm events. I see the complex adaptive system of the midterm events, which spanned over two full weeks and beyond, as the the center of our journey to Planet Xeno. Just before the midterm developmental events, I had written in a general journal that I was "having such a hard time getting my class to come with me to the 'learning space'". By this I meant that I knew we would need to move to an entirely different set of ways of knowing and ways of learning in order to really accomplish several of the class goals. But I also was at quite a loss at that point as to how to get people to go there, to follow me there, or to lead us all there. I was ready to just give up and move back into the familiar comforts of the "foundational space". I had recognized that the midterm would be a boundary zone for us all. It was a place where the typical institutional needs and constraints could meet what we had been gradually trying to create and then research as a non-foundational and creative, if turbulent, new kind of learning space. I had wanted us to all take the risk of modeling a non-foundational, collaborative, and learner/learning centered form with our own class activities, and then to take a step back and look at and research how it was working. Before the midterm, I had started to "realize", or talk myself into, the idea that I had wanted to take us all, including myself, too far too fast. I had hoped for more than was possible, I thought, and I had lost the energy to try to subtly guide and "irritate" the group into discovering it on their own. I felt I was going to give a really traditional, though fair, midterm and let it fall as it would. And if the class decided to sit back and let that happen, then I was just going to read and discuss for the rest of the semester—slip back into good old foundational mode. So I sent a perturbed email to everyone, drawing a line in the sand as to the future of our class in general, and the form and function of the midterm in particular.

When we got to class, it was a frustrated and pretty negatively inclined professor who entered the room. Suddenly, though, (all I said was, "let's discuss the reading, but first, what do you want to do about the midterm?") the class members took off. There was an intense and very earnest discussion about various options for the midterm. One of the students started the real interaction by making a non-foundational suggestion for what could be done to co-create the midterm. There was a lot of excellent, engaged, respectful, and creative discussion, with several different suggestions made. There were different levels of willingness for risk-taking behavior or non-foundational thinking among the members, but most of the group was getting more and more engaged. I took the role of a (delighted) observer for most of the time. Here and there I raised some more questions in a directive way, but I was mainly able and very willing to stay on the sidelines of the discussion. A gradual consensus emerged, various people took the lead at various points, and passed the "lead" on without difficulties when someone else had a series of constructive points. I was delighted to recognize that the students were going on very well, even beyond what I had at first imagined, without my having to do any more pushing. There was, indeed, as one student said toward the end of the discussion, an entirely changed energy in the room, and in the group.

It is on that day, before the midterm, that we became a community of learners and teachers (note the plurals) in a new learning space—one that is indeed non-foundational and co-constructed, collaborative, and connected to computer mediated communication in several modes. The energy, the changes of perspective, and the willingness for risk-taking in a community of people who are open and ready to seriously consider suggestions, content, and process from each other and with high mutual respect, has been maintained, even beyond the end of the semester.

The quality of the actual midterm event was also quite special. The students all suggested and voted on, in asynchronous CMC sessions, various extended interpretive essay questions based on our readings and discussions. The questions were randomly assigned on the day of the midterm *event* (we decided that calling it an "exam" was too foundational for what we were doing). The students then wrote essays in pairs, using the conferencing features of POLIS, our on-line instructional web based system, so that their discussions and gradual merging toward a consensus essay were evident.

As I read the products of this process, I noticed many differences in approach by the dyads, but I mainly noticed a very high quality of "answer", of engaged discussions that complemented each other in many instances, and of a collaborative and co-constructed event and product that was certainly much more than the sum of its individually contributed parts. This had been a real formative assessment event, where several voices had a chance to synthesize several of the ideas in ways that we had not been able to do before. I think my biggest challenge in the midterm event was to keep my mouth shut. It wasn't that I wanted to re-direct any part of the process;it was that I was (and am) so pleased with what was going on that I kept wanting to say—"Did you hear what you just said?" "Did you notice how that interaction just moved from a foundational to a non-foundational moment?" "Did you all hear the insecurity in participant X's last comment? What is the source of that, do you suppose, and what can we do to re-direct the insecurity?" The observer/teacher in me was being deluged with teachable moments, yet I didn't want to interrupt the wonderful process as it was unfolding in order to comment on it. Part of our continuing research into the products and process of the class is based on a detailed ethnographic and communication analysis of the CMC portions of the event.

In sum, I consider the midterm events to be the turning point in our class and in my own understanding of what interdependence can mean in a classroom setting It remains with me, in affective as well as in cognitive terms, as a key event, as a "top-of-the-mountain" experience in teaching and learning. Mainly I feel thankful that everyone jumped in, took the risks, and made it happen.

Descriptors, Definitions, and 'Artifacts' from Planet Xeno

Given the time and space constraints, I can best sum up some of the further products and processes of the Planet Xeno events by listing and briefly describing a set of descriptors that the class participants extracted from our experiences. These are a kind of artifact from our ethnographic study of Planet Xeno. I would again refer you to the web site portfolio of our class for more comments on and more voices describing or illustrating these artifacts. There it becomes clear what I can only report here, that our diverse and polyphonic voices shape the meaning and interpretation of all aspects of the new planet. Here the summaries remain as descriptors of some of the essential aspects of the landscape of Planet Xeno.

Collaboration is an interactive and interdependent act of working together in order to generate new ideas, increase knowledge, and achieve common goals which could not be accomplished individually.

Communication is a necessary prerequisite for any collaborative effort. It includes listening to what others have to say (i.e. understanding what they mean and not what one wants to hear) and having the chance to give one's own opinion. It requires mutual respect and trust for the negotiation of meaning.

Autonomous, active, engaged, interactive, interdependent learning process are terms which describe non-foundational learning. In this new learning environment, the roles of teachers and students change and students gain a higher sense of responsibility for their own and others' learning.

Process – product are ideas that highlight the habit of focusing more on the process of learning, and on the mutual exchange of ideas rather than exclusively or primarily on the outcome. The product, however, is also important and a matter of responsibility for outcomes presentable to others.

Co-construction and meaning making occur when people exchange their ideas on a specific topic, collaboratively creating new knowledge, a tangible product, or a common understanding of a concept, and reacculturating this knowledge into their own belief and knowledge systems.

Community of support is the power or energy that people give one another when working together to accomplish a desired goal. Such a community involves reciprocal interdependence where one member's output becomes another's input, and viceversa. Members work together and trust each other in a co-creative symbiosis. This community is a safe place for risk taking and voicing opinions without fearing sanctions.

Dialoguing implies the suspension of judgement in the exchange of ideas and opinions. In dialogue, the goal is not to reach a conclusion, rather, it is to foster an environment where multiplicity of opinion is valued.

Ways of knowing is our approach to challenging the positivist paradigm, which values one truth. In our context we placed value on a multiplicity of perspectives, the process of sharing, exploring, and hypothesis testing. Teachers who thought they were teaching knowledge that they considered "true knowledge" have to "unlearn" what they thought was true, and instead, integrate different perspectives into their teaching.

Coloring outside the lines refers to learning without limitations on ways of being, thinking, and knowing. Collaborative writing, learner-initiated tasks, inclusion of multiple literacies, especially computer mediated communication (CMC). Here process-oriented evaluation, encouraging and assuming reciprocal interdependence, and the co-construction of knowledge are all examples of moving away from the traditional paradigms of teaching and learning towards a non-foundational paradigm.

Concluding Remarks

In this beginning exploration of these rubrics, and using the texts and experiential reports by the members of the class, I have begun to illustrate and point toward further possibilities for the essential use of CMC and non-linear, complex, dynamic ways of knowing, learning, and teaching as the future for fully implementing information technology and CMC for teacher education. These ideas, brought into juxtaposition here, clearly support teaching, learning, and research paradigms that investigate multiple ways of knowing as the epistemological home for this inquiry. In the words of (van Lier 1998):

> Traditionally we have thought of scientific research as a matter of looking into causes and effects, and benefits have been cast in the shape of generalizations from a sample to a population and of accurate predictions of future occurrences. This research scenario . . .will no longer work once we venture forth into the real world of complexity, in which many people and circumstances act and interact. Here there are no simple causes, and predictability must yield to contingency. Research must be aimed at increasing our understanding, both holistically and in the smallest details, of the social setting as a complex adaptive system. (pp. 157-58).

This descriptive account shows, then, how a groups of teachers and learners could explore and push the boundaries of possibilities for addressing the web of relationships among collaborative and other forms of non-foundational graduate education, collaborative language, literacy and culture learning, and multiple literacies including those possible in CMC. Learning to inhabit Planet Xeno as resident aliens there meant acculturation to a new way of thinking, learning, and teaching, based on the non-foundational paradigm described here. As we found ways to live and learn the theories, terminology, and especially the practices of non-foundational learning and teaching, we became members of a new complex adaptive system which we know as our transitional knowledge community.

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Developing A Contract For Learning: A Constructivist Approach For Professional Development

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Abstract: An increasing number of teachers returning to the Faculty of Education for advanced coursework are interested in learning technology skills—with a specific emphasis on learning how to effectively use computers in their classrooms. These teachers explain that the alternative has been to learn on their own or attend professional development days which often only focus on skills such as word processing, grading programs, or use of the internet, but not how to use technology to enhance student learning. In this longitudinal study, we utilized a constructivist approach (Duffy & Cunningham, 1996) facilitating the development of teachers' skills to increase their competency in using technology in the classroom. The primary focus for the use of technology in the classroom was to enhance opportunities for student learning and to develop higher order skills such as critical thinking and problem solving (Jonassen & Reeves, 1996). Through interviews, questionnaires, and observation, data were collected to address the specific research question, how can practicing teachers best learn to use technology to enhance the learning experiences for their students?

Background

In Canada, the implementation of technology in public schools lags considerably behind what can be found in comparable school settings in the United States. In the United States, hardware and software is more prevalent, however meaningful integration of technology within the classroom, particularly to enhance learning still falls short of expectations (Hill, 1999; MDR, 1998; O'Donnell, 1996). This study takes place in British Columbia where elementary school districts are just beginning to plan for the wiring and development of other infrastructure systems to support the integration of computers into the classroom and computers are just beginning to be available in classrooms throughout the school (BC Ministry of Education, 1995b). A curriculum document (called an Integrated Resource Package—IRP) with learning objectives in instructional technology for K-7 was recently developed (BC Ministry of Education, 1996) but then pulled from circulation and has been put on hold indefinitely. At the secondary level, computer use is most frequently found in computer science courses, with increasing use in technology education, science

and the fine arts. In most institutions, students graduating from universities from a teacher education program are not required to take technology coursework or pass exit requirements based on technology competencies and therefore enter the school system unprepared to integrate technology into the teaching/learning process. As computers do become more prevalent in the school setting, there is a great need to provide professional development for teachers so that the computers can be used effectively to enhance learning in the classroom.

Many professional development efforts to date remove teachers from their school setting and take them into a district computer center, often with equipment much different from that which would be found in their local school setting. Teachers are taken through step-by-step instruction on common software programs or introduced to the internet. Educational software is seldom presented and little instruction is provided to the teachers on how to integrate the use of computers into their classroom or connect technology experiences to the curriculum. Learning basic skills is of import to the teachers, most of whom have little to no formal training in the area, but the efforts fall short of what the teachers say is really needed. As O'Donnell (1996) comments, "the majority of teachers who are utilizing computers in their classroom have not fully integrated them into the curriculum but have only incorporated the computer with little change in actual curriculum and classroom strategies" (p. 3). Teachers are learning how to use computers, but not in a manner that appreciably impacts students' learning or connects to curricular content.

Participants

Five groups of teachers and two groups of parents participated in this on-going study of in-service efforts aimed at providing teachers with the skills to successfully implement technology and new media into the classroom to enhance the learning experiences for their students. All research was conducted in the Lower Mainland in British Columbia. In the mid-1990s, O'Donnell (1996) remarked that, "there are no studies that asked a broad spectrum of classroom teachers what their specific needs are for integrating computers into the classroom" (p. 16). To begin our studies, we were interested in first looking at what teachers think about the use of technology in the classroom and explore how they were currently using technology. Little research beyond Ministry-sponsored reports (BC Ministry of Education, 1995a; 1995b) is available from within a Canadian context, particularly in Western Canada, so our first research efforts were to gather baseline data.

Four small groups (n=~8) participated in the first stage of the research aimed at looking at what teachers and parents think about the integration of technology in the classroom. Separate focus group interviews were held with these four groups; one group of teachers consisted of elementary level (K-5) teachers, the other group were lower secondary level teachers (grades 6-8). Both groups of teachers were non-computer users, in the sense that they did not actively incorporate the use of computers in their classrooms. We included both new teachers and more established teachers from across their stated primary discipline affiliations. The parent groups were also grouped by grade level of their children (grades 3-5 and 6-9). During the second stage of research, an inquiry was made to find out how elementary school teachers were currently using computers in the classroom. In contrast to the focus group interviews, teachers in this group actively used a computer within their classroom. An effort was made to include teachers from a broad stated range of comfort and knowledge about using computers; every effort was made to be inclusive and not limit the participants to those most comfortable with technology. 120 teachers were surveyed to find out how they were using computers in their classroom. From this group, 16 teachers participated in an in-depth interview.

During the next stage, actual in-service efforts were examined. From our research, the district-arranged professional development did not seem successful in the teachers' opinions. In light of this, it was decided that we would next focus our attention on school-based and university-based efforts. Following the lead of literature recommendations (Duffy & Cunningham, 1996; Hill, 1999; Wilson, 1996) we focussed on programs that utilized a constructivist approach toward learning.

The first in-school group consisted of 14 teachers in a secondary setting, who came together as a community to learn how to use the internet in their classroom. They were guided by the computer studies teacher but were asked to develop their own goals. The CS teacher also took on the role of researcher in this study. The teachers were followed for one school term (six months). The other school-based group had just received a grant for new equipment and software—the school as a whole was looked at for how they decided to implement the technology and provide training for the teachers and students in the school. Fifteen teachers were observed in the computer lab setting (the researcher was on site as a participant observer three days per week for a period of six months). In-depth interviews were conducted both before equipment was purchased and after a routine of use had been established. (Follow-up research during the current academic year is being conducted to look at the sustainability of the efforts to engage teachers in integrating technology in their classroom).

The final group was university-based and consisted of 16 teachers from both the primary and secondary levels. This group shared some course experiences together, but was brought together as a community primarily through the use of a web-based course tool, WebCT and informal sharing sessions both on and off campus. In these three groups, the focus was on learner-centered and directed learning experiences (Duffy & Cunningham, 1996; Hannafin, Hill & Land, 1997; Wilson, 1996)—learners developed their own goals, constructed their own knowledge building experiences (facilitated by others in the group), and applied their learning to their individual classroom settings.

Methodology and Data Collection

For the focus group sessions, a professional interviewer was hired to interview teachers about ways to improve learning in their classroom. The teachers did not know the particular topic of interest, only that researchers were on the other side of a two-way mirror and were interested in the teachers' ideas about the teaching-learning environment. The interviewer was asked to guide the discussion toward how classrooms could be improved through the use of technology and what problems they saw in the implementation of technology. With the parents, the interviewer was directed to steer the conversation toward the topic of what the parents would like their children to know about technology and the skills they felt were important for their children to acquire related to technology. The group of researchers had a variety of research interests including the development of technology products that could help teachers in the classroom as well as how teachers' apprehensions about the use of technology in the classroom could be overcome. The interviews were tape-recorded and transcribed. In addition, the researchers during the interviews made extensive notes. In follow-up meetings, the team of researchers pulled out themes that seemed to emerge from the data and utilized a modified-Delphi technique to arrive at agreement on major themes, concerns, and issues that related to technology that surfaced from the interviews.

To look at the current state of affairs in the elementary setting, a survey was sent to 120 elementary teachers in British Columbia. A total of 89 questionnaires were returned for a response rate of 71%. Follow-up interviews with 16 of these teachers were held to confirm survey information and to provide a more in-depth look at the use of computers in the classroom. Interviews were transcribed and data triangulation methods were used to find convergence between survey data and interview data.

Based on the information gained during the focus group interviews and the survey of elementary settings, it seemed important to look at efforts to build technology skills of teachers both within school settings and through university coursework. Three separate case studies were initiated to provide a multi-faceted view of teachers learning to use technology. In all three settings, the researcher acted as a participant observer (Bogdan & Biklin, 1992). Interviews, observation, and personal research journals were kept as data sources. To identify and establish patterns or trends in the data, the constant comparison technique described by Bogdan and Biklin (1992) was used. Teachers in the settings were asked to develop their own goals and to connect their goals to projects that they would actually implement in their classroom setting. Their written documentation was also used as a data source and a method of comparison of how they intended to implement technology (learning goals, objectives, and instructional strategies) and what they were actually observed doing in their classroom settings.

Results

From the focus groups, it was immediately apparent that the teachers were uncomfortable with technology in the classroom. Their concerns focussed on three areas: their own lack of preparation and experience; the assumed chaos that would result if students were allowed to use computers on their own (at a learning station or computer center); and the teachers' inability to "fix" the computer when something went wrong (the teachers shared a perception that something was always going wrong with computers). This is consistent with Reeves' (1998) finding that across many studies, teacher confidence is a factor limiting computer use in the schools. The parents on the other hand were anxious for their children to develop a variety of computer skills ranging from basic word processing to the development of multimedia presentations and use of computer languages. The parents in both groups were convinced that their children's future success depended on strong computer skills.

From the survey of elementary teachers, it was clear that teachers learn their technology skills on the job and do not share common strategies for integrating computers in the classroom. Learning more about how to integrate the use of computers into the classroom and connect technology experiences to the curriculum was a common concern. District efforts were judged to be of less value, whereas learning on their own and interaction with other colleagues seemed to best aid teachers in implementing their goals. Obstacles to using computers were lack of time, inadequate hardware and software, and lack of appropriate training. This is consistent with findings from the U.S. as well (Becker, 1994; Chiero, 1997; Hope, 1995; Reeves, 1998; Sheingold & Hadley, 1993).

Additional findings were that teachers and students worked together to decide how to use the computer in the classroom and that groupings at one computer were usually in pairs or individuals. Teachers across the study agreed that the ideal set-up was to have both a computer in the classroom to help facilitate integration within the classroom, but to also have a computer lab for skill instruction and full class projects. 73% of the teachers said that having a computer in the classroom did not affect the way in which they taught. The focus group on the other hand felt that it would be chaotic to have a computer in the classroom and worried that they were unprepared (and in some cases unwilling) to change their instructional methods to accommodate computers. Because the survey group was comprised of computer-users, it may be that they were more comfortable with an open classroom approach (where students move about from their desk to the computer) and thus did not find integrating computers to be disruptive to their normal class routine.

In the first study in the school setting with 14 teachers interested in using the internet in their classroom, it was found that the development of a community was important in initiating an effort to increase the teachers' levels of competency. The project was started by the computer science (CS) teacher who offered to meet once per week with teachers on Friday afternoons to help the teachers develop and fulfill their own specific goals. These meetings turned into hallway conversations as the CS teacher found himself engaged in supporting the community during every free moment away from his regular classes. At the conclusion, many of the teachers successfully implemented the use of technology in their classroom, but to great cost on the part of the CS teacher. His thought was that the effort might not be sustainable without his direction. (The sustainability of the effort is being addressed in a follow-up research effort). The key to success from the view of the CS teacher was that the teachers chose their own goals for how to use technology in their classroom and that their efforts were supported by on-going interaction with other teachers in the school. The CS teacher also found that it was important to provide instruction that helped teachers reach their stated goals rather than offer general one-size-fits-all workshops. When the teachers were provided with the support they needed to develop their in-class technology goals, their engagement with technology overall increased and they were successful in implementing their planned projects. It was also found that these teachers were implementing technology in their classroom with the same constructivist principles that were guiding the development of their own learning. Students engaged in using the internet to solve problems of personal importance and to connect with students in different locations to gather information, opinions, and feedback. Their feeling was that the students in their classroom increased their ability to use higher order skills such as critical thinking and problem solving (though this is anecdotal, as they were not systematically measuring this).

Similarly, the university-based group formed a community of learners to support each other throughout the course of the project. They were also asked to develop ideas articulated in the form of a "contract for learning" describing what they would like to learn about technology and to specifically connect their learning to experiences that would enhance their students' learning in the classroom. This departs from the norm, where university technology courses often present theory or present a variety of skills to teachers unconnected to their classroom environment or to their previous level of experience in technology. In this research project, the teachers could choose at any time to attend workshops that focussed on the skills that they wanted to learn; participate in group discussions about technology issues; learn on their own or with peers; or work in an open lab setting with opportunities to consult with graduate student peers or the instructor. All learning experiences required the teachers to use their chosen in-school project(s). The teachers agreed that they learned far more from this initiative (as contrasted to previous experiences) and that they all were able to see the results of their efforts in their personal classroom setting.

The focus of both of these efforts was primarily to look at how teachers could learn to use technology in their classroom, facilitated by a university-based effort and a local school-based effort. The ideas for technology implementation were observable when they worked on their projects with the facilitators of these efforts. As well, interviews provided data that helped to draw conclusions about what happened when the ideas were actually tested out in the classroom, but direct observation of how the students engaged with technology in these teachers' classrooms did not occur. As stated previously, we were most interested to see that teachers used a constructivist approach when integrating technology in their classroom. Because many of the projects developed required students to use the computers as tools to develop and construct their own knowledge, it was felt that in many cases this was the approach used by teachers.

The final case was an examination of how one school addressed the implementation of technology after receiving a large grant funding equipment, software, and limited training. Initially, one teacher became recognized as a Lab Coordinator (though his appointment was as a fulltime grade 6 teacher) and made decisions regarding the development of a computer lab and class use schedule. He also organized and conducted lunchtime professional development workshops once a week. Of the 15 teachers on staff, about four teachers would come to any one workshop. After some initial prescribed workshops, the teachers began suggesting themes or topics for the workshop. Attendance at the workshops usually consisted of those teachers who were interested in a particular topic being offered or if they needed help to implement their ideas in their own teaching setting. The majority of the teachers used the lab for their class when it was scheduled, though some were sporadic while others tried to gain additional access. Because the Lab Coordinator was also a teacher and could not be in the lab during use, the researcher who was acting as a participant observer in this study (and was present 3 days per week, all day in the Lab), the researcher found himself in the role of facilitator. He was often asked to help students or to aid the teachers in achieving their goals. This also provided the direct observation that was missing in the other two cases.

Although both the Lab Coordinator and the researcher discussed using an open-ended learning environment (Hannafin, Hill & Land, 1997; Hill, 1999) to promote the development of the teachers' skill with technology, the initial training efforts more closely resembled direct instruction. Later as teachers initiated dialogue about what and how they would like to learn, a more open approach was used. This was particularly the case in the lab sessions when teachers interacted with the researcher in this study. The nature of his involvement clearly impacted how many of the teachers learned about and then used technology in their classroom as he took on more the role of facilitator rather than an observer. We did not feel that this compromised the study, as it further provided evidence that teachers are most comfortable initiating their own projects for the classroom and then seek the help of others to facilitate the integration of technology.

Our final observation in this study was that the comfort level with technology impacted significantly the way in which technology was used. A few teachers put on a false front, bringing their classes to the lab because they thought they were supposed to; others taught computer skills; while about half integrated the use of computers throughout their instruction and used the computer as a tool to accomplish instructional goals. Teachers who were more comfortable with technology (or were not afraid to let students see them as less than an expert) were able to engage students in a variety of opportunities to use the computer and

demonstrated a more student-centered approach toward learning. All teachers acknowledged that time was a major factor inhibiting them from fully realizing their goals. They spoke both of the time it would take for them to learn how to use the computer in a meaningful way and the time it takes students to learn the technology.

Conclusion

Early indications are that developing a community of learners to support each other in learning about technology and implementing it in the school setting may be of more value than district-provided professional development efforts as they are currently organized. Further, it seems important to have teachers connect their technology learning to actual teaching and learning experiences in the classroom and to play a more significant role in their own knowledge development. In addition, these efforts provide a more thorough understanding of how teachers are learning to use computers in Canada.

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Minds On, Hands On: The Linear-Nonlinear Problem-Solving Approach to a Multimedia and Internet Course

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Abstract: This paper examines how a bilinear instructional strategy incorporating both linear and nonlinear problem-based teaching approaches was designed and then implemented in a graduate applied technology course. It outlines how the course *Multimedia and Internet for Educators* was developed, and reports the responses of students in the course to the instructional approach used. These findings include student attitudes toward the following: usefulness of the course, effectiveness of learning process and learning atmosphere, proficiency in multimedia and Internet, perception of technology integration on completed projects, and additional information gleaned about student attitudes. Conclusion and recommendation for using the bilinear problem-based approach are provided.

Introduction

The importance of preparing future teachers to integrate technology continues to be a critical concern at the national level. A report published in 1997 by the National Council for Accreditation of Teacher Education (NCATE) entitled *Technology and the New Professional Teacher – Preparing for the 21st Century Classroom*, states "The nation's teacher education institutions must bridge the teaching and learning technology gap between where we are and where we need to be. Teacher education institution 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 (p 1)."

The traditional way of conducting technology courses must be considered inadequate for the needs of the 21st century classroom. The exclusive use of a didactic model is not only pedagogically ineffective, but reinforces a practice that will likely be reincarnated later. Cooper and Hirtle (1999) reported that a formal didactic transmission approach caused students to learn just enough to be successful in the context of the course they were studying, yet, the acquired skills were quickly diminished. They found in subjects a lack depth of conceptual understanding and an inability to construct meaningful

applications. Educational technology is a field in which knowledge, content, and skills change very rapidly. New technology such as multimedia and Internet are too complex and too multi-contextual to rely on traditional models of instruction. We need to find ways to prepare students not only to use technology in meaningful ways, but also to integrate it authentically into their teaching.

Problem-based teaching strategies have received the increased attention of many educators (Cooper and Hirtle, 1999). Problem-based approaches provide the student with the ability to more authentically interact with their subject and make connections that are more inherently meaningful to their own lives and previous learning. In an applied technology course, they provide an opportunity for students to develop greater technological competency while reflecting on their own learning processes, develop a deeper understanding of the tasks they are engaged in, and enhance skills needed to solve real-world problems.

Forcier (1999) describes two models for problem-solving strategies - linear and non-linear. A linear approach is characterized by a direct, sequential and outcome-driven strategy. A nonlinear approach is characterized by an indirect, random and process-driven strategy. This study examines the adaptation of a combination of both strategies implemented into an applied technology course, where each was employed sequentially to obtain the most authentic and effective combination.

The Study

In order to provide its students with experience in using updated technology to enhance instruction and professional development, the School of Education at the State University of New York at Oswego created a new graduate course, EDU 505 Multimedia and Internet for Educators. In an effort to construct the most authentic and effectively delivered course possible, the choice of course design was re-evaluated from those previously used, and the decision was made to employ an alternative model from the traditional course structures using formal, didactic transmission models. Ultimately, EDU 505 was designed using a model characterized by the following components:

1. A problem-based approach to processing content.
2. A sequence of linear and nonlinear instructional strategies.
3. The application of productivity tools for creating multimedia presentations.
4. The use of computer-based technologies including telecommunications to access information and enhance personal and professional productivity.
5. The use of computers to support problem solving, data collection, information management, communications, presentations, and decision making.

(ISTE-Recommended Foundations in Technology for All Teachers: Personal and Professional Use of Technology, 1998)

The Course

EDU 505 was offered in summer 1999. Enrollment in the class was restricted only to graduate students. The class was limited in size (16 students, 4 males and 12 females) and met for 3 hours twice a week for 6 weeks. The course covered three major topics: (1) Use of the major Internet tools for K-12 teaching and research, (2) Design and development of multimedia programs, and (3) Design and development of basic educational web projects. Coverage of each area was divided into a linear and non-linear component. Forty percent of the instruction was based on a linear outcome-driven approach intended to instruct students in the use of applications and provide guided problem based exercises. In this component, problems were designed to lead students through deliberate stages of facility with each of the requisite operations. Sixty percent of the instruction was based on a non-linear approach grounded in an inquiry/problem-solving model. In this component students were given tasks with more open-ended criteria. The focus here was placed on inquiry and self-directed, creative, collaborative problem solving.

The instructor was the primary designer and instructor for the course, and participant-observer in the data collection of the study. Two colleagues acted as additional participant observers and design consultants throughout the duration of the course. Data were collected from the following sources:

1. Field notes taken by the co-investigators
2. Interviews with students
3. Final reports from students

Component One: The Linear Problem-Solving Phase

Most students entered the course with word processing experience, but little exposure to multimedia and Internet applications. They had minimal experience with e-mail or Internet browsers, and had limited skills and understandings needed to integrate updated technology with their instruction. Therefore the initial emphasis of the course was to create a foundation of necessary concepts and skills.

The linear problem-solving approach follows a deductive cognitive pattern consisting of two phases; analysis and synthesis. The analysis phase includes defining of the problem, understanding the component tasks. The synthesis phase includes designing a solution to the problem, developing a solution to the problem, and then evaluating the results (Forcier, 1999).

To initiate each of three new topics, a problem was introduced to the students in the form of a case study. Both instructor and students collaborated to analyze the problem, seek the solutions, apply related computer technologies, evaluate the final product, and discuss possibilities for integrating new technologies into real-world problems/projects.

The following instructions were provided to students for each of the 3 projects:

1. Simple and general – initial analysis involved student-driven idea/topic generation. Students majored in different fields, so it was crucial to make sure students could understand the content and had a sense of their collective common interests and related their own experience to the project/problem. EDU 505 was organized around three general problems: finding a lesson plan on the Internet (topic 1); Powerpoint presentation on "Welcome to SUNY Oswego" and HyperStudio jeopardy game on "Do you know Oswego?" (topic 2); and the web site "Introducing EDU 505" (topic 3).
2. Straight and sequential – students had different learning styles, they viewed the same case of the problem with different perceptions. To ensure the prerequisite basis for effective problem-solving, the instructor provided the students with clear definitions, an understanding of the problem, the requisite task skills related to the problem, and possible strategies to help students find solutions. During the independent practice portion of the activity, the instructor assisted in the development of project storyboards, supplied content outlines for each problem/case, and provided formative feedback to students throughout the process.
3. Small and applicable – students entered the course with different computer technology capabilities, and experience and background were varied. This created an inherent problem related to how much depth and at what level of detail each application should be introduced. Given this, consideration needed to be given to the most appropriate applications and tasks for each problem/case. To reduce computer anxiety and students being overwhelmed by the vast capability of each application, the instructor begin with small and selected features of each application. For example, the instructor allowed basic multimedia functions to be included in products/problems without requiring students to engage in detailed programming. It was found that this introduction of basic skills and concepts was probably the best way to develop students' knowledge and confidence in this "hands-on" setting. A good rule is to teach simple concepts when the anxiety level is high, and more complex ones when there is a high level of comfort.

Component Two: The Nonlinear Approach Phase

With each topic, after an outcome-driven grounding using a direct linear problem-solving approach, students were ready for a transition to a nonlinear collaborative-inquiry approach. The main purpose on this phase was to let students operate in a flexible environment that would be more comfortable for more random thinkers and challenging and exciting to the more concrete and sequential thinkers. In addition, this phase has the added factor of being motivational, given that students selected their own direction and projects.

The nonlinear approach allowed individuals the room to determine their own path to goal attainment without having a hierarchical structure or predetermined outcome imposed on them. This strategy consists of a sequential three-part process: The first part is the "given" and is characterized by the information in the learner's possession. The second part is referred to as the "to find" phase and is characterized by the information the learner is seeking. The third part is the "procedure" characterized by the process the learner is going to use to reach her/his goal.

Three integrating projects were assigned for the semester. The following section outlines how the three part nonlinear strategy was implemented for each of the projects.

Project One: Using Internet as Educational tool

Given – Related web sites: Sink or Swim: Internet Search Tools & Techniques (http://www.ouc.bc.ca/libr/connect96/search.htm), Online Resources for Educators (http://www.berksiu.k12.pa.us/kevin/); evaluation standards on web sites.

To develop – A clear, concise, convincing review article on one or more education area.

Procedure – Identify key words on interested topics, apply search engine strategies; review the related web sites; find separate sources that say the same thing, organize thoughts clearly; copy and paste cited web sites into a word processing file; and write final review.

Project Two: Educational Multimedia Project

Given – Multimedia applications (Powerpoint and HyperStudio); different multimedia examples and ideas (make a proposal or recommendation, present a research or scientific report, give a lesson or instruction, report progress or status, make a book report).

To create – A group multimedia project dealing with real world teaching and learning.

Procedure – Negotiate project topic with team members; plan the structure or create a storyboard; decide the purpose or goal of the project; create a time line for the completion of the project; assign roles to team members; search for information using textual, electronic, and pictorial sources of information; decide how information will be represented (text, picture, video); decide how the information will be organized, and evaluate and revise the design of the project.

Project Three: Educational Web Site Design and Development

Given – Web design software (Claris Homepage, FrontPage, and Netscape Composer); types of educational web sites (class web, web lessons, learning webs, educational resources, virtual field trips, and individual webs).

To develop – A group or individual educational web site.

Procedure – Decide the intended audience, project topic; decide the web site format; make internal pages (text, picture); evaluate and choose external links (reliability, authority, appropriation, validity); structure the internal and external links.

Being graduate students and current teachers, class participants recognized the attempt made at a bilinear model and appreciated the opportunities it afforded. In this phase, the instructor mainly stayed in the role of resource, guiding students in potentially fruitful directions and answering questions related to technical aspects of the course. When students were unclear as to how to best accomplish their project, the instructor acted as facilitator to help students "solve their own problems," and examine the lessons within the problem itself. While the students were given ultimate freedom, the instructor often needed to assist students in their decision-making regarding how to segment and sequence information to make it understandable, how information could best be represented (text, pictures, video), and how the information could be organized (i.e., hierarchy, sequence) and linked most meaningfully. In this phase, a primary role of the instructor was to act as technical consultant. In many cases, the technical problem's solution was best "discovered" by the student using their own resource and inquiry skills. However, some

problems substantially inhibited a student's progress, and in those cases the instructor needed to intervene to provide solutions and/or micro-teach lessons on application capability and use. In this phase of the instruction, students were strongly encouraged to collaborate with peers. As problems lead inductively to novel solutions and innovation often "two heads were better than one." Quality performance was judged less in this phase by product as by process outcomes.

Findings

Findings from written surveys reflected positive student reactions in the areas of instructional effectiveness, usefulness of the integrated model, and affect on classroom atmosphere. Student responses related to the use of the bilinear instructional strategy demonstrated that they felt their experience was for the most part both meaningful and productive. This could be seen in the following set of written comments: "I like the structure of the course because it allows graduate level students to explore and learn on our own with support from professor. I know that there are various levels of computer experience, so this allows everybody to receive the amount of help that they need." "The course was a useful one. It enabled us to do some things that other classes do not have the time for. This class enabled each person the opportunity to create a web site, and perform a multimedia presentation. The hands-on approach really was beneficial." "I feel that the class as structured was super. So many classes are just straight lecture and honestly I feel little information is actually retained. This class was instruction and then tons of hands-on practical experience which is the best way to learn. Instructor gave excellent step-by-step procedures on how to work on the project and always gave examples which I find extremely helpful when trying to understand a concept." "The learning process was fundamentally easy and satisfactory because theory and hands-on were combined into one. The professor did an excellent job presenting the materials in a level that everyone can understand. I enjoy the hands-on side of the course and the autonomy to be creative." "I appreciated the manner in which we were taught how to use specific tools and then allowed to utilize them immediately. In this way, the lessons were fresh in our minds and the skills were easier to master." "I enjoyed the way this class was run. Once the professor shows me the way I like to take my own course to reach the end product. This style was perfect for me."

Students felt overall that the integrated and hands-on nature of the course was conducive to their making meaningful applications to their own work. These sentiments were reflected in the following comments: "The use of technology for my projects made it more enjoyable and interesting. Not only did my proficiency in the subject matter increase, but also at the same time I improved my computer application skills. It is almost like two courses in one." "The material I created in this class will be used in my classroom This is exactly what I was hoping to get out of the course." "It definitely enhanced its appearance and clarity. Technology can be used in so many different ways that creating some of the projects we've done in this class is only a stepping-stone to what can be done with our students. It offers a more focused use of technology within our classes." "I plan to use the things I have learned in my classes. I set up my web site for my students. It includes some information about myself, my expectations for each class, and students' grades and homework assignments. I mentioned the idea to my summer school students and they said that they thought it would be very useful. I am really excited about showing the site to my principal and colleagues. The best thing about this course is that I have learned some things that I can actually use." "I think technology integration enhanced my project and enabled my audience to understand clearly my point of view." "My proficiency in multimedia skills and using the Internet has increased quite a bit. I plan to use both the PowerPoint and web page in my class this year, so my efforts will be well rewarded both in the near and distant future." "Being a technology teacher this course relates directly to my field of study, and NY State curriculum for technology education. I feel through this course I have increased my knowledge of the Internet and I got exposure to a new multimedia program HyperStudio."

Finally, students reported that the linear-nonlinear collaborative problem-solving approach created a positive environment in which to learn, seen in the following comments: "The learning atmosphere was great with many of us working together and helping people." "The format of the class was very laid-back, and a non-threatening environment was provided for learning." "Although I found all

of this overwhelming I was grateful that professor allowed us to work with partners. My partner was a patient teacher and made me do all the steps even though he knew how and it could have gone much faster." "The best thing about the class was the supportive atmosphere. There was not any pressure or stress when working on the computer. There was always help when you need it." "It was also nice that other students in the class were willing to help each other." "I feel that our class was a very safe and comfortable learning environment."

Discussion

As the findings suggest, using a purposeful combination of both linear and nonlinear strategies within a problem-based approach, provides students with dimensions of learning that neither one alone can achieve. To reduce students' computer anxiety and enhance technology integration, computer-based courses should be relevant to students' interests and learning styles, and incorporate an instructional model that employs a cognitive developmental framework most suited to the needs of the learners. The learning program should provide hands-on learning, opportunities for feedback, supportive and caring instruction, and active learning experiences in which students work on their own projects and see the application of computer skills to their area of study, (Yang, Mohamed, and Beyerbach, 1999; Comer and Geissler, 1998). The linear component outlined here also provides the concrete sequential learners, of which a high proportion are teachers (Shindler, 1998), a safe and well matched starting point. Likewise, participants' comments reflected a true appreciation for the challenging and self-responsible nonlinear component to each project. The more random and abstract minded learners were able to unleash their creativity while the more concrete learners could move more confidently into a less structured horizon having been grounded in the earlier linear experience. All students seemed to appreciate that whether the learning was outcome-driven and direct, or process-driven and indirect, it was "hands-on" and problem-based. Concepts and procedures, whether direct or indirect, were experienced within the context of an exploration of "real and material" action. Students walked away from their technology experience having developed a meaningful understanding of its capability within an authentic context. Moreover, because these teachers often find themselves reproducing the instructional environments that they themselves have experienced, the bilinear problem-based model provides a sound and innovative practice to add to their teaching repertoires.

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Staff Development: Task-Oriented Training

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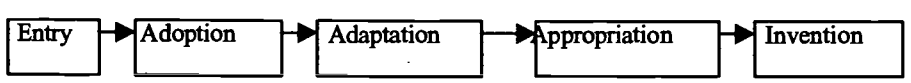
Abstract: The present article documents a particular model for inservice faculty development at a computer-technology magnet school in a Midwestern city, Using the ACOT model the article recorded the beneficial training activities leading the faculty through different stages of developing their core technology skills and implementing instructional technology in their daily teaching. The most important strategies utilized in this school setting was task-oriented training, which contributed greatly to the faculty development of technology competency and the understanding of technology-related issues in classroom practice.

Introduction

In 1998, an ISTE (International Society for Technology in Education) national survey showed that information technology is increasingly available in schools. Related similar studies showed that K-12 schools in the United States have approximately one microcomputer for every five students. At the same time, past studies have also documented that teacher professional development including both preservice and inservice teacher training, has not kept pace with the rapid changes in the quality and quantity of information technology. During the next decade, the teacher work force is expected to experience a rapid turnover, not to be replaced by technology as such, but by teachers with technology skills and implementation strategies. (ISTE, 1999)

The Burlington Community School District Computer-Related Technology Plan states that "The effective integration of technology assumes that teachers are facilitators of learning, designers of individualized programs, and learners themselves. Efficient operation and management requires staff skilled in the use of technology tools. On-going training and access to information technologies are essential." (http://www.burlington.k12.ia.us/TECHDEV.HTML) This statement makes clear the role that teachers are expected to play. According to the U.S. Department of Education National Center for Education Statistics, relatively few teachers (20%) report feeling well prepared to integrate educational technology into classroom instruction (Teacher quality: A Report on the Preparation and Qualification of Public School Teachers, January, 1999).

Staff development or inservice training is a scheduled or regulated practice in both private and public schools. With an increasing time investment dedicated to training inservice teachers with basic technology skills and the skills of integrating instructional technology into their classroom teaching, there are correspondingly high expectations of seeing more technology implementation in the students' learning and their outcomes. Among the existing models popularly used in the schools, the Apple Classroom of Tomorrow (ACOT) sponsored by Apple Computer Inc., has gained particular recognition among the practitioners. The book, Education & Technology edited by Charles Fisher, David C. Dwyer, and Keith Yocam (1996) provides reflections on computing in the classroom. The most commonly shared realization among the participants is that technology implementation should bring changes not only in the learning environment, in teachers' roles and student behaviors, but also in the learning outcomes. Also those involved in training the inservice teachers should come to realizate that teachers need ongoing emotional, technical, and instructional support during this process. Teachers go through different stages in the development of their respective perceptions of technology and their skills to implement and integrate instructional technology in their classroom. The following five stages were proposed by ACOT:



(ACOT, 1996).

While the above model can be viewed as a template for training inservice teachers, one must be mindful of the fact that variations on this theme will generally be necessary to make the model applicable in any particular situation. Furthermore, the transition from any one of the stages to the next can be an arduous one. Years of experience have taught us that the success of training very much relies on strategies that fit the special circumstances of a particular school or district, such as those related to financial resources, technology facilities, faculty perceptions and commitment, attitudes of administrators, and support from the community.

In Alan November's article "Drill the Teacher, Educate the Kids" (http://www.anovember.com/articles/drill.html), we find that "The goal should be to train teachers not to master specific technologies, but instead to design learning environments in which technology helps children learn." However, this statement is incomplete as one must strive to train teachers to have technology skills beyond the rudimentary levels, as well as to look into methods of implementation and creating interactive learning environments for our children.

Analysis of the School Situation

The present article documents a particular model for inservice faculty development at a computer-technology magnet school in a Midwestern city, thus fleshing out a particular version of the ACOT model given above. It is likely that small variations on this model will apply to other schools, as well. In the course of this faculty development, we found that the transition from the *adoption* in the ACOT model to the *adaptation* was especially difficult. Below, we describe this difficulty, as well as document how a solution based on project-based learning was effected to bring about a successful resolution of this difficulty.

The school in question had five hundred students covering grades K-5, with most of the students coming from low-income families. Part of a three-year federal grant was used to purchase 450 computers, to be distributed into four computer labs each with roughly 20 computers, and into individual classrooms, each having 12 computers. In addition, various instructional software packages were purchased and installed, which over the course of the three-year grant, included over 300 different software packages in all subject areas and covering all levels (K-5). Finally, one salaried teacher (trainer) with a Master's degree in gifted education was given the responsibility of curriculum development and of training the full-time faculty, which included 24 homeroom teachers, six special education teachers and close to fifty additional administrators and staff. Six times each semester during the period of the three-year grant, the teachers participated in technology staff development, with a portion of the grant money used to hire substitutes to cover the inservice teachers' classes. The training was primarily to help teachers become familiar with the school network, as well as with the software. Every teacher and staff member had one personal computer for administrative and instructional work.

The Beginning Stage

After a few basic orientation sessions for the teachers and staff, the trainer divided the teachers into two groups, grades K-2 and 3-5. The K-2 teachers were trained in the basic functions of word processing, use of spreadsheet and database software packages, and in the use of Kid Pix for graphic and text applications. Those in grades 3-5 were trained to use HyperStudio as a multimedia application in addition to the basic software packages mentioned above. The goals were for the teachers were not only to learn the basic skills in using these technology tools, but also to apply them in their teaching and to assist their students to use the tools in order to promote learning. Beyond this second stage in the staff development process, however, the teachers reached a plateau, learning very little in the way of real instructional applications of the technology. Where there was some use, this was generally of a record-keeping or organizational nature, rather than innovative instructional applications. Despite the training, by the end of the first year too many of the teachers did not feel sufficiently comfortable with what they had learned to create a technology-supported learning environment.

In order to help the teachers resume their learning, as well as to enhance confidence in the use of technology to deliver a more meaningful education, the training sessions were modified so as to be more *project-based* in their approach (Zhang, 1999). That is, rather than having the training being based on a variety of

microscopic skills in technology, it was decided to divide the remainder of the training into using technology to generate a few (four in all; see below) much larger-scale projects. This not only made the technology much more meaningful for the teacher trainees, but also it gave them a better opportunity to work closely with the students, as this was necessary for seeing the projects to their successful conclusions.

Computers and technology, unlike the vast majority of the more classical academic subjects, has found a relatively large number of devotees, even amount the relatively young school-aged children. Popular stories already abound that describe the young enthusiast who spends hours of free time each week, honing his or her skills on the computer, often to a level far in excess of the teachers. This can be at the same time a challenge and an asset for the teacher trying to become sufficiently competent with the technology to find creative uses in the classroom. In the learning project under discussion, it was our conviction that those students already having far surpassed their teachers in computer and technology-related skills should be used in an integral way, for the benefit of both the remaining students as well as for the teachers in training. Therefore, such students were identified and asked to serve as teachers' assistants to help facilitate the completion of the assigned projects. These "assistants" proved to be important catalysts in both the teacher training as well as in the student development.

Task-Oriented Training

The projects themselves were chosen to be both meaningful and relevant and mirrored similar real uses of technology in society.

- Project 1. Using audio-visual technology, students produced a 15-minute news broadcast, covering school or classroom news and events, student interest stories, student awards, as well as other special news.
- Project 2. Using Microsoft Publisher, students produced a school monthly newspaper, complete with news stories and editorials, as well as a literary section, drawing from students' stories and their writings, together with student photographs.
- Project 3. Using Kid Pix or PowerPoint as the primary software packages, students created highly professional-looking presentations covering a wide range of subjects. Some of the presentations were even dubbed onto video tapes and broadcast by the local TV station to the entire community.
- Project 4. Using a combination of desktop publishing tools and related products, different groups of students each month created monthly displays highlighting diversity as a theme. Classes were paired together to work on this project, with upper-grade students helping lower-grade students. This taught not only the technical skills, but also cooperative skills as well.

The above projects were valuable and meaningful introductions to technology for the students, and the teacher trainees also developed a much better appreciation of the potentials for creative introduction of technology into their curricula. In addition, these designated projects with specific responsibilities for particular groups of students were valuable in motivating teachers to assume their roles as facilitators and as leaders. As a result, after this third year, most returning faculty had the confidence, knowledge and skills necessary to apply instructional technology in creating an enriched environment for students learning. Of the teachers in the training project, fully 80% of them continue to use technology as integral components of their instruction as well as of their administrative duties.

With the completion of the above three-year training session, we were able to bring the teacher trainees, many having previously only the most rudimentary training, from the *entry* stage to a point well into the *adaptation* stage of the ACOT model. Many of the teacher trainees had come so far in the realization of the potentials of the application of technology, that they had made the further transition into the *appropriation* stage or even into the *invention* stage. This was brought about by a training session not only with specific goals and creatively conceived tasks, but also by a degree of flexibility to allow for solutions of unforeseen difficulties. The final result, quite apart from the better-trained teachers, is a new generation of technologically-literate students ready to meet the challenges of an increasingly complex society.

Conclusions

The above model can be considered successful partly because it brought a certain degree of pride among the teacher trainees, helping them into the process of becoming a self-regulated learners. Not only have they not stopped learning, but they have established a solid foundation on which to further their self-directed learning. In

turn, many have developed confidence to the point where they can play leadership roles in assisting technology trainers in educating future teachers in important basic technology competencies and implementation strategies

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Learning to Teach, Teaching to Learn: How Post Graduate Students on Initial Teacher Training Courses Develop their Information Technology Skills

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Abstract: This paper examines, from a contructivist perspective, the ways in which student teachers seek to improve their Information and Communications Technology (ICT) skills in order to gain Qualified Teacher Status (QTS). All trainee teachers in England and Wales have to meet nationally agreed standards of competence in the use of ICT in order to gain QTS. These standards (DfEE 1998) cover a wide range of skills and include both personal skills and the application of ICT within a school and classroom setting. The research examines the sets of conditions which prove most enabling for students integrating technology into their teaching and the implications for future course design in teacher training.

The education system in England and Wales draws a distinction between IT, the study of information technology as a subject, and ICT, the application of these technologies to teaching and learning situations in all areas of the curriculum. In this paper, we will use IT for all aspects, except when quoting papers that make specific reference to ICT.

Introduction

Over the past few years, the Department for Education and Employment and the Teacher Training Agency have introduced far reaching regulations and standards for schools and for pre-service teacher education. In this study, we are principally concerned with *Circular 4/98* (DfEE 1998), which sets out the information technology standards all students must demonstrate. These include skills in their personal use of the technology and the ability and judgement to use the technologies successfully and appropriately in the classroom. These standards apply equally to all students, irrespective of their subject specialism.

Each September some 200 postgraduates enter our one-year Post-Graduate Certificate in Education (PGCE) to train to teach in 'secondary schools' (ages 11 to 18). The year is divided into two semesters and in each, students have a short serial placement of two days per week in schools, followed by a longer period of full-time school experience during which their teaching load rises to 75% of a full timetable. The majority of the PGCE students are "mature on entry" — the median age is usually 31 or 32 — and they have a wide range of knowledge of IT. A rapidly increasing proportion have worked in jobs involving regular use of IT and the younger or more recent graduates will have had to make use of IT in school or on their degree courses. However, their IT experience is rarely "balanced": they may have been involved in DTP or as a multimedia designer, yet have little or no experience of spreadsheets or databases. A number of studies have considered the general spread of students' IT skills at the point of entry (notably Denning and Sellinger, 1999) and for the past six years we have monitored our students' IT skills both at entry and exit.

In previous years, following the initial IT audit, we have provided personal IT skills training for those in need. Such training was, in effect, voluntary, as there was no *requirement* to have any particular level of competence, nor to demonstrate its use in the classroom. Thus, those students who were "naturally" interested in new approaches and those who, for whatever reason, had an interest in information technology took up the training whilst, it seemed, those who were most in need could "safely" ignore it.

With the changes in the regulations for teacher training, all student teachers must now attain a high level of personal ability across a wide range of IT and must demonstrate, in their school placements, that they can apply these appropriately in a professional setting. In considering the relationship between 'knowing' and 'doing' we are using the comments offered by Pilkington and Groat (1999) "The distinction

between skill and knowledge is that a skill embeds knowledge in procedure." Thus, to demonstrate their IT skills, students' must show evidence that IT has become embedded in their teaching-related activities.

The required standards (DfEE 1998) are quite explicit about both the personal and professional aspects of students' IT skills and the requirement to demonstrate these cannot but have an effect on the students' approach to the use of IT. For example, the standards regarding classroom use say that "*students must be taught* [inter alia] *how to:*

- *decide when the use of ICT is beneficial* [or not] *to achieve teaching objectives in the subject and phase*
- *use ICT most effectively in relation to subject-related objectives*
- *identify in their planning:*
- *the way(s) in which ICT will be used to meet teaching and learning objectives*
- *key questions to ask and opportunities for teacher intervention*
- *the way(s) in which pupils' progress will be assessed and recorded*
- *ensure that judgements about pupils' attainment and progress in the subject are not masked because ICT has been used*
- [judge the] *impact of the use of ICT on the organisation and conduct of the subject lesson and how this is to be managed*"

They must also be taught "*the most effective organisation of classroom ICT resources to meet learning objectives in the subject*" and must "*be given opportunities to practise, in taught sessions and in the classroom.*" (The standards are, in fact, several pages long and can be found at http://www.dfee.gov.uk/circulars/4_98/annexb.htm).

The methodology which students use seems likely to have a great bearing on how easily they achieve these standards. There can be little formal teaching: the standards have been introduced into what is already widely felt to be an overcrowded and under-resourced curriculum: nor has there been additional resourcing to match the additional requirements. Basic training and development guidance will be offered, but it seems inevitable that students will play a large part in training themselves. Students will be faced with the need to use IT skills in planning and resourcing, teaching, monitoring and assessing and in recording and reporting. We, their tutors, need to learn how students improve their IT skills and how they learn to apply them if we are to plan effective courses for the future.

The Study

Our current research is not simply concerned with levels of resources or what particular skills are needed. We are more concerned with how the individual students build on their knowledge of and expertise in IT, what are the conditions for success and which circumstances lead to the use of IT becoming embedded in the students' planning, teaching and assessment. Research of this nature inevitably raises many questions: for example,

- does an initial facility with a word processor make it more likely that students will gain expertise in, say, using a spreadsheet to track pupil progress?
- does an initial positive attitude to IT lead to its use becoming embedded in the student's teaching?

To maintain good practice in teacher education, we need to understand the sets of conditions which prove most enabling for students integrating technology into their teaching. In assuming a constructivist basis for this integration (Brooks and Brooks, 1993), we shall examine the implications for future course design in teacher training.

There is support in the literature both for the general approach to the problem and for the nature of the questions asked. For more than a decade, researchers have argued that the effective use of information technologies in the classroom requires some shift from "teacher as source of knowledge" to "teacher as facilitator of learning". Chatterton (1985) showed that, when using IT in lessons, "The teacher is encouraged to work in a much more supportive rôle: he/she is no longer simply giving instruction (in the didactic sense) but ... reinforcing some aspects and/or extending the pupil's awareness into new areas." In similar vein, Gonzales and Thompson (1998) argue that "In order to tap the increased access to information made possible by technology, a shift in pedagogy from the model of 'teacher as information-provider' to the 'teacher as facilitator' is needed, but the change process is slow at best." It is by using a constructivist model that we hope to show the extent to which newly trained teachers can make this shift! Gonzales and Thompson go on to quote one example in which "[the] educator began with word processing in which case

the technology was used to do the same things always done, only faster. It appears that it is only with much personal experience with the tools that the potential is realized, such as using word processing to compose more effectively."

Willis (1993), importantly argues that "questions about hardware, software and how to use applications are no longer the most important topics in educational technology. Today, the major issues are related to instructional strategies, instructionally appropriate software, professional development and how to provide continuous administrative support." While this statement is certainly true in terms of the 'most important topics' and ones which we would be most interested in discussing, some of our students are still struggling with outdated computers inefficiently organised and situated within schools. They then have to expend considerable time and energy working with a system, the knowledge of which will not be of much benefit to them in future. As one student explained: 'Teachers haven't talked much about IT, but have explained which error messages indicate that it's better to give up at that point.'

The BECTA (previously NCET) publication *Managing IT* (1996) used a model developed by the MITs 90 Research Group which modelled the extent of IT integration within organisations in relation to its effects and benefits. The adapted model used five strategic levels of application of IT: localised, co-ordinated, transformative, embedded and innovative. The model may be used holistically so schools which are at the 'embedding' stage may well have teachers whose expertise varies widely but the school policy will in practice encourage all staff to improve their IT skills and use them as part of their teaching repertoire. However, in a school where the IT practice is localised within departments some may be excellent while others are failing to innovate at all and the school policy will not in practice implement IT across a range of subject disciplines. If we use a similar model here, concerning students and their IT development, then it is very important to gauge where a student is in terms of that development. We suggest, from the evidence gained so far from our students that 4 factors are of crucial importance, degree, job experience, subject area and placement school. Whatever the students do in terms of improving their own IT skills within the professional year the experience gained in those 4 areas is cumulative and significant. Students can only move so far in terms of their own personal skills, that experience itself promotes confidence but, unless teaching experience at school is available, they cannot develop as far or as fast as we would want them to. It seems likely that students are affected by the stage of implementation the school has reached. So, for example, Business Studies students are often asked to teach IT basic skills to pupils of 11 –13 years of age, and they are not only encouraged to use IT labs with suites of computers but have to do so. When they are in the labs the work is often already organised for the pupils so that the teaching students can go around and help with the teaching. English students find themselves in a different situation, where they know there are IT suites but they are often booked up, they do not see many English teachers using IT in their lessons and they are not asked to help with basic IT skills teaching.

Denning and Sellinger (1999) in their extremely useful commentary on data relating to student competences in ICT, pointed out the range of variance in school equipment, teachers' ICT expertise and the knowledge and experience of students (self-rated) when they began one year post-graduate courses in teacher education. They cited findings by Goldstein, (1997) that overall standards in IT varied unacceptably between schools and by the McKinsey group (1997) that penetration of ICT across schools was extremely variable, and that the experience, skills and attitudes of teachers and the way ICT was used varied widely. Denning and Sellinger, in their analysis of questionnaires from 983 students, also found that 'there are clear differences between the reported competence of students with different subject specialisms'.

Our research has looked specifically at students from different subject areas, placed in schools and colleges serving a wide range of communities. In phase 1 (reported here) we interviewed 24 students on the postgraduate course, 12 expecting to teach Business Studies and 12 English. At the time of this interview, the students were half way through their first teaching placement and so could be expected to have a fair knowledge of the school and its procedures and to have developed some opinions on the use of ICT in education. In a semi-structured interview, students were asked about their experience of IT before joining the PGCE course and what views of IT this experience had engendered. They were then asked about their experiences of IT within the university-based part of the PGCE course and within the school-based part. They were finally asked about their own use of IT in teaching, its benefits and drawbacks, and their views about what helped and/or hindered their own progress. The students' self-assessment questionnaires, completed at the time of their initial interview as PGCE candidates, were also available to the project. At the end of the academic year, when we will have interviewed the students during their second placement in a second school, we will have a year-long profile of their IT development.

Student Responses

All the students interviewed (and 91% of the cohort) had a personal computer at home, many of which had been bought, at least in part, because they were coming on this course. Most students had acquired confidence in basic IT skills before starting the course — a marked change in the last four years — and most had experience of IT in the workplace. Without exception, all the students who had worked with IT reported that *having to use IT* was a very significant factor in building their confidence. It should be noted that IT was used as a tool, they were not employed as IT specialists. Jobs ranged from marketing, to customer relations, to banking and insurance and these students generally had little or no experience of IT before starting work. Surprisingly, banking and insurance gave little training, but "*left me to get on with it*" as more than one student said: a situation with some resonance in teaching.

Of the younger graduates, with only vacation work experience, the degree course was inevitably more significant. All had had to use a word processor to submit assignments and, for the English graduates, that was all they had to do. Business degree students had surprisingly little further experience, in many cases using spreadsheets for finance was as far as it went. However, many of these younger students regarded themselves as "*part of the computer generation*" and expressed confidence in their ability to cope with IT issues and there was no significant difference in the attitudes of the English and Business Studies graduates. We found this surprising, as prejudice would suggest that business graduates would have much more computer experience.

In schools, however, there was a marked difference in the frequency of use of computing: given the nature of the subjects this was to be expected: English students used computers less than Business students. However, the story is not quite that simple: some of the English students were using IT more than some of the business students were. This would appear to be, in large part, a function of the resourcing of the school and of the attitude of the schools' staff: the two may well be related. In one school, an English student was encouraged to send small groups of pupils to the computer room as part of the normal process of the lesson. In another school, IT was not used for business studies below Year 12 (grade 12). In almost all schools, business studies had only limited access to computers and any given group was, typically, timetabled in an IT room for 25% of the time. In contrast, most business studies students found themselves teaching some IT to classes in the lower age-range of the school. This seemed to have a positive effect on their ability to deal with the technicalities of the school system and with the issues of classroom management and control.

How, then, do students bring their IT skills to bear in the classroom? Basic skills in IT seem to be transferable in a way that is not expected in many areas: simple maths problems may suddenly be found difficult in science lessons. When asked, students felt that these skills transferred because they, the students, had to be able to use IT and had to provide the evidence for it. Most of the students interviewed said that they had been involved in planning for the use of IT and all the business students and about half of the English students said that that they had already taught using IT. In a number of schools' English departments, the staff made little or no use of IT: the fact that our students were compelled to use IT was seen to be encouraging the department to make provision. This fits nicely with statements from the government and others about students and NQTs being 'agents of change' in schools.

Two cameos are presented here, to indicate the range of IT knowledge and use and also the range of expectation and possibility within our secondary schools.

Cameo 1:

Student A is at a secondary school which is a 'City Technology College', one of a small number of specialist schools built in inner-city areas, with matched funds from the private and public sector, to provide an IT rich environment. The initial influx of funds provided for hardware and software purchases in a modern, purpose built school.

Student A is 45 years old, used IT in his degree course and used many software applications during his 15 years in business. Since he came to the university for his PGCE course, he has used the intranet for contacting the library, for reference and for looking in FirstClass for information from his tutor about assignments, but otherwise he already had all the IT skills he has needed in teaching.

"All my lesson plans, schemes of work, proformas, PowerPoint presentations are on my own computer at home. The school has 480 computers for 900 kids. The place is brilliant, I'm enjoying it. I'm using skills I've already learned but, because I'm in a work environment, I can apply them in different ways. I'm experimenting too - when you're at work you don't have the time to deviate from the things you normally use. I'm getting a lot off the kids, I must say ... in

effect they were actually teaching me. I say, 'Come on guys, you're wizard with this, show us the way.' We use IT for research, the Internet or CD-ROMS and encyclopaedias. I stipulate they have to *use* the information not just download it. ... It's really weird, the kids queue up at a quarter to eight, there's 300 of them waiting at the door in a line to get into school, to do emails, research. ... I like to involve the children in the lessons. I use real live scenarios or past scenarios that were real live events - I try to relate it to the children's own experience. For example they have to do a job evaluation, I've asked them to draw up an evaluation sheet for what they needed when they joined, what they had to have, what were advantages, what were bonuses as skills. Using IT allows me more time to interact with the children. They tend to be engrossed in what they're doing -- if you took 4 or 5 minutes with one pupil in a normal class then the rest would tend to drift off task but with IT, it keeps them on task, focused on what they're doing. This school is a one-off in some respects. In some schools, for example my daughter's, there's a limited amount of IT ... but I've always seen IT as something positive, as a tool to do whatever I'm doing. It hasn't changed in that respect.'

Cameo 2:

Student B is aged 21, also at an inner city school, but one that has not been funded as a Technology College, teaching English. She didn't learn anything about computers in the school she attended as a pupil.

"I used a word processor for my assignments and things like that during my degree but not often. I just thought I'd better learn to do it, I didn't go on any courses or anything so I was basically self-taught. When I came for interview here, I filled in the questionnaire about using computers and afterwards I was asked to go on the pre-PGCE IT course, which was great. I learned to do spreadsheets and went on the Internet. But I haven't done so since then. None of the teachers has said anything to me about using IT at school and I haven't observed anyone using computers. No one has suggested I book any of the IT rooms. My mentor has discussed IT with me, as part of the student profile thing, and she was very helpful. She showed me where they had set up a system for making worksheets so I have used that often. But really I've learned more from my fellow student (who teaches IT) than from anyone else. He's often in the staff room when I am. I definitely use more ICT now, since I started on the PGCE course, mainly for worksheets."

Student A was able to talk volubly about his pupils and his teaching and the school itself, when discussing IT usage. Student B said far less, although, recently, she has used IT a great deal more, has developed her own skills and is learning from a peer in a context which is meaningful for her. It is interesting to speculate on the causes of this difference.

As part of the monitoring of students' IT experience, we have been considering a points scoring system where, for instance, a student gains up to 5 points in each of the following five categories: previous educational experience of IT; experience of working with IT; experience in the university-based part of the PGCE; semester 1 school experience; semester 2 school experience. On this basis, student A entered the PGCE with 10 points and is probably now at 20 points and is able to learn from every environment and his own pupils. Student B, however, gained perhaps 2 points from her degree and 3 from the PGCE course and 2 from her school/colleague, giving a total of 7. This scale is at the earliest stage of its development, but it is interesting to speculate that prior IT experience is directly transferable to this setting and greatly aids the students' development.

University staff were seen to use IT extensively in the preparation of lectures and seminars and, in schools, students followed this practice: all students said they did all their preparation — lesson plans, worksheets, evaluations etc — on their computer. This was seen as a great time saver and, equally importantly, students felt that this was 'expected' of them by the school pupils. PGCE students clearly felt that their materials should be produced to a good standard because pupils were used to well-presented material in the media. They felt that it would devalue the subject if material were poorly presented.

The interviewees were clear that having basic IT skills is essential to self-confidence. They felt strongly that they should be given help with learning about IT in the classroom and that this could be integrated into the normal university subject-based sessions, perhaps with an IT specialist working with the subject tutor. The example set by tutors is important: many students commented on the encouragement given by tutors and they felt it was good that they had seen materials prepared using IT as it gave them good ideas for their own preparation. Pupil-motivation was recognised as an important feature of IT but, more unusually, students themselves felt motivated by IT and most enjoyed the fact that pupils sometimes appeared to know more about IT than they did. IT was seen as increasing the pupils' self-worth and as directly beneficial to both pupil and student teacher. One student said, "IT engages their attention and is more interactive. IT is such an important element [of learning], it lets you do things in new and different ways - this is important, pupils can be inspired to a better view of English and see it as relevant to them."

Students recognised changes in teaching and learning styles when using IT, although most think of changes in teaching style in limited terms of differences in class management. Few considered changes in their behaviour without prompting and then only in limited terms - probably an indicator of their inexperience. There was marked disagreement between students about whether using IT makes classroom

management easier or harder. Those who found it harder tend to think in terms of room design, seeing the backs of pupils' heads, and problems with the physical side of the technology such as leads falling out, printing problems and so on. Those who felt it was easier tended to talk about pupils being absorbed in their work, sharing problems, teacher talking 1:1 with pupils etc.

Conclusions

Prior experience was, without doubt, a major factor influencing the students' attitude towards IT and their ability to make quick progress with relatively little direct intervention. PGCE courses are notoriously overburdened and it seems difficult for students to make a 'standing start' in IT: the 'flying start' given by prior experience is a huge advantage. Experience in schools also varies considerably, both between schools and between departments within a school. English students were likely to get little encouragement to deal with the school IT system; business students were expected to be closely involved in teaching IT. We would suggest that all students not teaching IT as part of their normal timetable should have to work as a classroom assistant in one IT lesson per week in the lower school. This would not involve planning or assessment, but would enable them to develop confidence in their own abilities in a relatively safe, but focussed setting.

Making use of pupils' knowledge of IT was generally felt to be beneficial for all concerned, although it is recognised that student teachers need to be secure in their place in the classroom to make full use of it. The mutual learning which can take place in such settings was positively encouraged by most schools and, from the student viewpoint, it was felt to encourage good relationships in the classroom.

Relationships with pupils were an important factor in issues around classroom management and control when using IT. Students who were, perhaps, less sure of their class management skills felt threatened by pupils facing the monitors rather than facing the teacher. This is, in part a function of how rooms have been adapted to house computers — typically with the computers on benches running round three walls, leaving the centre of the room for tables for non IT work. Conversely, the ability to see all the monitor screens in this arrangement was seen as positive by more confident students.

Our constructivist hypothesis that students will build on prior experience and knowledge of IT has been borne out. Students are at a conjunction in their teaching career where situation (the two schools where they spend the majority of their time) and context (government requirements regarding IT competences) matter significantly.

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