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ABSTRACT

This document contains the papers on preservice teacher education from the SITE (Society for Information Technology & Teacher Education) 2001 conference. Topics covered include: preparing tomorrow's teachers; insights for pre-service teachers about computer use; geographic information systems in teacher education; digital cameras in education; integrating technology in research courses for preservice teachers; a computer-assisted coeducational and transdisciplinary experience; technology integration in reading and science; preservice teachers' experiences in a technology-rich urban K-12 school setting; unique collaborations in preservice teacher programs; the evolution of a curriculum in technology and pedagogy; multiple delivery systems; a Holocaust World Wide Web site; creating collegial networks; cooperative teaching and learning in information technology (IT) and modern foreign languages; analyzing bilingual education preservice teachers' learning outcomes in a computer literacy course; the next generation of professional development; the role of IT in the classroom and its implications for preservice teacher education; a planning model for integrating technology and educational methodologies in the preservice teacher education program; curriculum models for computing and IT; economics, information literacy, and teacher education; constructivist use of technology; understanding the leadership role in promoting reading outside the classroom; technological capacities of distance education teachers; standards-based reflection; anchored instruction using WebQuests in post-baccalaureate teacher education courses; virtual learning, Web videos, and elementary mathematics teacher education; teacher education changes, transitions, and substitutions; graphic representations for learning; observations of the computer use of preservice teachers; using Dreamweaver 3 for generating preservice Web-based teaching portfolios; perceptions of preservice teachers' technology competency skills in Arizona; learning with Internet resources; culture clash in the college classroom; using multimedia and technology to teach mathematics and science; preparing teachers to succeed in online professional development courses; empowering teacher through cognitive literacy skills development; teacher preparation and online learning; addressing teacher concerns toward technology; technological tools

and mathematical guided discovery; the R.O.A.D. (Read, Own, Apply, Discuss) system for enhancing teacher professional growth; building a professional cyberspace community; Internet use in teacher education; student teacher educational technology use; a collaborative teacher preparation technology project; educational technology at the University of Florida; assessing faculty attitudes toward information technology; a collaborative approach to integrating technology and information literacy in preservice teacher education; PT3 (Preparing Tomorrow's Teachers to use Technology) first year accomplishments; reducing distances between colleges via Web CT; technology and problem-based learning; effectiveness of an exemption exam for an introductory educational technology course; and a computer endorsement program. Most papers contain references. (MES)

# PRESERVICE TEACHER EDUCATION

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This year's submissions in the area of Pre-service Teacher Education fell into three broad themes: Integration, Collaboration and Information Literacy. By far the largest of these categories was *Integration*, a theme that carried over from years past, and continued to be of major importance. This theme included papers reporting on pre-service teachers learning and using technology in education classes to enhance their own learning and modeling inclusion of technology in their own practice, as well as papers reporting on faculty and colleges' inclusion of technology when teaching courses. The area of *Collaboration* included papers reporting on pre-service teachers work with in-service teachers, and university personnel collaboration with in-service teachers, community colleges, other universities, government agencies and/or local schools. We introduce *Information Literacy* this year as a new category of papers that concern efforts to facilitate students' use of technology to gather, manipulate and evaluate information. Subtopics in this area included the development of technology skills aligned with the National Educational Technology Standards (NETS), development of cognitive skills, and employment of technology applications to facilitate learning.

## Integration:

Several areas came together under the umbrella of Integration. Kilbane (University of Massachusetts, USA) & Gartland (University of Virginia, USA), Schepise (University of Central Florida, USA), and Zembal-Saul & Gimbert (Pennsylvania State University, USA) discussed theories and practice for pre-service teachers learning about and using technology in college of education methods courses as a tool to enhance student learning. Hartle (University of Central Florida, USA), Wilson (Langston University/ Tulsa, USA) and Swain, Foti, & Dawson (University of Florida) outlined developmental changes in teacher education programs where an increasing emphasis was placed on the inclusion of technology instruction in educational methods and foundations courses. Ferguson (University of Northern Colorado, USA) focused specifically on the role of the inclusion of technology in anchored instruction. While Mize, Purkiss, Burleson, Gibbons, & Mann (West Texas A & M University, USA) called for the seamless integration of technology in pre-service teacher instruction, Keating & Evans (Boston College, USA) stated, in direct opposition, that technology should not be seamless, but explicit.

Runyon & Rose (Robert Morris College, USA), Rose & Runyon (Robert Morris College, USA), Rose & Winterfeldt (University of Wisconsin Oshkosh), Molebash (University of Virginia, USA), Ramirez & Bernard (University of Texas-Pan American, USA), Grable (NC State University, US), Keely & Sjoerdsma (Calvin College, USA), Rubio & Sedersten (Albion College, USA), Duran (University of Michigan-Dearborn, USA), Bober and Dodge (San Diego State University), and Brown and MacKinnon (Acadia University, Canada) all stressed modeling the use of technology to enhance pre-service teachers' learning. Each provided for the integration of the technology in their practice for the enhancement of student learning. Gibbons & Burleson (West Texas A & M University, US) and Cook (Notre Dame, USA) provided a rationale for the inclusion of technology in education courses as models to be emulated by students. Hutchinson, Sherron, Lynch, Mary & Mary (University of Central Florida, USA), Chen & Cmajdalka (University of Houston-Downtown, USA), Chatterton & Willan (Sheffield Hallam University, England), Casey (St. Bonaventure University, USA), Baker (St. Vincent), Anderson (Shippensburg University of Pennsylvania, USA), Almeida (Universidade do Minho, Portugal), Alibrandi, White, & Hagevik (North

Carolina State University, USA), Dickey & Dickey (Eastern Kentucky University, USA), Calandra & Fitzpatrick (University of South Florida, USA), Amber (National University, USA), Chatel (St. Joseph College, USA) and Norwood (North Carolina State University, USA) reported situations where modeling has been implemented by embedding the technology in methods instruction, each for specific areas of the curriculum. The inclusion of specific technology applications was of interest to those wishing to broaden the use of technology in instruction. Gao (Purdue, USA); Anguita, Osuna, Martinez & Dimitriadis (Universidad de Valladolid, Spain); Henry & Crawford (University of Houston-Clearlake, USA); Baker (University of Missouri, USA); Luca (University of Massachusetts Lowell, USA), Flake (Florida State University), Albion (University of Southern Queensland, Australia), Johnson, Ertmer, & Lane (Purdue University, USA), Wentworth & Monroe (Brigham Young University, USA) and NEWT.com all outlined the use of specific inclusion examples. In this same vein, Bynum & Considine (Indian River Community College, USA) discussed the use of distance learning to model technology integration in teacher education. Kaplan (University of Central Florida, USA) examined the strengths and weaknesses of instructional technology in a discussion of the cognitive and affective aspects of online learning.

Barrclay-McLaughlin & Nonis (University of Tennessee, USA) and Ragan (University of Wisconsin-Greenbay) called for the integration of technology not only in university classroom environments, but also in the practice teaching environment with the placement of interns in technology rich schools.

One paper in this Collaboration category, White & Sprague (George Mason University, USA), bridged the areas of integration and collaboration with a report on the elimination of a single educational technology course and the inclusion of technology skills instruction in all college of education foundation courses using collaboration between technology faculty and foundations area faculty.

## Collaboration

Collaboration is an area that continued to be of importance in pre-service teacher education. Golden & Erb (Mariatta College, USA), Dutt-Doner (University of Southern Maine, USA) & Powers (Indiana State University, USA), Kerr (Brock University, Canada) & Slepkov (district School Board of Niagara, Canada), and Myhre (Western Washington University, USA) reported on projects where collaboration occurred between pre-service teachers and active classroom teachers. Technologies used included video and e-mail to enhance communication among all participants.

Another area of collaboration involved interaction of the university or college with community colleges, other universities, government agencies and local schools and community groups. Coe & Land (Midwestern State University, USA) described a collaborative effort between the university and in-service teachers in the community. Projects of both Begeron, Wenhart, Hopper, & Barrett (Arizona State University East College, USA) and Sheinkopf (Florida Solar Energy Center, USA) & Krupp (Brevard Community College, USA) involved collaborations of upper level schools of education with community colleges. Sheinkopf & Krupp, Hoffman (Eastern Michigan University, USA), Roempler (Eisenhower National Clearinghouse, USA), Mardis (Merit Netork, US), Wiley & Recker (Utah State University, USA), and Banks & Traxler (St. Mary's College, USA) all described collaborative efforts especially designed for the enhancement of science instruction by providing added background instruction or information for teachers. Verkler (University of Central Florida, USA) described a collaborative project that involved language students in the US collaborating with students in France and Spain using technology as the communication tool, thus providing not only a model for collaboration, but also for technology integration.

## Information Literacy

Information literacy is a broad topic that embodied cognitive skills, the instruction in and use of applications for learning, technology skills and assessment of educational technology. Templeton, Warner & Frank (Westfield College, USA) provided an in-depth look at information literacy and the need for inclusion in all areas of pre-service education. Zhang (Washburn University, USA), and Jensen & Fowler (University of Nebraska-Lincoln, USA) examined technology language, "cyberjive," as an indicator of technology efficacy while Downs, Repman, Carlson, & Clark (Georgia Southern University, USA), and Hokanson (University of Minnesota) examined the background of entering pre-service teachers to ascertain skill needs. Two other presenters focusing on teacher technology training were Egan (Minnesota State at Moorhead, USA), who examined rural teacher technology skills, and Morton & Bollulo (Laval university, Canada), who presented the CAMITE model for technology training. Sanders (Winthrop University, USA) & Sanders (Lander University, USA) addressed the issues of information evaluation and cultural/racial diversity in resources.

Two PT3 Grant status reports were included in the category of cognitive skills. Pittman (University of Cincinnati, USA) reported on using technology to improve cognitive skills while Hoskisson, Thompson, Bass, & Holcomb (Valley City University, USA) reported on the use of technology and learning communities to enhance cognitive skills. Also in the area of enhancing cognitive skills, O'Rourke (Carlow College, USA) and dos Anjos, de Morales, Paas, & Barcia (Universidade Federal de Santa Catarina, Brazil) provided descriptions of the cognitive skills that distance learning requires and offered ideas for

facilitating the development of these skills. Williamson (Brown University, USA) presented an argument for the use of technology at higher levels of Bloom's taxonomy than currently seen in most instruction where technology is employed merely as a tool. Inquiry learning and culture clash were the focus of two more presentations (Morgan [Bemidji State University, USA] & Bender-Fayette [Horace May Elementary, USA] and McClelland [Kent State University, USA]) where cognitive skills received particular emphasis. Dils & Ayre (King's College, USA) applied digital video in a constructivist environment for pre-service instruction, thus modeling the integrated use of technology in the classroom; Bennett (Navajo Education Technology Consortium, USA) presented another digital video project designed to assist pre-service teachers in the development of skills necessary to use this tool in the classroom; and Austin (Black Hills State University, USA) tendered a model for the use of Palm Pilot PDAs for faculty supervising intern teachers.

Focus on NETS and development of pre-service teacher technology skills were integral themes in Deek & Kimmel (New Jersey Institute of Technology, USA), Madison & Hutchinson (University of Wisconsin-Stevens Point, USA), Wiencke (State University of West Georgia, USA), Melczarek (Troy State University Dothan, USA), Young (Indiana University South Bend, USA), Gregory & DeTure (Rollins College, USA), Ku, Hopper, & Igoe (Arizona State University, USA), McCoy (University of Alaska Anchorage, USA), and Jones (University of Sunderland, United Kingdom). In these presentations, differing emphases were placed on NETS skills with varied program ideas for development of learning opportunities to enhance these skills.

Assessment and evaluation of technology instruction provide valuable insight into what works. Lou & MacGregor (Louisiana State University, USA) examined the use of WebQuest in instruction in terms of its capacity to provide guidance for learning, as well as enhancement of motivation when employed in a cooperative learning environment. Other assessment-focused presentations included Seed (Northern Kentucky University, USA) and Schnorr, Burnell, Robertson & Cope (California State University, San Bernardino, USA), where Seed examined the theoretical concerns of technology implementation in a university college of education and Schnorr et al. looked at the transfer of technology instruction to actual practice. Faculty attitudes provided the focus for Szware (UNIP, Brazil), while in-service teacher concerns and the need for a concerns-based training model drove theory presented of Rakes & Casey (University of Louisiana at Monroe, USA). Finally, Connell (NTU, Australia) examined the role of Instructional Technology as it may be altering teaching techniques and philosophies to such an extent that it must impact on pre-service training.

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# Beyond the Status Quo in Preparing Tomorrow's Teachers

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**Abstract**: This paper presents a case for rethinking the existing paradigm of the personal computer in educational technology. In particular it examines the nature of failure, the evolution of technology, and the general lack of acceptance of educational technology in today's classrooms. The paper asks the question what is the role of teacher educators in the development of new technology implementation paradigm, and provides a rationale for a more critical analysis of existing educational technologies.

## Introduction

In his book the Evolution of Useful Things, Henry Petroski suggests that failure is the fundamental principle by which products arrive at their form and function. When a product fails to meet expectations it either evolves or becomes extinct. Laptop computers offer an example of Petroski's notion of failure driven product evolution. Early portable computers were heavy, cumbersome and limited in power. These properties failed to meet the expectations of mobile users. The failures led to lighter, smaller and more powerful laptop designs. Does Petroski's product evolution hypothesis generalize to other areas of technology such as educational technology? Are the products and processes of educational technology evolving? The relatively rapid obsolescence of school computer labs suggests that the answer is yes. Product failure has played an important role in the evolution of educational technologies. However, if form follows failure as Petroski suggests, does twenty years of technology evolution and the resulting lack of acceptance of educational technology by the majority of classroom teachers constitute a deeper form of failure?

A view of "normal" science may prove useful in understanding deeper forms of failure. Kuhn (1970) noted that much of the knowledge in scientific fields involves puzzle solving - elucidating anomalies to fit an existing paradigm. When the solutions no longer fit the paradigm, they generate a crisis. The existing paradigm no longer explains the phenomena adequately and the potential for a shift to a new paradigm increases.

Is there a view of "normal" in educational technology? What is the accepted paradigm in educational technology? Since the field encompasses numerous technologies, proposed here for the sake of simplicity is a "normal" view that focuses on one common educational technology - the personal computer (PC), in particular the application of the PC and its software as the common paradigm for the classroom implementation of technology. The benefit of this viewpoint is that it provides both a recognizable paradigm with identifiable methods and an opportunity to revisit Petroski's notion of failure and evolution.

Twenty years of technological advancements have supported the paradigm of personal computers as the primary tool for the integration of technology into classroom teaching. Each new version of PC is faster, more powerful, and in many cases less expensive than its predecessor. Still, despite PC advancements, many teachers cannot justify the time and effort required to integrate PC technology into their teaching. and the cost of accessibility is still beyond the grasp of many schools( Dias, 1999).

If a historian traces advances in educational technology backward for the past twenty years, she is likely to find puzzle solving incremental changes akin to those offered by Kuhn's "normal" science. Incremental changes are evolutionary. They gauge progress. They clarify methods and importantly in the case of educational technology they proved instrumental in introducing technology into classroom instruction. Clearly, history shows that problems/failures have been overcome. Early personal computers were slow, the

solution was to make them faster. Second generation PC's lacked adequate the memory to run complex software. Their descendants gained memory. When teachers and their students needed improved access, PC labs were institutionalized. When teachers suggested that the PC's were too difficult to use, professional development was provided. In these and other instances immediate problems were identified, addressed and solved. All of these advancements fixed problems encountered with educational technology but none solved a key problem evident in the PC paradigm. Even with access to advanced equipment teachers seldom integrate PC's into their teaching.

Is it possible that educational technology evolution efforts have been misplaced? Probably not. The PC paradigm in education followed a path analogous to the one encountered by business users. Only now are standards for educational use entering the mainstream. Even with an absence of educational failures, the PC was destined to evolve as a function of business and economic forces. Nevertheless, the educational community has not asked, "Does the PC as an implementation paradigm fit the work environment and goals of teachers and students?" If the answer to this question is yes then educational technologists simply need to identify failure points, correct them and watch technology evolve. If, however, the paradigm does not fit the goals and environment of the intended audience then no amount of failure, puzzle solving, or evolution will correct it.

Is there evidence to suggest that the PC paradigm is flawed? Seminal research suggests that a wide cross section of middle school teachers do not perceive existing educational technologies as supportive of their classroom teaching (Abate & Jin ,2000). The results are preliminary but revealing. It has been documented elsewhere that lacking a job-imposed requirement, individuals are not likely to use tools that they perceive to make their work more difficult (Ehn, 1993). As failures of technology become more prominent and the public begins to question the efficacy of educational technology (Stoll, 1995) it becomes increasingly important for teacher educators to consider alternative educational technology paradigms.

What is the role of teacher educators in the development of a new technology implementation paradigm? In most professions the design of tools takes into account the work context of the user (Kuhn, 1996). In the field of educational technology few reports discuss the design of the technological tools available in typical classrooms. This is understandable. Most educators are not designers of educational technologies. However, in other fields, medical equipment for example, medical personnel work closely with designers to produce technologies consistent with their work environment. In the design of office furniture, ergonomic experts work with office staff to provide solutions unique to office workers needs. Even in recreation, biomechanics experts work with athletes to design foot apparel for specific sports. The precedent for collaborative design exists should teacher educators choose to assume the role of learning technology designers. One approach is for teacher educators to join forces with classroom teachers to take a more active role in the design of classroom technological tools. The alternative is to continue the present course, a course where existing technologies are adapted for the classroom, and the learning environment is adapted to meet the requirements of the tools.

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# Talking with computer-using teachers: Insights for pre-service teachers

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**Abstract:** Access to models of appropriate practice is an important aspect of pre-service teacher preparation. Multimedia materials can be used to supplement uneven field experience. The project on which this paper is based included materials prepared by and interviews with ICT-using teachers. Analysis of the interview transcripts and trials with the CD-ROM confirms that the interviews are likely to be effective in presenting pre-service teachers with appropriate messages about the use of ICTs in teaching.

The development of teachers' capacity to work effectively with information and communications technologies (ICTs) in their classes is influenced by many factors. Clearly access to, and personal skills in the use of, appropriate hardware and software are important. Another important influence is access to appropriate examples of teachers who work with ICTs.

The importance of modeling for professional development of pre-service teachers in respect of computer use has been argued in previous studies (Albion 1996; Becker 1994; Downes 1993; Sherwood 1993). For students in teacher education programs, the logical context for encountering these teachers is field experience. However, pre-service teachers have reported seeing little use of ICTs during their field experience (Albion 1996). Hence, various researchers (e.g. Albion & Gibson 1998; Chambers & Stacey 1999) have proposed the use of interactive multimedia to present accessible and appropriate models of teaching including the use of ICTs.

Previous papers have described aspects of the design (Albion & Gibson 1998) and development (Albion 1999) of the *Integrating Information Technology into Teaching* CD-ROM (Gibson & Albion 1999), which presents a set of problem-based scenarios related to planning for the use of ICTs in primary school classrooms. An important goal in the development of these materials was to provide pre-service teachers with access to appropriate models for the integration of ICTs into their curriculum planning by having a small group of teachers provide sample responses to the tasks embedded in the materials. As part of creating a context within which the examples might be better appreciated, video of interviews conducted with these teachers was also included in the materials. In an evaluation of an early prototype of the materials a majority of participants nominated the video interviews as their favorite element (Albion & Gibson 1998). Hence the content of the interviews was analyzed to determine what messages might be conveyed to users of the materials. This paper reports on some results of that analysis and some responses of participants in trials of the completed materials.

## The Computer-Using Teachers

Seven teachers (4 female and 3 male) cooperated in the development of the multimedia materials. The author invited four teachers after they had presented aspects of their work with computers at a local professional development activity. When their schools were approached for permission to film, one of the principals suggested two additional teachers from his school. Finally a recent graduate who was known to be commencing an Internet project with a class was invited to participate.

Their teaching experience ranged from beginning teacher to as many as 20 years. The class levels being taught at the time of the interviews varied from Years 1 to Year 7 and the arrangements for computer access varied from laboratories to one or more computers in the classroom. For the purposes of the materials, the teachers were identified by pseudonyms and these are used in the following brief biographical notes.

**Carla** was a secondary teacher who was working part-time as a specialist computing teacher with children in Years 3 to 7. She took groups of children for weekly classes in a ten-seat computer laboratory and had some responsibility for assisting other teachers to develop skills and adapt curriculum to integrate computers. **Julie**

was commencing her first teaching appointment and had arranged for her Year 4 class to participate in an Internet Travel Buddy project with a class in New York State. She had access to a single computer in her classroom. **Karen** was an experienced teacher who had been using the Internet with her class for several years. Her Year 6 class shared a mini-laboratory of five computers with the class in the room next door. **Ken** had more than 16 years teaching experience and was active in his local computer using teachers group. He had a single computer in his Year 4 classroom. **Matt** had 15 years teaching experience and a strong local reputation for innovative uses of computers in his teaching. He had two computers in his Year 7 classroom. **Neil** had twenty years of teaching experience but was a relative newcomer to using computers in his teaching. His Year 4 class in one end of a double teaching space shared five computers with the other class in the space. **Robyn** had been teaching for 4 years and was studying a masters degree majoring in educational computing. She regularly took her Years 1 and 2 class to a 15-seat computer laboratory, which she managed for the school.

There is no suggestion that these teachers are necessarily typical of computer-using teachers, nor that they are a representative or random sample. They were invited to participate in the project because they were known to use computers or were suggested by a peer or principal. They present a sufficiently varied group to avoid any suggestion that there is a preferred stereotype of the computer-using teacher. The interviews were conducted in the teachers' classrooms using a common schedule of questions (Table 1) with supplementary questions or prompts used to clarify meaning where necessary. The teachers' responses were videotaped and later transcribed. The digitized video and transcripts were included in the multimedia materials.

**Table 1:** Schedule of interview questions

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|---|---|
| 1 | How did you learn to use computers in your teaching? |
| 2 | What made you chose to use technology in your class to supplement traditional approaches? |
| 3 | What type of factors do you have to consider when planning for technology use in your classroom? |
| 4 | What classroom management factors must be considered with the addition of computers to your classroom? |
| 5 | Where do you go to get support, ideas for technology use? |
| 6 | How does the integration of technology into your classroom assist in achieving the objectives you set for your students? Have the objectives you use changed in any way? |
| 7 | What differences have you noticed in outcomes for your students following the integration of technology? |
| 8 | What impact has the use of technology had upon your own approach to teaching? |
| 9 | What implications do you see for your classroom as a result of connecting to the Internet? |

## Emerging Themes

Analysis of the responses was undertaken manually using a constant comparative method. Although the responses were directed to the questions, common themes were identified across responses to different questions. Six major themes, each with several sub-themes, emerged (Table 2).

**Table 2:** Major categories emerging from interview analysis

| Category | Description |
|---|---|
| Purpose | Statements which offer explanations of the decision to use computers in teaching |
| Development | Statements about training and support for computer use |
| Method | Statements that comment on practical aspects of working with computers in classrooms |
| Impact | Statements about the ways in which using computers has affected the teacher or children |
| Issues | Statements about problems or challenges associated with using computers for teaching |
| Internet | Statements which offer a view of the Internet and its significance for education |

### Purpose

Although all seven teachers were dealing with children who were at least 4 to 5 years from entering the workforce, all but one made statements which related the importance of computers in education to future

employment. Almost half of the statements about purpose related to future employment or study. Julie suggested that the skills she would teach her nine-year olds were "*the same skills that they'll learn when they're in high school, when they want to write reports for university, or in the work force.*" Karen thought that her twelve-year olds "*could use some of the things they have done, for instance, if they were looking for a job*", although she added that looking for a job was unlikely at their age.

Five of the teachers appeared to regard technological advance as inevitable but ascribed no particular educational value. Neil said, "*Technology is a thing of the future. Kids need to have a basic idea of computers because they're going to be what everybody's going to be using in the future.*" Ken chose to use ICT because "*it's available and, if we don't we're certainly behind the eight ball and it's just the way of the future.*"

Even when they referred to the educational potential of computers it was often undefined as in Carla's suggestion that computers provide "*such wide scope for the children*" or Julie's choosing to use technology "*because it was something different*". Only Matt was able to articulate the value of ICTs as "*a way of enhancing the curriculum*" and supporting other aspects of his work with his class. Nevertheless, as is evident in the statements coded under other themes, these teachers were strongly committed to a variety of educational applications of computers.

**Development**

Issues associated with learning how to use computers in teaching or obtaining support for their use loomed large in the minds of the teachers. More statements were coded under the theme denoted by *development* than in any other, indicating the importance these teachers accorded to ongoing learning. That theme also had the greatest number of identified sub-themes, suggesting an openness to a variety of sources of learning.

The most mentioned source of professional development was a variety of activities that the analysis grouped into a sub-theme labeled as *networking*. Ken said, "*I talk to other people. I steal ideas from other people and they steal ideas from me*", although he was probably using "steal" in a metaphorical sense. Robyn spoke of building a network of friends, locally and through the Internet, for mutual support and commented that the "*increased interaction with other teachers is very beneficial*".

A second major source of development was tagged as *experience*. Julie referred to her learning to use computers as a "*learn as you go sort of thing*" and Ken spoke of how he "*played around with them on Christmas holiday*" and of "*trial and error*". Karen "*just kept using it and teaching* (her)*self and using it with the children, and learning with them which was very good.*"

Children are often described as developing confidence with ICTs more quickly than adults. Julie and Ken noted this and Julie referred to teachers "*not wanting to try to use the computer in their classroom because they just don't think they have the knowledge.*" In Karen's class "*there were quite a few very good computer children and they taught* (her) *what* (she) *needed to know.*" Robyn was open to learning with or from children:

> *Don't expect to know everything. Or to always be the person who knows the most. There will always be children in the class who know more than you. Use them. Make them a part of the team. They'll love showing their skills off and you'll love learning from them. You build a really good relationship.*

**Method**

Key ideas grouped within this theme included teaching *with* rather than *about* computers, integrating ICTs into the curriculum, and managing the complexities of matching among children, computers and curriculum. Despite the challenges, these teachers managed to maintain a focus on the educational value of the activities rather than on using ICTs for their own sake or as a "filler" when students completed other activities.

Matt said, "*I don't think it's appropriate that you build your curriculum around technology, but that the technology fits in with the curriculum.*" He described how he had equipment "*set up in the classroom in such a way that* (he could) *monitor what the kids are doing.*" Robyn described her management strategy as being

> *to always have open ended projects so that children; the brighter ones, the faster ones can always just do that little bit extra on their work. You don't ever want to have the children finish and that's it. Or go too far ahead of the rest of the class. So it's best to have open-ended projects and they can work on it.*

### Impact

The most commonly cited *impact* of ICTs was enhanced motivation of teachers and children. Ken described his reaction after he had purchased a home computer: "*I kept coming to school and saying 'Look what I can do, look what I can do, look what I can do!'*" His enthusiasm spilled over to his class, resulting in "*a lot of keen kids who enjoy being on the computer in non-school time and doing school tasks in the school time.*" Julie found that her Internet project impacted motivation in her class:

> *Andrew yesterday was writing this report and he didn't want to do it and I said this has to go to the class in New York and his face lit up and he was saying "Oh, it has to be my best hand writing and my best spelling" and then he had his best handwriting and everything and he was so proud of it then because it was going to someone else and he had a real audience.*

Ken found that his new skills increased his efficiency so that where he "*used to spend a lot of weekends making charts*", he could "*go to the computer at home, whip up a very professional chart, blow it up to A3 and it's done.*" Robyn found that the computer allowed her to "*get to children that normally won't click onto the idea.*" Both Robyn and Karen noted improvements in the quality of work done by children.

Another frequently mentioned *impact* was professional growth. Matt described how using ICTs had allowed him to "*learn a lot of bits and pieces about teaching*". Robyn spoke of moving away from "*chalk and talk*" but the major impact for her was enhanced professional interaction:

> *I feel like I've enjoyed meeting and getting to know many more teachers than I probably, ordinarily, would have because teachers who are interested in technology tend to talk about it more. They get excited about what they're doing and they start asking things like "Have you tried this?" ... So there's a lot more interaction, a lot more talking and teachers tend to build up a network of friends around the area.*

### Issues

Very few of the statements coded for the *issues* theme related to technical aspects of computer use. The most frequently mentioned issues were concerned with the acquisition and management of physical resources and time. Matt cited placement of computers as a key issue and Julie described some factors she had considered in deciding where to place her computer in the classroom.

Managing access when there were many more children than computers was typically resolved through the careful allocation of time using timetables or rotation of groups. Robyn and Neil both referred to using parent volunteers to facilitate their own time with children. As a beginning teacher, Julie was struggling with the balance between group and whole class activities:

> *I'm finding it hard at the moment when to decide when its OK for them to be on the computer and not being in the lesson and when they have to be in the lesson. Like sometimes I might send them over and a few seconds later I realize that they needed to hear that.*

### Internet

Most of the statements about the *Internet* referred to it primarily as a means of communication. However, the object of that communication was often access to information. Julie had explicitly described the Internet to her class as a community in which they were participating. Robyn compared the Internet to a

> *global village. The children get to know other children around the world through e-mail or through live chats. And it doesn't become a case of "us and them" any more. They relate to these children and understand that they're just children like themselves.*

Carla viewed the Internet more as a source of information and suggested that, as a result, "*encyclopedias are now out of date.*" Matt referred to both communication with children elsewhere and to the capacity of the Internet to provide his class with a "*taste of the world*" although the existence of "*good and bad points*" required him to "*manage the bad points a little bit.*"

## User Response

The multimedia materials were tested in use with a group of 22 pre-service teachers studying an elective subject related to the application of ICTs to teaching. As in the earlier study with the prototype (Albion & Gibson 1998), a majority of users (15 of 22) identified the video interviews as their favorite element of the materials. Data gathered using journals kept by users revealed that some users had spent a large proportion of their time with the materials (mean = 6 h) reviewing the video materials.

Several of the users indicated that the materials had exposed them to ways of thinking like a teacher about computer use. One pre-service teacher commented on the access to experiences that had not been available during time spent in schools. Other comments recorded changed ways of thinking about computer use away from seeing it as applicable only in mathematics classes, as a weekly skill lesson or as a filler activity when students had "spare time". These users reported changing their views to see the potential of computers as being capable of almost constant use across a variety of curriculum activities.

Participants in the study valued the insights offered by different teachers. One student noted the inclusion of "*alternate responses to the same questions – different doesn't mean wrong.*" Another wrote in a journal about the first scenario, "*The interview with Julie was great – helpful to have an actual insight on the use of technology.*" In an interview at the end of the trial a student commented on how the video interviews had given him "*a bit of enthusiasm, a bit of excitement to see computing technology can be used in a real and practical way.*"

## Discussion

Taken as a whole, the ideas expressed by the teachers in their interviews were consistent with the research about computer using teachers. Studies of exemplary computer-using teachers have found that they tend to de-emphasize teacher-centered activity in their classrooms in favor of more student-centered approaches consistent with constructivist theories of education (Becker 1994; Hadley & Sheingold 1993; Honey & Moeller 1990; Sandholtz, Ringstaff, & Dwyer 1994; Sherwood 1993). Teachers' use of computers and the Internet have been found to be related to their learning from or with students, orchestrating multiple simultaneous activities in class, assigning long and complex projects and giving students greater choice in tasks and resources (Dexter, Anderson, & Becker 1999).

The teachers in this study appear to have moved beyond a view of "teaching as telling" and to have accepted that one of their roles as teachers is to model the processes of lifelong learning. This is evident in their commitment to professional development and their willingness to learn from the children in their classes. There was an emphasis on teaching *with*, rather than *about*, ICTs. Ken spoke about how the use of computers had increased the enthusiasm of children for their work. Julie, Matt, Neil and Robyn spoke about the integration of ICTs to support the curriculum rather than as either an addendum or a central focus and described student-centered activities

involving multiple simultaneous activities in the classroom. Matt set up equipment so that he could monitor the work of multiple groups. Robyn advised the use of open-ended projects to enable children to extend an activity.

The pre-service teachers who participated in the trial found the video of the interviews engaging because of the clear connection to the reality of classroom teaching. They were able to recall ideas from the videos and to articulate developments in their thinking about computers as a result of working with the materials. The interviews included in the CD-ROM appear to be an effective means of providing pre-service teachers with appropriate messages about the use of ICTs in teaching.

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# GIS (Geographic Information Systems) in Teacher Education

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**Abstract:** This paper introduces Geographic Information Systems (GIS) technology as a useful addition to other technologies being introduced in K-12 classrooms in the context of an experimental teacher education course. In the iterative course design, graduate students (classroom teachers) provided email feedback and input to inform instruction. An in-service teacher and two graduate student teaching assistants were part of the instructional team, as was a middel school student. Students in the process of learning GIS mastered many other related technological applications. From a wide range of backgrounds entering the course, all students were able to design original GIS projects, importing data from a variety of sources for integration with existing map projections. The projects relate to Social Studies and Science curriculum frameworks, and lesson plans accompany the map products. Qualitative data from email, quizzes and evaluations is presented along with student products and preliminary findings. The course runs again in Spring 2001.

## Introduction

Geographic Information Systems (GIS) are used in virtually all industries and government agencies that require spatial planning and/or problem-solving. Emergency 911, TV weather reporting, satellite imagery and communications using GPS (Global Positioning Systems), transportation and distribution routing, infrastructure and community planning all require spatial analysis and design flexibility. GIS combines data from data-based information with coordinates in a spatial layout or map. When the data are coordinated with a geo-coded field to locations in the digital map, the data can be instantly located in the spatial layout. Once located spatially, the data can be analyzed in different ways depending upon what other data is related to it. For example, if data from a town water distribution system can be geocoded using street addresses, the fire hydrants all across town can be made to app4ear instantly on a computer screen in a GIS. Now, to analyze the locations of hydrants needing routine inspection, a field can be created in the database to record the inspection and conditions of the hydrant. Those in need of repair can now be shown on a map in a contrasting color to indicate where workers will route their repair work for the coming month.

How and why would GIS be used in schools? Why introduce a teacher education course in GIS? Once introduced, what kinds of problems will teachers find intriguing enough to answer using a GIS project? How will teachers learn and teach with GIS? These are the questions that guided the course and our inquiries with student participants.

## Theoretical perspectives on GIS in Education

As billions of dollars are spent to infuse technology into US classrooms, the values of particular technologies will become more apparent. Because GIS is ubiquitous in industry and government, students with these skills are in high demand (Alibrandi, 1998). Beyond employability, the rationale for GIS in schools is potentially more transformative. GIS analysis represents an opportunity for students and schools to provide real research-based service to their communities. Attendant with this potential is also an important responsibility to apply the technology ethically and responsibly. This implies an ability to take a critical perspective on the technology, on the nature of representation and its attendant biases, and to be able to describe those limitations and biases while presenting information in a GIS format. We have

written about the need to ground virtual applications in actual experience, to apply a critical perspective on the technology in order to ethically apply the technology to community problems.

Based on Pickles' (1995) Ground Truth; Social Implications of Geographic Information Systems, several students selected projects in which they analyzed race and ethnicity data from the Bureau of the Census. One advanced student developed a voter precinct problem that became more relevant in light of the 2000 presidential election. By framing the learning of GIS in a critical perspective, the students (pre- and in-service teachers) became interested in addressing social issues using GIS.

## Notes from the Field

Data for this preliminary case study derive from emails sent by students. Students taking the course for graduate credit were asked to reflect upon their learning processes through weekly questions posed on an email list that was an important means of communication for the class. Students shared their thoughts with us as instructors, and also often did so with their peers. As mastery improved over the semester, students used email to announce newfound resources or strategies to one another. This became an important source that informed course design. In GIS departments, the new landscapes of distributed cognition and expertise is common. We responded to student mastery by including it in the instructional design. As students discovered new ways to overcome problems, we asked them to share these strategies with the class. In this way, we modeled teaching with technology in a more democratic, collective and co-constructive environment. We experienced the discomfort of having to problem-solve on the fly with students; we couldn't always provide the answers to their problems, but we respected all who found solutions and immediately incorporated their learning to be shared with the whole group.

This model of teaching is not familiar to students and at times the cognitive dissonance over not always having an answer created frustration and productivity gaps. The gaps were places in which other students' strategies and findings could be inserted into this highly experiential and problem-based approach. As students hared their projects, problems and solutions, unanticipated dynamics and new levels of technical expertise were achieved that surpassed the instructors' expectations and in some areas, our abilities. This also is an artifact of teaching with technology that becomes useful when incorporated into the instructional design.

## Preliminary Findings and new directions for research

As we review the gaps, we see opportunities for designing to address them. Where simple repetition is needed to routinize procedural operations of GIS software and its many related applications such as hotlinks, graphing, integrating data from various sources such as the Internet, GPS, video and still imagery, we see opportunities for process and product design. Identifying gaps will be important in the upcoming iteration of the course, collaborative group problems will move to the foreground, emphasizing actual experience will become a more grounded starting point, and a continuing inquiry into the learning processes of teachers as students will continue to iinform our design and research. Finally, as we build upon the projects of our students, a bank of GIS projects for teachers will become available to other teachers through web-served versions of GIS porjects. Once established, teacher access to GIS projects on a website in a limited version can to serve other teachers and communities to begin to manipulate GIS and see its potential for integration into existing curricula as well as to demonstrate applied GIS.

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# Digital Cameras in Education

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**Abstract:** Intended for convenience, digital cameras are an inexpensive learning technology schools may easily benefit from. Once captured, digital photographs are already in a universal format that makes them exceedingly uncomplicated to distribute and use with PC or MAC computers. There versatile usage makes including visual images in word processing documents, e-mail, class projects or on web sites effortless. Digital camera technology brings about a totally new innovative and motivational approach to teaching and learning.

Designed for quick and easy operation, digital cameras are one of the most inexpensive learning technology purchases a school can make . Though only a few years old it is already finding wide acceptance in many areas where images are needed to enhance projects. (See Figure 1).

Figure 1. Student projects

Digital cameras and traditional cameras are very much alike in many respects. The biggest difference is the way images are captured. With traditional films, they are captured on silver-based film. With digital cameras, they are captured on solid state devices called image sensors.

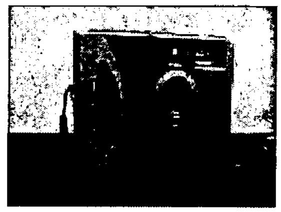
Once captured, digital photographs are already in a universal JPEG format that makes them exceedingly easy to distribute and use with PC or MAC computers. For example, you can insert digital photographs into multimedia projects, word processing documents, send them by e-mail to colleagues, or post them on a Web site, just to mention a few ways. With many cameras you can immediately see your images on a small LCD screen on the back of the camera, or you can connect the camera to a TV and show them much like a slide show.

Editing is simplified because once transferred, the images can be manipulated, digitally edited on-line, and then copied back to a variety of other software programs. Not only is it easy, there is no loss of image quality comparable to scanned photos. Once on the computer, you can also easily add audio, change the texture, change

the size or add frames. Images in digital form may also can be pieced together and pasted into other images. These composite images can be routine or funny. In fact, composting is done so often on television and in print advertisement that we're growing used to it. Digital is the universal format.

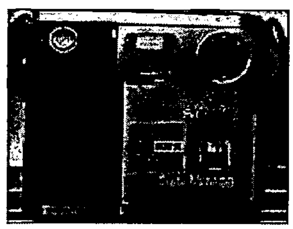
A convenient feature of digital cameras is that images are ready to post as soon as they are taken. The images don't have to be first processed and then scanned, as film has to be. This saves both time and money. Since most screens display only low-resolution images, the low-resolution of some cameras is no drawback. In fact, higher resolution images would be too big to post on most Web sites and would have to be reduced anyway.

Figure 2 **Earthlink DISCPRO Digital Still Camera**



The Arc soft photo base software available with this camera automates image transfer with a personal computer. It automatically starts image uploading whenever you connect the camera to your computer using a special USB cable. Uploaded images are stored in folders named according to the dates images are recorded. Images can be viewed on your computer using a standard Web browser, either as a group or individually.

Figure 3 **Sony Mavica Digital Still Camera**



The Sony Mavica Digital Still Camera (See Figure 3) stores picture images on a standard 3.5" HD floppy disk, therefore, no extra software is necessary. Each floppy disk holds approximately 40-50 pictures depending on the complexity of the picture image. The Sony camera has a playback menu option to view or delete any or all photo images without removing the disk from the camera. The floppy disk can be removed at any time and reinserted back into the camera without any problem. When the disk is full or you're finished with the desired pictures remove disk from camera and insert it into a computer. All picture images are stored by number of the order in which pictures were taken. Pictures can be viewed by opening each folder and used in a variety of ways. When finished with the picture images on the disks they may be deleted and the disk may be reused.

Point and shoot cameras as in the Earthlink DISCPRO, are generally small and inexpensive (at least in relative terms). They are fully automatic and usually don't provide a lot of overrides that give you creative control - that's why they are called "point and shoots." At the low end of this category are cameras with lower resolution whose images are limited to about 4 x 6 inches or so. Despite this small size, the images are ideal for Web pages and e-mail attachments

Positioned between the inexpensive point and shoot cameras and the very expensive professional cameras discussed next is a family of cameras based somewhat on the 35mm SLR model but designed exclusively for digital photography. This is the Sony Mavica camera. It is sometimes called a presume camera. It has 2-megapixels or more. Generally, the higher resolution is combined with more advanced features such as through-the-lens (TTL) focusing, various exposure modes, and manual overrides of otherwise

automatic controls such as focus and white balance. This is one of the fastest growing categories because these cameras appeal to serious amateur photographers and professionals who want creative control of their camera settings and prints up to about 8 x 10 in size.

The following projects used digital photos taken with either the Earthlink or the Sony digital still cameras.

## Projects

Project 1: This is a web site for a preservice graduate education class at National University in Los Angeles, California called CLD 605 The Diverse Classroom. On the web site there is a power point presentation or media gallery, which have a collection of images. There are writing assignments and class discussions designed around the images.

Project 2: Open House Fall 2000: This is a video developed for an open house presentation for students and their parents. Video consists of a collection of digital camera photographs of students engaged in class activities throughout the school year. The original work was developed on power point and then transferred to video.

Project 3: After school computer class: Students at Shandin Hills Middle School in San Bernardino, California completed this collection of presentations. Presentations will consist of student power point and digital camera projects.

Project 4: Gifted Students art project: Web site illustrating the art projects from a fifth grade class at Belvedere Elementary School in Los Angeles, California.

Digital cameras have many uses in the schools. Here are just a few of the most common uses in the average school.

1) school newspaper / newsletter -
2) year book -
3) open house / staff training presentations -
4) student projects / reports -
5) individual teacher and / or school web sites -
6) school dances / activities / sports -
7) field trips / class parties –

### Additional Web Sites References

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PC Computing How To Buy a Digital Camera
http://computershopper.zdnet.com/texis/cs/ddoframe.html?u=www.zdnet.com/computershopper/edit/howtobuy/C0000024/

Peach, J, 2000. Making Best Use of Multimedia, the internet and Video to enhance you instruction. Bellevue, WA. Bureau of Education.
http://www.peachboys.com

Photography in the Digital Era
http://www.photocourse.com/00/00-01.htm

# Tools of the Trade:
# Integrating Technology in Research & Methods Courses for Preservice Teachers

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**Abstract**: This paper examines and describes one approach of integrating technology into research and methodology courses for teacher education. Each course is complimented with a web site that serves as a virtual office and learning resource center. The instructor used the resources at Blackboard.com to build the framework for each site. They were designed upon the premise that it is acceptable to not under go a total systematic change in delivery but a hybrid where technology supports the learning environment is preferable. The courses have produced students that are competent and knowledgeable about the subject matter and technology, its use and instruction integration.

The true power and potential of computer based technologies lies not in the machine itself but in the prudent and appropriate use of software applications to gather, process and communicate information. Teachers; integration of these tools into the educational experience of students, including those with special needs, is crucial to preparing them for lives of personal, academic, and professional growth and achievement.

California Commission on Teacher Credentialing 1999.

It is this philosophy all teacher credential programs in California have been required to address in their approach of the implementation of new computer standards. With a multitude of skill levels & technology limitations, increasing how we implement technology in teacher education programs may first seem monumental. This paper explores one approach toward this task

The three classes discussed in this paper are; Research in Education, Foundations of Education and Cross Cultural and Multicultural Teaching Methods. They are established in a teacher credential program where students are completing a credential or working toward a master's degree in education.

There are several common denominators found in each group of students that enter the program. Each campus where the classes are held has a computer lab and all students automatically receive an email account upon enrollment. The students come to the program with a variety of skills in technology. The courses are taught in the standard face-to-face tradition where students are expected to attend each class meeting to receive general information and to have round table topic discussions. It is an accelerated pace with each class meeting twice a week for one month. Lastly, upon the first class meeting the students are introduced to the technology tools available to them in that particular class. When presenting class projects / presentations students are strongly encouraged to utilize technology in creative ways.

Each course is complimented with a web site that serves as a virtual office and learning resource center. The instructor used the resources at Blackboard.com to build the framework for each site. Courses on Blackboard.com have a unified appearance beginning with the same page layout starting each course. The first page of each course greets the user with icons on one section of the page that lead to various pages of documents, communication tools and video capabilities. The course sites make use of access to information on the Internet, synchronous and asynchronous communication. There are several other free, user-friendly resources educators may use to develop web sites. They all have similar features and are geared to accommodate a variety of skill levels. Blackboard.com was selected because of the ease for the novice computer literate student to utilize the supplemental information without having to surf the web. Everything is available at the student's fingertip.

Guiding Philosophy

The integration of technology is not an all or nothing approach. It is acceptable to not under go a total systematic change in delivery but a hybrid where technology supports the learning environment is preferable and comfortable to utilize appropriately (Bothel &. Enfinger,1999).

Knowledge is acquired through involvement with content instead of imitation or repetition. This allows for the horizontal transfer of skills, from the university classroom to the K-12 classroom. As content and technology share the goal of competence, technology should be taught in context, not in isolated tasks. It is important for the teacher education faculty to model the technology with proper usage. If we do not model effective uses than we are inhibiting the development of our students repertoire of teaching skills.

Key Features of Course Web Sites

Research Methods: The communication tool where students and teachers send documents is essential. The research classes are taught in a one-month format where much of the class time is based on individual meetings with the students. By using the web site, students may send the instructor drafts to review or submit at any time. This allows for the instructor to have more time with the students to discuss their drafts. The site also allows for external links where the instructor may post links to web sites which host quality research. Not only does this give students suggestions of where to begin their own research but it provides a bases for them to use in evaluating quality information found on the Internet.

Cross Cultural and Multicultural Teaching Methods: Discussion of the required reading is continued well beyond the classroom. Students are required to respond to questions about the material in the threaded discussion feature of the web site. Threaded discussions are a common feature of online classes with asynchronous communication. The participants have the opportunity to process or reflect on material before responding. This assignment can be extended where groups of students are responsible for summarizing and synthesizing the threaded discussion each week and distributing the results through email. Each course site has a quiz and test feature that may be incorporated in the class. This course uses this feature as a test your knowledge exercise. The non-graded quizzes on material are used to help students grasp major concepts presented in the course.

Foundations of Education: This is often the first class in the program. The classes are comprised of new students balancing classes and full time employment. Students in this course have appreciated the synchronous communication tools that allow for them to work on group projects outside of classes. The students agree on a meeting time online in the course web site meeting area. For their convenience, they may be at any computer, i.e. home, school, or library and proceed to discuss their work. This class also features a media gallery with the case study assignments. Student may view a collection of pictures presented in a slide show. This collection of images gives the students a visual stimulus that is more favorable for visual learners.

Each of the courses described in this paper was designed with the desire to provide students with deeper learning, better use of time, and the possibility of additional cycles of observations and analysis of content materials. The courses have produced students that are competent and knowledgeable about the subject matter and technology, it's use and instruction integration.

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# CECI: A Computer-Assisted Co-educational and Transdisciplinary Experience

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**Abstract**: This paper describes a CSCL application named CECI (*Co-Edición de Cuentos en Inglés*. Co-Edition of Tales in English), which assists would-be teachers in the development of multimedia educational resources aimed at learning the English language. These resources are used by students with a basic or elementary level and are accessed through a computer net. Those would-be teachers write a children's tale and then add a methodology and collaborative activities that describe the prospective use of that tale in the classroom.

## Introduction

One of the biggest challenges that is actually taking place in educational practice is teaching skills for the use and exploitation of Information and Communication Technology (ICT) to would-be teachers. However, despite all these efforts, we can still appreciate the would-be teachers lack of initiative to promote the development of new technology for the classroom. From our point of view, apart from the lack of technological skills, there are also other aspects that affect this situation, namely the absence of a methodology that enables the creation of teaching materials and the difficulty entailed by the interdisciplinary teacher-technological developer relationship. This has led us to reflect on the need to treat teaching problems from the perspective of the skills but without forgetting the rest of the aspects listed above.

On the other hand, we can also observe the recent and increasingly usual emergence of applications oriented to the use of the technology through which students both interact and learn; this is known as CSCL (*Computer Supported Collaborative Learning*). There are applications that have been developed to learn different types of skills: scientific, social, reading-writing and teaching skills to name but a few. Among these technological applications, we can find some which are oriented towards language learning –especially English– but their main focus is learning how to use the language rather than how to teach it. These aspects are treated in a new CSCL application called CECI, which is based on the asynchronous authoring of documents by means of the Internet. To be more precise, the student is placed in a learning situation in which he/she has to create tales in English in a collaborative way; these tales are then represented as teaching material that will be used in the classroom; this aspect is fulfilled by means of technological tools and computer networks that enable the publishing side (Alario & Anguita, 1998)

## The CECI Application

Taking into account the CECI goals, we can easily appreciate that the teaching-learning process covers features from different disciplines and this makes it even more complex. Not only do we expect to create an application for *"the edition of material"*, but we also want it to allow the student to practice and work with the English language, to have a methodology assisting him/her and to produce materials that are adequate to be used with future learners of the language. In order to develop the application, a work group including teachers belonging to two different areas was created; on the one hand, Foreign Languages and New Technologies teachers, both subjects being taught in the Faculty of Education at the University of Valladolid; on the other hand, Telecommunication Engineers from the School of Telecommunication at the same university, took the role of technology developers. The group used the methodology called DELFOS (A Description of teleEducational Layer Framework Oriented to learning Situation) (Osuna, 2000). This framework provides a series of attributes the enable the analysis of the requirements needed to create a collaborative learning scenario. It also requires that both teachers and application developers play an active role in a transdisciplinary working environment in which dialogue and commitment are crucial for the development of the applications.

After an in-depth collaborative analysis, we decided to form groups of would-be teachers; they should jointly create multimedia materials that would be used to teach English to primary school students. Besides

creating the material, this would-be teachers had to propose a methodology for its subsequent use in the classroom. This is how we decided to develop an application that enabled the asynchronous edition of the material: each student edits the document individually and then it is published in an Internet server so that another student from the same group can edit it again. Fig. 1 shows the interface developed for the application. We can see that there is an editor that includes general HTML editing operations such as headings and bolds, and also especial operations in order to publish (send to the server), collaborate (add comments, suggestions) and visualize (see "preliminary views" as you go along). Moreover, the application also includes an interaction analysis tool that enables the reconstruction of the tale taking as a basis the different identified events, as if we were in front of video sequences. The teacher and the student can add commentaries about the process and, at the same time, they can get information about any of the versions, know how is their group and subgroup acting, see what is the role of the teacher and check general information about the editing process. Lastly, the application presents an evaluation instrument that continually evaluates each of the new versions.

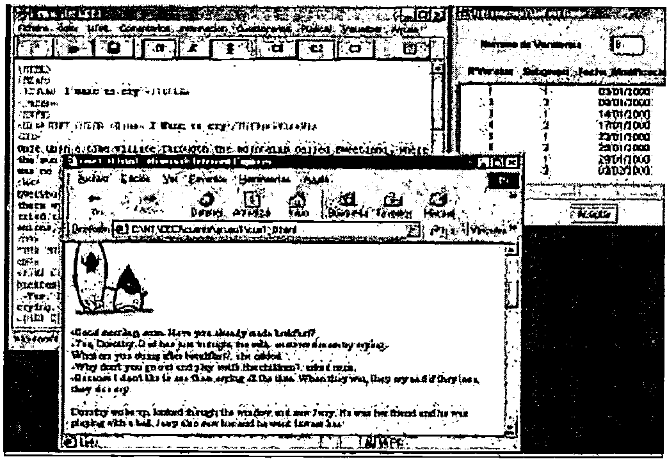

**Fig. 1 Interface of CECI**

CECI was used by would-be teachers during a whole academic year. Our aim by using this application was not focusing on technological architecture, but observing the progressive application acceptance process by would-be teachers and measuring how this process is related to technology and uses technology at the same time. In order to measure this, we have used the methodology proposed by DELFOS which is supported a set of ethnographic instruments such as interviews, questionnaires, classroom observation, etc.

## Conclusions

The development of activities based on transdisciplinary orientation techniques is a valid strategy to ensure the educational process; this is especially so when we are dealing with technology learning because it enables a constant dialogue between the problems in both disciplines. Joining two different subjects in the same project helped the would-be teacher in two aspects: visualizing a problem from a twofold perspective and using technology adequately to solve educational aspects.

We should highlight that the students developed their technological skills progressively and as they went along and the need to use them emerged. Besides, they stopped viewing technology as a hardware and software set and started to see it as a potential tool to be used during classroom activities in the future. This situation made their former lack of initiative to develop new educational technology decrease.

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# Integrating Technology into Courses for Pre-Service Teachers

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**Abstract:** Collaborations of college faculty, pre-service teachers, and in-service teachers proved to be a successful combination in developing expertise in using technology in K-16 classrooms. Pre-service and in-service teachers developed units, lesson plans, and other activities that were implemented in the in-service teachers' classrooms. The students were able to see their work applied in real life situations. The college faculty employed the skills they learned through the collaborations to integrate the teaching of specifically designed technology skills in the pedagogy courses and content area courses that pre-service teachers must take from their first semester through student teaching. In this way, students apply learned skills immediately, and as the skills become progressively more advanced, pre-service teachers build on past activities and successes.

## Introduction

Using technology has become a way of life for many children in today's K-12 schools. It is the youngsters who know better than their parents or teachers how to program a VCR, manipulate all the controls on a Play Station, and find really "cool" graphics on the Internet. These same children are entertained in a fast-paced simulated world that comes to them via the television set, the movie screen, and the computer monitor. In a classroom devoid of high tech approaches and applications, students become disinterested bystanders on the road to relevant education.

With the majority of K-12 teachers and college faculty nearing retirement age, they obviously did not grow up with computer technology and thus are, in some cases, intimidated by the seeming intricacies and complexities of the URLs and hypertext. Most can understand the advantages of using computer technology in their classrooms; they just don't have the means, or sometimes the patience, to learn how most effectively to employ this wizard technology.

What about today's college students who are the pre-service teachers preparing to enter the workforce as K-12 teachers? Their level of expertise might fall between that of the K-12 students and their teachers. The college students have Play Stations at home, use e-mail to keep in touch with all their friends attending other colleges, shop via eBay, and word process all of their college essays and research papers. Where they lack expertise is in the use of appropriate computer technology to create, deliver, and assess meaningful, relevant lessons in their content areas.

## Link-to-Learn Program

To address the appropriate use of technology in the K-16 classrooms, Saint Vincent College in Latrobe, Pennsylvania sponsored a "Teaching and Learning with Technology" workshop that spanned two summers (1999 and 2000) and one school year (1999-2000). This program was funded by the Pennsylvania Governor's Link-to-Learn Initiative, designed to bring technology to the pre-service and in-service teachers of Pennsylvania.

Saint Vincent College is a four-year liberal arts college with an enrollment of approximately 1100 students; 15% of them are enrolled in the teacher certification program. All students at Saint Vincent College, including those in a teacher certification program, must major in a content area. Students must also include a very heavy concentration of core curriculum classes into their academic programs. The requirements of the major and the core leave students with little time to take the required courses needed for certification. Therefore, it becomes

necessary to incorporate important pedagogical and technological skills into all Education courses and into many of the content area and core courses, as well.

In order to include rigorous instruction in using appropriate technology for teaching and learning, the Education Department and six content area departments with teacher certification programs (biology, English, history, mathematics, physics, and psychology) adapted courses already being offered in the departments to be "technology designated" courses, all of which incorporated specific skills, competencies, and products in using technology for classroom instruction. Within these courses, pre-service teachers develop skills to incorporate technology successfully into their model lessons, units, demonstrations, lab experiments, and other learning activities.

The vehicle for developing the "technology designated" courses was the Saint Vincent Link-to-Learn workshop "Teaching and Learning with Technology." The workshop brought together teams of participants--one college faculty member, one pre-service teacher, and one K-12 teacher on each team. The teams collaborated in curriculum development and lesson planning based on educational objectives, state and national standards, the International Society for Technology in Education (ISTE) standards, and technology resources as they apply across the K-12 grade levels and the undergraduate college curriculum.

## Participants

- 18 college faculty in chemistry, education, English, history, physics, mathematics, and psychology
- 18 pre-service teachers (college students) enrolled in elementary, early childhood or secondary (biology, chemistry, English, and mathematics, physics, and social studies) teacher certification programs
- 18 teachers from three area school districts

Because most of the in-service teachers served as cooperating teachers for the pre-service teachers, the collaborative lesson plans and other learning activities were implemented in the teachers' classrooms, with both the in-service and pre-service teachers having an integral part.

## Goals

The Link-to-Learn Program sought to make people into educators who could use technology to enhance and improve instruction; thus the program concentrated on the following goals:

- Emphasize *teaching* with technology, not *about* technology.
- Provide adequate technical support for all participants to reduce frustration and burn out.
- Promote relationships among pre-service and in-service teachers and college faculty so that they can develop authentic curriculum materials that incorporate appropriate technology.
- Incorporate both technology standards and approved and emerging national and state academic standards.
- Design new course syllabi or lesson plans--or revise existing ones--to reflect academic and technology standards.

## Equipment

All participants had access to state-of-the art equipment. Acquisition of necessary hardware and software was supported by funds from the Link-to-Learn Initiative. All participants received IBM laptop computers. The college faculty and K-12 teachers retain use of their laptops until they leave their place of employment or until the laptop needs to be replaced. The college students keep their laptops through the end of their student teaching internship.

All workshop sessions were held in the new Saint Vincent College Instructional Technology Resource Center, which is equipped with the following:

- Three "smart classrooms" each equipped with a Softboard, LCD projection device, document camera, laser disk, DVD, and videocassette
- Multimedia laboratory with computer workstations, scanners, digitizers, plotters, printers, and audio-video resources
- Academic Lounge which contains collaborative networking access pods with ports for laptop access by as many as 16 students and faculty

The classrooms in the Education Department were upgraded through the addition of three desktop computers, an ink-jet printer, a scanner, a document camera, and an LCD projector with a laptop computer per classroom. All classrooms have Internet connections. Students use this equipment during classes in simulations and in micro teaching demonstrations. When the rooms are not being used for class, students can use rooms as small computer labs.

**Topics covered during the workshops included:**

- Locating, reviewing, evaluating, and using software
- Trouble shooting problems
- Using imaging devices (scanner, digital cameras)
- Using productivity tools for word processing, database management, and spreadsheet applications
- Making multimedia presentations
- Using telecommunications to access information and enhance personal and professional productivity
- Demonstrating knowledge of equity, ethics, legal, and human issues concerning use of computer and technology
- Identifying computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator

By the end of the summer workshops, the K-12 teachers and the pre-service teachers had created products that they can use in the classrooms and had developed technology skills that enable them to incorporate appropriate technology into their teaching. See the Link-to-Learn Home Page to view the projects: http://facweb.stvincent.edu.L2L/projects.html.

The college faculty, likewise, developed expertise in using technology as part of their instructional repertoire. Their new goal was to teach the students in their classes how to use specific technology applications and how to incorporate them into lesson plans, learning activities, demonstrations, and labs. Fourteen courses became "technology designated," and specific skills and competencies were assigned to each course.

Below are courses or groups of courses taught at the college. Following each course is a list of competencies that students develop through instruction in the course or courses. Material in parenthesis refers to ISTE Foundation Standards (ISTE, 2000).

***Foundations of Education (required of all certification candidates):***

- Demonstrate knowledge of equity, ethics, legal and human issues concerning use of computer and technology. (1.2.6)
- Use productivity tools for word processing; submit all work in word-processed format. (1.2.1)
- Establish e-mail accounts; learn features including send, reply, forward; create contact lists, set up group lists, send attachments; maintain contact with course instructor and submit and receive assignments via e-mail.
- Describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum. (1.3.3)
- Research and compose a paper on the use of technology resources to facilitate lifelong learning. (1.2.7)

- Develop a home page that will include resume, philosophy of education, service activities, work with students, annotated bibliography of interesting books and articles, list of educationally valuable web sites.
- This web page will be expanded throughout all subsequent courses.

*Observation and Interaction Laboratory (required of all certification candidates):*

(Students will use resources available at field placement sites and at the college in preparing these activities.)

- Develop a list of television, videotape, videodisc, and CD-ROM resources suitable to pre-service teacher's grade level and content area.
- Use digital camera and insert pictures into course work. (1.1.4)
- Develop scenarios of using classroom computers or computer labs for student learning.
- Use record-keeping software for creating gradebooks/rosters/progress reports for parents. (1.2.4)
- Add to homepage: photos of field experiences, lists and scenarios developed, sample gradebook page or roster.

*Strategies and Techniques of Instruction (required of all certification candidates):*

- Operate multimedia computer systems with related peripheral devices to successfully install and use a variety of software packages. (1.1.1)
- Use terminology related to computer and technology appropriately in written and oral communications. (1.1.2)
- Locate, review, evaluate, and select instructional software appropriate to pre-service teacher's grade level and content area. (1.3.1)
- Prepare a lesson that includes a selected software program suitable to pre-service teacher's grade level and content area; install and demonstrate software. (1.3.3)
- Use video camera to tape a classmate teaching a lesson. Review one's own videotaped lesson for self-evaluation.
- Add to home page: evaluations of instructional software, lesson plan with software application, video clip of teaching demonstration.

*Education Psychology (required of all certification candidates):*

- Perform Internet functions of search, retrieve, copy to file, and evaluate. Research a topic including use of original sources, artifacts, and reports to be used in lesson or unit plan. (1.2.3)
- Use software and other diagnostic tools to assess different learning styles among children. (1.3.3)
- Add to home page: research paper prepared with sources from the Internet as well as more traditional sources.

*Education and Psychology of the Exceptional Student (required of all certification candidates):*

- Demonstrate awareness of resources for adaptive/assistive devices for students with special needs. (1.2.5)
- Describe use of adaptive technologies such as text-to-speech, special keyboards, Braille printers, touch screens, closed caption, digitizers, large screens. (1.2.5)
- Use technology to adapt lesson plans for special needs students, incorporating strategies such as simulations, peer tutoring, dialog journal, and use of problem-solving videos.
- Add to web site essay on the use of assistive technologies, adapted lesson plan.

*Child and Adolescent Development (required of all certification candidates):*

- Develop an annotated listing of URLs that are useful resources for understanding child and adolescent psychology.

- Add this list to home page.

*Secondary Reading Instruction (required of all secondary education certificate candidates)*
*Children's Literature (required of all elementary education certification candidates)*

- Use multimedia and other forms of technology to develop alternative activities for special needs students, ESL students, and culturally, racially, or ethnically diverse students. (1.1.1)

*All Content Specific Methods Classes*

- Evaluate software packages for their appropriateness in pre-service teacher's content area and grade level. (1.3.1)
- Develop an annotated listing of URLs appropriate to pre-service teacher's grade level and content area.
- Use appropriate resources for classroom instruction including databases, CD encyclopedia, atlases, dictionaries, spreadsheets, and Internet. (1.3.1)
- Use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software in development of lesson plans or units. (1.1.4)
- Create multi-media presentations using a combination of computer, projection device, document camera, overheard projector, VCR, videodisc, CD-ROM. (1.1.1, 1.1.4)
- Add to home page: software evaluation, annotated list of URLs, multi media lesson plan(s) that feature the above-mentioned resources, imaging devices, and equipment.

*English (secondary) Reading and Language Arts (elementary)*

- Use e-mail to communicate with children in local schools for tutoring and mentoring on reading and writing projects. (1.3.3)
- Use multimedia to create interactive learning environments in which technology can be used to show the relationships between literature and other subject areas such as music and art. (1.1.1)
- Develop criteria for evaluating Internet resources for accuracy, logic, use of propaganda, author's purpose, and tone. (1.3.1)
- Research effective oral reading presentations on laser disks, videodisc, CD-ROMs, or other electronic sources for use in developing listening skills and vocabulary. (1.3.3)
- Use computerized literature databases such as ERIC.
- Add to home page: criteria for evaluating Internet resources, lesson plan show integration of reading with other subjects, citations of useful auditory resources, a bibliography taken from ERIC or another literature database.

*Mathematics*

- Create electronic spreadsheet activities. (1.2.1)
- Use geometry supposition software to demonstrate electronic conjecturing and proof. (1.2.1)
- Use graphing software to visualize and print algebraic and trigonometric relations and functions. (1.2.1)
- Use materials generation software to customize worksheets/posters/banners for the classroom. (1.2.1)
- Establish math tutorial program with a middle or high school student through e-mail correspondence.
- Add to home page: a sample spreadsheet activity, samples showing use of geometry supposition, graphing and generation software packages.

*Social Studies/Geography*

- Develop criteria for evaluating Internet resources for accuracy, logic, use of propaganda, author's purpose, and tone. (1.3.1)

- ❖ Use computers to support problem solving, data collection, and information management. (1.2.4)
- ❖ Use computer software for site-location analyses, diffusion modeling, and simulation.
- ❖ Use spreadsheets to present results of regional geographic studies. (1.2.1)
- ❖ Produce data banks for regional study projects. (1.2.4)
- ❖ Produce CD-ROM programs of flora and fauna of bioregions.

*Science*

- ❖ Use computers to support problem solving, data collection, and information management. (1.2.4)
- ❖ Use appropriate content-specific technology tools such as probe ware, midi devices, graphing calculators, data plotters, video microscopes. (1.2.4)
- ❖ Use data acquisition and analysis software to design and build spreadsheets. (1.2.1)
- ❖ Use simulation software, computer-aided laboratory devices, and data reduction software to develop and test hypotheses regarding various physical phenomena. (1.2.4)
- ❖ Use instruments and systems such as CBLs for automated data collection/develop lesson plans that utilize this technology.
- ❖ Use analytical probes connected to graphing calculators to collect a variety of data.
- ❖ Analyze the data through calculator-based mathematical analysis or graphing. (1.2.4)
- ❖ Establish math tutorial program with a middle or high school student through e-mail correspondence.
- ❖ Add to home page: criteria for evaluating Internet sites, evidence of using laboratory equipment and software specified above.

***Pre-Student Teaching Seminar***

- ❖ Use computers to communicate information to parents, students, colleagues, teachers, and professors. (1.2.3)
- ❖ Prepare a lesson that teaches your students how to create a technology-based project.
- ❖ Produce informational pieces such as brochures, newsletter, flyers, sign, school newspaper, and letters using desktop publishing software or resources. (1.2.1)
- ❖ Use "grade book" or other record keeping software to record and track student progress. (1.2.1)
- ❖ Add to home page examples of electronic correspondence with parents or teachers, an instructional technology lesson, your brochure or flyer.

## Conclusion

By the time the students are ready for their 15-week student teaching internship, they will have had experience in creating a number of units, lessons, activities, demonstrations, and labs that incorporate appropriate technology applications. They gain these skills and competencies through observing them being used in an instructional setting and then through applying them within the classroom to create materials required as part of the course.

Integrating technology into already existing courses for pre-service teachers was done out of necessity. The Education Department did not wish to add another course to the students' already heavy academic loads. With the success we have seen with this approach, we recommend the integrated approach even for schools that have the "luxury" of being able to add one or more instructional technology courses. The key, of course, is to make sure faculty are well trained in the use of technology before undertaking a department-wide integration endeavor.

## References

ISTE Standards Projects: NCATE. 2000. <http://www.iste.org/standards/ncate/basic.html>

## Eureka Science Academy: A 2-Year Progress Report on Technology Integration in Reading and Science

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**Abstract:** The Eureka Science Academy is in year 2 of a 3-year grant. This is a report on the Academy and 2 groups of preservice teachers that have taught in the program and how they integrated reading, writing, science, and technology in the project. Team leaders and interns spent one week in training prior to the arrival of the Eureka students. Their training, provided by the program directors, consisted of team building activities, writing team mission statements, developing effective literacy strategies, performing science activities, and reviewing books and computer software. Time was also spent reflecting on the focus of the Academy - meeting the needs of students through an integrated program of reading, writing, science, and technology.

### Introduction

In August of 1998, with the aid of a Lilly Planning Grant, discussions with area teachers and principals from both public and parochial schools were initiated. While the needs of students experiencing substantial academic difficulty are addressed through special services and those high-achieving students typically have access to special classes, children of average achievement (40th-60th percentile in various standardized tests) often have few programs directed to their needs. These are the students who can gain the most from more encouragement and additional preparation, becoming enthusiastic and successful learners.

A 3-year Lilly Grant enabled the development of the Saint Mary's College/Students/Teachers/Parents Science Project, hereafter identified as CoSTEP. CoSTEP is a comprehensive science education outreach composed of three key activities which bring together students from South Bend area schools grades 4-12, their teachers, their parents, and Saint Mary's College faculty to encourage active inquiry-based science that engages the hands and minds of all participants. The project sought to help students, teachers, and parents achieve success in teaching and learning science; to increase the use of technology of students; and to nurture habits of discipline, scientific inquiry, critical thinking and communication that will help students succeed in school. An ancillary goal was the increased preparation of the Saint Mary's College elementary education majors prior to their student teaching

Students attending the Eureka Science Academy, one part of the CoSTEP project, were given intensive instruction in reading and writing, exploring environmental science, and technology. Essential to the program were twenty interns: Saint Mary's College elementary education majors who completed their junior year of studies including courses in developmental and corrective reading, the science and language arts methods courses, a technology course, and at least 70 hours of field study in area schools. Each intern was responsible for developing and carrying out the daily lessons with three or more students and for keeping records on the students' progress. The interaction between the students and the interns gave the intern an opportunity to expand her teaching repertoire. A weeklong training program before the start of the Academy completed the intern's preparation for this important role

According to Woodrow (1998) Technology-enhanced instruction (TEI) is not a new heady concept. It is just another step on the learning highway that permits disciplined organized, meaningful pursuit of understanding- whatever the subject. TEI is a pedagogical device, which does not smother creativity; it empowers access and choices to vast realms of information, an access that enriches thought,

and thus, creativity, a peculiar form of imagination. Somehow trainers of teachers must communicate this message substantively throughout the educational community; they must become leaders in the implementation of technology-enhanced instruction. Technology is not a master. It is a product of the most essential forms of human creativity. A cycle has been completed from stone to silicone, the toolmakers continue to extend their reach, to improve their grasp.

Five of the interns were chosen as team leaders. The team leaders worked with four interns each and were responsible for team activities. Interns facilitated the program in a 3:1 or 4:1 student: intern ratio. This ratio was a key element of the Eureka Academy because it provided for individualized instruction, dialogue between the intern and students, and immediate feedback during discussions

During the first year, fifty-three students from grades 4-6 representing four public and three Catholic schools, arrived at Saint Mary's College to begin their Eureka Science Academy experience. During the second year 56 students from grades 4-6 representing 4 public and 6 private schools began their Eureka Science experience. The overall science theme was the environment, and all the reading, writing, technology, and science activities revolved around this central theme.

**The Program**

Planning for the first Eureka Science Academy summer session began in January 1999. A brochure and an application form were designed and local schools were contacted about the program. Classroom teachers identified students according to the criteria specified for the Eureka Science Academy. Parents interested in having their children participate in the Academy, submitted application materials and were notified of their status in a timely manner. Simultaneously, the application process for team leader and intern positions began. Once selected, the team leaders began their initial training with the program directors.

Team leaders and interns spent one week in training prior to the arrival of the Eureka students. Their training, provided by the program directors, consisted of team building activities, writing team mission statements, developing effective literacy strategies, performing science activities, and reviewing books and computer software. Time was also spent reflecting on the focus of the Academy - meeting the needs of students through an integrated program of reading, writing, science, and technology.

Woodrow (1998) reports if public education is to continue serving learner needs, then teachers must be trained in the use and application of available technology. Except in very special circumstances, little is achieved by loading up a school with technology and saying, "Get to it." Be it rather fast, technological application still must evolve to suit known learning needs in the classroom. Playing on the Internet does not constitute advanced technological application to learning needs: the curriculum is still the curriculum; methods of learning, together with the grammar of disciplines and the understanding of the principles of the relationships among parts, must be learned. First however, a generation of preservice (and inservice) teachers must learn to understand and be completely comfortable with computer/multimedia technology as essential learning tools.

At the end of the preparation week for the preservice teachers, a parent orientation evening was held. During this event, the Eureka students were introduced to their team leaders and interns and were given an opportunity to get acquainted with their team members. All Academy students had their photographs taken and displayed on their team boards. They also received T-shirts and hats with the Eureka Science Academy logo on them. The evening ended as families toured the campus, giving everyone the opportunity to visit classrooms, the computer lab, library, and dining hall. The goal was to make everyone comfortable on the very first day.

Environmental science was chosen as the central theme of the Academy because it brings together chemistry, physics, and biology. Each of the three weeks had a specific focus - the living environment (Indiana plants and animals), the physical environment (air, water, energy, and matter), and the interactions that occur between the living and the physical environments (food chains, weather, water cycle). Reading, writing, technology, and science activities all revolved around this central theme. Favorite science activities included dissecting owl pellets, germinating seeds, using microscopes, and working with the weather station. The use of software such as Tom Snyder Science Court CDs with accompanying hands on science kits - *Water Cycle, Soil, Living Things,* and *Seasons* were used to strengthen the students' process skills.

One intern wrote in the Academy daily diary "We then went into the Regina MAC lab and did the Owl Pellet CD-ROM on the presentation stand to allow the kids to better understand how the lab they were

to take part in would work. They thought the presentation board/computer was really neat. We then talked about the lab a bit and told the children what they could and could not do."

As the focus of each week was planned, related literature was identified and writing experiences were designed. Each day a story was read aloud and discussed. According to Anderson *et al* (1985), reading aloud to children is the single most important activity for developing a sense of story structure, promoting vocabulary growth, and teaching higher level thinking skills which are ultimately reflected in the student's writing. Tompkins (2001) points out that when teachers read aloud, they model what good readers do and how good reader's use reading strategies. An example of a picture storybook read during the study of the living environment was *Two Bad Ants* written by Chris Van Allsburg. The story presents life - adventures, dangers, decisions, values - from the ants' perspectives. Discussion of this book has focused on making choices, related consequences, and discovering what is truly important, as well as seeing the world from the ants' perspectives. Writing response choices included writing a poem from one of the ant's point of view, observing ants or other insects and writing their version of the story, and researching information about ants on the Web. Because the Academy was able to acquire many books, including multiple copies of paperback chapter books, students were also able to work in small literature response groups, read a common book as a team, and take books home for independent reading. Some favorites have included *Poppy, Stone Fox, Song of the Trees.* A word processing program AppleWorks was used to help students sharpen their writing and presentation skills.

A typical day at the Eureka Science Academy began with the 8:30 arrival of students, mostly on buses. Following breakfast, students and their team leaders/interns went to their classrooms for literature, writing, and science experiences. Teams often began with editing a sentence or paragraph related to the environment. Grammar, capitalization, punctuation, and spelling were emphasized. At least one read aloud was included each day - either a picture storybook or a chapter book - followed by discussion and a response activity along with vocabulary additions to the word wall. Another intern wrote "After the flower activity, our group worked on a project for The Well. Our project was to write a script about a scene in the book and then act it out in front of the camera. At first my group did not want to do this, but then they got into the idea. We then finished our script and went back into the classroom to regroup as a team to go to lunch."

A science activity would often be the focus of a morning or afternoon or sometimes the entire day. Using a microscope to view commercially prepared slides as well as self-prepared slides, dissecting owl pellets, and building seed germinators were extensive projects, while checking and graphing the weather was an ongoing activity that involved a short period of time each day. An intern wrote, "When lunch was over, all of us returned to the classroom for two activities. One of the activities was to make paper. The other activity was for the students to identify a leaf, find a picture of the tree that it came from, and write a paragraph about the tree with just the Internet. Our group went about doing these activities by having two of the leaders work with one group of students on making paper and the other leader working with the other two groups in the computer lab. I feel that this worked well because the papermaking was very time consuming."

Students also had the opportunity to go to the computer lab to search the Internet or use other aspects of the technology available. A intern reported in the daily diary, "They (the students) all logged on and I guided them to www.yahoo.com. I had them search for web sites on their favorite animal. Then I taught them how to copy their picture onto an AppleWorks document in order to save paper. They then gathered some Internet information so they can make a poster with the pictures and information they gathered." Each student compiled a portfolio. Photographs with accompanying written commentary were included for projects too large to fit into a portfolio. Photographic entries were included of field excursions as well. Some days the students took photographs and cataloged them or digitized them and saved them to their personal file on the college server. Another intern commented "Right after breakfast, we split the team into two groups. We took those who were finished choosing articles for their portfolios to the computer lab, and those who needed more time choosing stayed in the classroom. In the computer lab, I showed the students how to write a table of contents using the Harvard outlining system. I decided to use the presentation station to show then how to make the table of contents since there was so many of them and only one of me (plus Jenny). So while I demonstrated on the overhead, Jenny went around helping and answering questions. This system seemed to work pretty well. The kids did really well and all of their tables looked unique and nice. Meanwhile, back in the classroom, the rest of the kids worked diligently at putting their portfolios together. Some kids opted to hand write and decorate their tables of contents. After the students were finished in the computer lab, they joined those in the classroom ad put their finishing

touches on their portfolios. I must say, they all worked very hard and their final products were something they can be proud of!" Another intern wrote "All day the kids were bugging us to let them go on the computers. So I sent them to do a Best Weather webquest but apparently they recently took it off. I luckily had some back-up web quests for them. I altered the quest a little to fit out needs. One group was the Tornado Team; the other was the Hurricane Team. They had to search the web to find what materials could best withstand the effects of a Tornado or Hurricane. Then they were to draw a picture of a structure that would withstand the disaster using the information they found. The groups had a fun time doing this project."

Team leaders and interns facilitated the learning experiences as they encouraged, supported, and taught the young Academy students. Buses arrived in time for a 3:00 p.m. dismissal each day. One intern reflected "After lunch we had time to study the water. The hay infusion has been a self-directed project. Except for telling the students what I need to see for their final product, I have given no guidance to the group. They have done very well organizing themselves and making decisions. The rest of the day was spent writing poems and spending time in the computer lab."

Field trips, both on and off campus, enhanced the study of the environment. An off-campus field trip to a nature or environmental center was planned for each week of the summer session. Team leaders and interns prepared students for the trips by reading about and discussing various aspects of the trip as well as reviewing the activities that would be done at the site. One intern delineated her group's activities "My small group is reading Tracker. We discussed some of what they have read so far. Then we went to the computer lab. They checked their e-mail. (They enjoy it but there must be a time limit). I had my students research leaves and then go to www.pbs.org/Kratts. They worked on a "Mad Lib" type activity and will go in their portfolios. They enjoyed the web site- it was a good one! They also went to Fernwood's website to get ready for Friday's field trip." Each venue provided students with the opportunity to listen to docents present information and explore the environs with their guidance. As students participated in field trips, they wrote observations, gathered specific information, and drew and photographed the environment. On-campus field trips included the Saint Mary's nature trails and a tour of the Science Hall. When students were asked what they noticed about the teaching space in the Saint Mary's College Science Hall compared with their schools, they noted that nearly every room was a laboratory. Professors facilitating the tour explained that most of the science learning at Saint Mary's takes place in the laboratory. Hands on excursions both on and off campus provided the students with exciting experiences that extended their understanding of science concepts.

A family open house was held during the last week of the summer session. Although many parents work outside the home and their attendance at an afternoon event was questionable, an opportunity to view the products of their children's success seemed important. Every child but two had parents in attendance. The students enjoyed being able to present their science and literature projects as well as their portfolios to their parents and siblings. An intern reported "Since the kids wanted to show their skits and commercials to their parents, we brought in a TV and VCR and let the kids view their creations until the parents arrived. Then the parents came and the kids got busy showing their parents what they had done. We had set-up the seed germinators; owl pellets, microscopes, bread mold, and hay infusions at various places in the room so parents could see. We showed the skits to the parents once most of them got there. The kids also showed their newly acquired computer skills to their parents in the lab. We got so many thank-yous from the parents, and we thanked the parents for letting us have their kids. Everyone was gone by 3:00pm and I felt it was a successful day."

While surveys and questionnaires have not yet been statistically evaluated a technology proficiency survey for this year's intern indicated eighty percent of the interns and team leaders know word processing well and twenty percent felt they could not do without word processing. Half of the interns and team leaders know presentation software well or so well they could not do without it. All of the interns and team leaders know e-mail well or so well they could not do without it. They indicated the same about the Internet. Ninety percent of the interns and team leaders know how to use CD-ROM's well. Fifty percent of the interns and team leaders know subject specific software well.

A parent's e-mail to the program director said, "I had reservations about sending my child to an academic day camp during the summer months. I thought this was going to burn her out before school started. I was so wrong! My daughter is so excited when she comes home. She talks constantly about the camp activities and can't wait for tomorrow. [The student intern] has ignited a fire. My daughter wants to be an SMC girl like her. Thank you for providing my daughter with a good role model." On the parent survey sent home at the conclusion of the three-week Academy, one parent wrote, "We have never seen

[our daughter] more positive about a learning experience. So far her enthusiasm is being carried over into school. She wants to do science homework first. Thank you all!" Others mentioned how wonderful it was to see their children reading and writing over the summer because of their time at Eureka.

During a parent open house, a father was overheard telling his daughter that sure, she could attend Saint Mary's for college even though they had never thought about it before, and that it just might be a good place for her. Whether the child had thought about attending college prior to her experiences at Saint Mary's we can not say. The positive signal here is that the time spent on campus during the Academy stirred a desire in this child to ask her father about going to college at a place that she felt comfortable.

Most Eureka students will begin their school year with a greater interest in science and enhanced reading, writing, and technology skills. The hope is that the progress made during the Academy will not only continue into the school year but will make a difference throughout the academic lives of the Eureka students

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# Preservice Teachers' Experiences in a Technology-Rich Urban K-5 School Setting

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**Abstract**: This presentation will describe preservice teachers' experiences during their internship year in an elementary magnet technology school. This program is part of a grant designed to better prepare preservice teachers to work in urban settings.

## Introduction

This study is part of a larger research project designed to investigate the effectiveness of training and support for pre-service teachers and the extent to which various technology tools and applications are used in their assigned schools and classrooms. It is our expectation that this insight will improve teacher preparation at the University of Tennessee and reduce the growing exit of educators leaving urban settings. The current study is based on a series of focus groups that examine the perceptions of a group of students enrolled in a five-year teacher preparation program in the College of Education.

Participating interns have chosen to serve one year in the Knoxville urban school setting working full time under the tutelage of a mentor teacher. Even though interns do not receive an income, their experience is a part of the training towards a Master's credential. The primary assignment for interns participating in this study is an urban public school (K-5) with a concentration in science, mathematics, and technology. This school, located in one of the poorest areas in the city, reflects many of the academic challenges known to urban education. Nonetheless, it is uniquely rich in technology resources with state-of-the-art equipment due to a variety of special funding sources.

Two focus groups were conducted over two consecutive weeks with 15 students for approximately 90 minutes. Through our conversations with the interns, we were able to gain a sense of their perspectives about teaching, technology, and the integration of both areas in a technology-rich school environment. In addition, we were able to increase our understanding of their perceptions of their mentor teachers' uses of technology in the classroom. Future studies in this project will include interviews with the mentor teachers, administration, and parents to gain their own perspectives. The ultimate goal is to understand the broader context of the roles, relationships, and support needed to maximize learning opportunities for students and teachers to succeed in a changing, technological world.

## Teacher Preparation

Technology can be a powerful tool to help teachers in all aspects of their jobs, however many new teachers report being unable to use technology in their classrooms (OTA, 1995). With the increased attention to the level of technology in schools, certain obstacles preventing the effective use of these resources must be addressed. Of these, providing teachers with adequate preparation in the use of technology in their teaching is a major concern.

Teaching isolated skills is not as effective as grounding it within a context of relevance to preservice teachers. Typically, the response to preparing teachers to use technology has resulted in "add-on" courses that teach technical skills and topics in isolation from the rest of the teacher education program. Even if students use technology within their methods classes, many comment that they do not use technology during their student teaching experience because of a lack of adequate resources in the school.

Though interns were required to take an introductory computer course prior to their internship, findings from the focus groups revealed the following insights with respect to their technology experiences:

- Student knowledge and background experiences reflected a range of skill and comfort levels creating the need for differentiated instruction to build on existing skills and knowledge
- Comfort levels with software were varied and dependent on the frequency with which the software was used
- Computer preparation experiences within the College of Education did not provide consistent content or requirements, and sometimes led to repetition of topics and concepts
- Classroom management issues related to teaching and teaching with technology in a K-12 classroom were not adequately emphasized
- Course experiences prepared some students to use technology as a personal productivity tool but not necessarily as a teaching tool for instruction
- Software selection and use did not always reflect developmentally appropriate practices
- Students did not grasp underlying principles and concepts that would give them the flexibility to transfer their knowledge to different computer programs (e.g. Excel vs. AppleWorks spreadsheet)

### Instructional and Professional Technology Use

Preservice teachers observed different trends in the use of technology in the classroom. Among these, interns reported that teachers used technology as a whole class presentation tool, as a center for small group activities, as a remediation activity, and as a drill-and-practice application for practicing basic skills. There seems to be a relationship between mentor teacher's use, or support of technology use in the classroom, that impacts the degree to which interns themselves support or use technology. Technology resources differ within the school depending on the source of funding attached to different programs operating within the school. For example, some teachers submitted applications and received funding through the State to become a 21st Century classroom. The focus group findings revealed the following trends:

- Mentor teachers use of technology varied – classroom applications may not be consistent
- Mentors use (or non-use) of technology had an impact on interns use of technology in both positive and negative ways
- Interns with more experienced technology-using teachers felt more comfortable taking the initiative to explore the use of technology in the classroom. Teachers who used the technology often modeled various teaching strategies, applications and integrated uses of technology
- Greater coordination could contribute to more effective collaboration between teachers and the support and technical staff

## Conclusion

We have learned through the voices of interns that school and classrooms contexts are complex. Funding resource streams differ. For example, in a given school, classroom resources may vary depending on the funding source. Emerging findings from interns' reports suggest that teachers' values, beliefs, and attitudes differ and may be associated with such factors as age, training, and experience. Student needs vary, particularly in this context where poverty and equity issues often emerge. It is a context where technology can be used to ease some of the challenges on the teacher, especially when technology is integrated and not introduced in isolation. The leadership and excitement of being at a magnet school has set a positive tone and generated a lot of discussion and buy-in about the possibilities and expectations of a more coordinated and integrated practice.

# Unique Collaborations in Teacher Education Programs

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Abstract: The critical need for teachers coupled with the need for quality teacher preparation has led to a unique collaboration of a public school district, community college and the education department of a university. This collaboration has developed a teacher certification program that targets the non-traditional student with a strong emphasis in technology integration, authentic projects and quality fieldwork experiences.

**The CCACC Initiative**

In the past few years, a critical teacher shortage of has developed in the United States. The U.S. Department of Education predicts that the nation will need more than a million new teachers by 2010. (Kantrowitz and Wingert, 2000) In Arizona, the state which provides the context for this unique partnership, the media reports a demand for 27,000 new teachers throughout the next 10 years, a rate of growth currently ranking third in the nation. These new positions are intended to keep pace with the additional 200,000 students that will be relocating to Arizona over the next decade, and do not include additional positions to be vacated through attrition and retirements.

Coupled with a high demand for certified teachers is a renewed public scrutiny regarding teacher preparation. Concerns with current practices include a disconnect between universities and schools, limited field experiences, and weak links between education units and liberal arts departments (Burstein, Kretschmer, Smith, & Gudoski, 1999).

Although the needs are readily identified across the teacher education literature, few systemic or substantive changes have been made beyond superficial modifications to existing programs. This may be due in part to administrative or social barriers, including structures within higher education that support isolation, independence, and competition (Miller & Stayton, 1999).

Faculty members who want to improve the quality of teacher preparation often do so out of their own hide, without the support of the institutional environment.

The prevailing thought in current education reform focuses on collaboration and the potential for change to occur as individuals work in cooperative ways. As noted by Miller and Stayton (1999), "collaboration and innovation in teacher education are essential ingredients for preparing teachers for increasingly diverse and challenging school populations" (p. 290). Despite their potential, however, collaborative enterprises are also fraught with challenges. Often noted in the literature is the clash of cultures between schools and universities, resulting from a lack of shared vision or sense of larger issues through which the two cultures can be brought together. Superficial relationships between teachers and university-based faculty can also limit program impact (Bullough et al., 1999).

Three partners -- a university education program, a public school system, and a community college have developed a successful collaborative that is attempting to meet the dual demands of teacher shortages and quality preparation. The "Chandler Unified School District, Chandler-Gilbert Community College, Arizona State University East Certification Collaborative" (CCACC) was developed at the request of the Chandler (Arizona) School District, which is anticipating that its population of 20,000 pupils will double by 2012. The district requested a "grow your own" program that would allow its current instructional aides and paraprofessionals to earn credits towards certification while continuing their employment in the district. The community college would offer lower division courses, leading directly to admission at the university for a two-year teacher preparation block that would fulfill the requirements for a Bachelor's degree.

The CCACC initiative has the potential of addressing the current teacher shortage crisis while reforming teacher preparation through rigorous standards, innovative teaching, and intensive field experiences. Miller and Stayton (1999) purport that "creating professional communities designed for innovation is a complex social challenge, one that will require the actors to act with courage, integrity, and a willingness to create the structures we need for real reform" (pp. 301-302).

The CCACC partnership includes several distinctive features, including a focus on district and state standards in the development of a joint university/community college curriculum. The standards identified and aligned with each course serve as the framework for performance-based measures to trace the success of teacher candidates. For example, as students participate in intensive field experiences, their performances are mapped through observational rubrics and individualized professional portfolios. Quality is also enhanced through an emphasis on technology, and its effective adaptation to classroom instruction.

In addressing demands placed on the profession to accelerate the certification process, the CCACC collaborative optimizes conditions for current district employees to participate in the program. Courses are offered entirely on-site, and are primarily taught by the district's master teachers who consistently model best practices and standards integration in their own classrooms. The program also revolves around the district's calendar, facilitating the participation of employees while providing concrete experiences based around a complete school year. Critical to the collaborative nature of the initiative is the Site Coordinator, a university adjunct professor assigned to the district to assist in developing syllabi, advising, supervising, and mentoring the master teachers. These unique programmatic features, offered in the context of a university/district/community college collaborative, will provide the venue for the session's interactive exchange.

**"Grow Your Own" Certification**

The Chandler Unified School District, in the Phoenix, AZ metro area, serves a diversified population of over 21,000 students in grades PreK-12. Due to a booming city population and open enrollment laws, Chandler Unified is one of the fastest-growing districts in the state. The district has opened 8 schools in the last 10 years and now consists of 17 elementary schools, three junior highs and two high schools. In the next 15 years, the district will build a new high school (scheduled for 2004), a new junior high (scheduled for 2003) and at least 10 elementary schools. Additionally, in the last 5 years, the district has hired over 700 teachers. This number is half of the current 1200 certified staff members. In the last 3 years the district has hired 220 plus teachers per year.

As the school district reviewed the number of teachers retiring, the pool of new teaching candidates, and the number of prospective teaching positions, it was decided that a proactive stance needed to be taken. The district decided it was time to "grow our own." They were determined to find quality individuals who were interested in entering the teaching profession. Many of these individuals

are the employee pool of support staff. With the partnership of Chandler Gilbert Community College and Arizona State University -EAST campus, the district has been able to offer a program.

Students who have completed their required courses at Chandler Gilbert or elsewhere will take their methods courses in the Chandler district and participate in valuable learning experiences with master Chandler teachers. Additionally, this program is available to students with a degree in another area, wishing to pursue a post baccalaureate degree. Opportunities for participants to work for Chandler Schools as an instructional paraprofessional are available for those participants interested.

**The Role of the Community College**

It is approximated that at least 40% of prospective teachers meet at least a portion of their general studies requirements at two-year institutions (Haver & Watson, 1997), and that community colleges enroll 43% of all U.S. undergraduates (Anglin, Mooradian, & Hamilton, 1993). These institutions are therefore, prime venues for recruiting prospective teachers and, in particular, present a virtually untapped resource pool for minority teachers.

The role of the community college is to provide general education classes at times that are convenient for the working student or full time student. In addition, advisors meet individually with each student to develop a program of study. When cohorts are large enough, classes can be offered on site at the school district. Students can choose education classes as well as general education classes that meet the requirements of the first two years of college, and they can attend either full time or part time. Upon completion of the community college courses, they can transfer to the university program or one of the on-site collaborations as a junior.

The community college education program at the Williams Campus is geared for full-time students, many of who are already admitted to the university through the Partnership in Baccalaureate Education program (http://www.east.asu.edu/programs/pbacc/index.html). A 4-semester block of classes has been developed. Learning communities and a structured set of courses have been planned.

During the first semester, students are involved in a learning community which includes First Year English, Introduction to Education, and the Internet. This 7-9 credit hour block of classes is taught for 4-hours, twice a week. The three courses are fully integrated so the papers that the students will write for English 101 will be based on topics discussed in the Introduction to Education course. The Internet class will include development of computer literacy skills, research skills and web page design skills.

During the second semester, the learning community courses will be the second semester of First Year English, Contemporary Multicultural Film and Literature, and presentation graphics (PowerPoint). The Contemporary Multicultural Film and Literature will help students meet a humanities requirement, cultural diversity awareness, or a literacy requirement while serving as the theme around which students will write their research papers for the English composition course. Eventually, students will be sharing their research through the use of PowerPoint presentations, skills which will be developed in the presentation graphics computer course. Students will be asked to research, write and present around the theme of "Teaching and Learning in a Multicultural Classroom."

During the third semester, a 3-credit computer course will be linked with Children's Literature and Math. The students will learn more about computer terms and concepts using word processing, database, and presentation graphics to do various assignments with the children's literature class. They will use spreadsheets within the math class.

While the fourth semester is still in the planning stages, the students will be completing foundation courses in their major and certification requirements.

The students will proceed through the four semesters by taking some general education courses and some courses in education, specific to their major. In each semester they are completing important core requirements, gaining exposure to life as a teacher, and developing technology skills. A very important element of the program is that during each semester, the students will be involved in service learning experiences that include direct interface with school-aged children. They will serve teachers and children in a variety of K-8 school settings: working with children living in a nearby transitional housing program which provides shelter for formerly homeless families; serve at a branch of the Boys and Girls Club; and work at a YMCA early childhood program.

The faculty at the community college and the university are working in a collaborative manner to establish common goals for the students with items such as portfolios and course expectations.

**Teacher Preparation Curriculum**

The Elementary Education Program at ASU East is an extension from the program of the main campus at Arizona State University. ASU has entered into a partnership with the city of Mesa and the Chandler-Gilbert Community College to utilize the former U.S. Air Force Base -- Williams Field. The program began 2 1/2 years ago with 14 students.

In the course of development, the ASUE program began to no longer "mimic" the ASU Main program. Fieldwork became a more integral aspect of the ASU East program required each semester of the education program. Methods classes were taught at partnership elementary schools in the area. As the program began to grow, it became more obvious that major revisions were necessary in the curriculum.

Collaboration of the faculty lead to the development of a curriculum with a strong literacy base. The literacy methods courses follow the timeline of child development beginning with "Emerging Literacy". In each semester, there is an integrated learning experience, which emphasizes the application of the content of the methods courses, classroom management and portfolio development. The study of technology has been strengthened from a 1 credit course to 3 credit course with more emphasis on the integration of technology into instruction. The faculty has collaborated to develop cross-curricular assignments requiring the authentic use of content and technology in field experience. The faculty has also made a commitment to "model" the integration of technology into their instruction with the use of an Internet portal, multimedia presentations, and other forms of assistive technology.

**Technology Integration**

A 1997 report by the President's Committee of Advisors on Science and Technology stated that preservice teachers are not getting the training that they need to integrated technology into instruction. Preservice teachers do not routinely use technology in field experiences and do not work with mentor teachers who can demonstrate and advise on technology integration. (Moursund and Bielefeldt, 1999).

The Education Program for ASU East is fortunate to be based at the site for the university's computer and technology program. Classrooms on the campus are equipped with instructor stations (computer, VCR, projector) and the instructional support is very strong. With this support, it is a natural progression to integrate technology use into the education classes.

As part of a PT3 grant, the education faculty worked with classroom teachers to incorporate technology based projects in methods classes. These projects utilized skills developed during the required technology course and periodic workshops. At the expiration of the grant, the faculty made a commitment to continue with a strong technology integration model. Faculty has collaborated to develop assignments that are cross-curricular. The use of Internet resources is required in the research for these assignments and all work must be "word-processed" or produced using technology -- for example, video and digital cameras. The faculty also is endeavoring to model the use of technology in their own instruction. All instructors are required to provide instructional support through the use of the university Internet portal software. Students have 24/7 access to syllabus and other course documents, posted grades and discussion group. All notices and announcements are posted on the department's "community" site and are sent to the students via e-mail.

The administrators of the public school recognize the need for teachers to receive a solid foundation in technology training. In a recent survey, a vast majority of principals indicated that they would give more consideration to hiring a teacher with demonstrated technology training. (Heng-yu and Hopper, 2000). ASU East offers students the opportunity to earn a technology credential through additional coursework, workshops and an applied project.

It is a natural progression to continue the strong technology integration model of ASU East to the CCACC program. Chandler is home for the Intel Corporation and the company has strong ties with the school district. Intel and the CUSD are in the process of developing "the classroom of the future" where teachers will be trained in the latest educational applications -- including the use of PDA's as a teacher and student learning tool. The preservice teachers enrolled in CCACC will have the opportunity to train in the "classroom of the future" and develop projects to use in their fieldwork.

**Field Experience**

One of the strengths of the education program at ASU East has been the required field experience. Preservice teachers complete 6 hours weekly each semester working with a mentor teacher. To coordinate with the child development focus of the literacy curriculum, the fieldwork assignments are coordinated with that particular semester's study -- i.e. during Emerging Literacy, preservice teachers are assigned to K-2 classrooms as interns. Assignments in methods classes are developed to utilize the fieldwork.

To accommodate the non-traditional students of the CCACC program (working adults), modifications have been made in the fieldwork requirement. Fieldwork is still a strong component and valuable asset of the teacher education program. The number of required hours has been reduced while the district administration has screened and trained mentor teachers to make sure that the fieldwork hours are all "quality" hours. Those students who are employed as paraprofessionals in the district will use their work experience as fulfillment of the fieldwork credit. This may require "visiting" other classrooms in order to complete an assignment. Those students who work as substitutes in the district can count their substitute experiences for half of the fieldwork hours. Other students have made arrangements with employers for flexible hours to free time for fieldwork. The school district has also asked for interns to work in "Saturday" school -- a remedial study program.

**Conclusion**

The collaboration for providing training for future teacher is continuous and reciprocal. Each party has approached the discussion with the goal of providing the best possible scenario for training teachers. Although, we have not endeavored to "reinvent the wheel", we have made an effort to look at pedagogy with new eyes and not be caught in the trap of how it has always been done. There is much give and take, but never a compromise on quality of the program. The discussions will continue throughout the program as we analyze what works.


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Technology and Pedagogy: The Evolution of A Curriculum

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Abstract

Acadia University was the first laptop university in Canada. Being first has had its challenges. This paper discusses how between 1996 and 2000 a School of Education has adapted to the new technologies and made efforts to incorporate them pedagogically in their two-year after-degree teacher education program. Data gathered from review of equipment and facility inventories, demographic and curriculum documents, and surveys of students and faculty regarding background computer knowledge, attitudes, skill development, application, and innovations have formed the basis for this analysis. An examination of the first four years since initial implementation of laptop technology infusion into the teacher education program demonstrates an interesting evolution of curriculum and its impact on education students and faculty. The conference presentation graphically illustrates various survey results, and raises discussion questions about the technology/pedagogy/curriculum linkages.

Technology and Pedagogy: The Evolution of A Curriculum

## Introduction

In 1996 Acadia University embarked on an IBM-sponsored laptop project, the first of its kind in Canada. By the fall of 2000, full implementation of this initiative, coined the Acadia Advantage, put Pentium laptop computers in the hands of some 3420 full-time students and 357 full- and part-time faculty. A complete rewiring of the campus has allowed for virtually unlimited network and internet access. The campus-wide project has had profound implications for the School of Education teacher education programs. Computer technology was an immediate concern, and remains so, as Education faculty seek to develop, to use, and to model the use of, pedagogically appropriate classroom strategies. This paper follows the evolution of curriculum between 1996 and 2000 as technology has taken a more prominent role in our teacher education programs.

## The Setting: Acadia University

Founded in 1838 and one of the oldest universities in North America, Acadia University is located on a 250 acre campus in a rural farming community. The student population of approximately 3420 is attracted from over 30 countries around the world. The university offers 200 degree combinations, primarily undergraduate degrees, although a limited number of Master degree programs are available in most faculties. Research funding from Canadian granting agencies alone reaches approximately ½ million dollars annually. Class sizes vary of course, but average teacher:student ratio of 1:15.

Acadia University is recognized as an educational institution worthy of considerable praise. In each of the past three years, Maclean's magazine conducted a national survey

and ranked Acadia as the "best overall", "most innovative", and "highest quality" primarily undergraduate university in Canada. In 1999, the Acadia Advantage initiative was inducted into the Smithsonian Institute.

All teacher education programs in Nova Scotia are legislated as two-year pre-service professional education following a first degree (arts, science, etc.). Acadia University School of Education takes in approximately 130 students each year for a total enrolment of 260. School of Education faculty includes 18 full-time and 7 part-time professors.

The Process

For this study, data gathered from a review of equipment and facility inventories, demographic and curriculum documents, and surveys of students and faculty regarding background computer knowledge, attitudes, skill development, application, and innovations have formed the basis for this analysis. The purpose of examining the first five years of initial implementation of laptop technology infusion into the teacher education program, was to describe the pedagogical and curriculum changes that became necessary as students and faculty grew into their new roles as teachers/learners in a fully-wired and technologically-enhanced learning environment at Acadia University.

Technology Infrastructure

For the campus: Acadia University campus has 5200 data connections spread over dormitories, student meeting areas, classrooms and teaching laboratories. Laptop computers are leased by students as part of their $5000.00 tuition fee. The same model laptop computers are provided for each faculty member.

**Computers Used by Students and Faculty 1996-2001**

| 96/97 | 97/98 | 98/99 | 99/00 | 00/01 |
|---|---|---|---|---|
| 365ED | 365XD | 380ED | 380/385 | A20M |
| 100 MHz | 133 MHz | 166 MHz | 166/366 | 500 MHz |
| 412 MB | 1.2 GB | 2.1 GB | 2.1/4.8 | 6 GB |
| 12 MB | 24 MB | 48 MB | 48/64 GB | 128 GB |

For the School of Education: Acadia University School of Education has 286 network connections and 10 wired classrooms. Equipment available includes digital projectors, opaque projectors/overheads, sound systems, VCRs, analog/digital video production, digital cameras, and scanners in teaching labs plus one in each faculty office.

Technology Support

AITT: Acadia Institute for Teaching and Technology (AITT), or more commonly known as the Sandbox, provides support for instructional design and teaching innovations for faculty. AITT has a full-time staff of eight, including one seconded member of faculty, and a part-time staff of up to 20 students. Typically to access support, a faculty member starts with an idea of how technology might improve the manner in which a particular course component

## Technology Support

| | Full-Time Staff | Part-Time Staff | Support For Whom? | Example |
|---|---|---|---|---|
| AITT: Acadia Institute for Teaching and Technology (8) (22) | 1 director<br>1 manager<br>3 academic computing specialists<br>1 project coordinator<br>1 multimedia producer<br>1 seconded faculty | 1 instructional designer<br>1 webmaster<br>1 digital audio specialist<br>1 programmer<br>15- 20 students | Primarily for faculty; student occasional use | Curric. development and tech. problem-solving |
| ACME: Acadia Courseware Management Environment (4) | 3 academic computing specialists<br>1 programmer | | Faculty prepare it for each course; students access it during course | Faculty place all course materials and assignments on ACME; registered students access |
| USC: User Support Centre (13) (11) | 1 manager<br>3 senior technicians<br>6 senior help-desk consultants<br>1 software consultant<br>1 trainer<br>1 IT support & training coordinator | 11 (student) help-desk consultants | All faculty and students | Problems with computers, network access, classroom equipment, etc. |
| CSS: Computing Services Support (16) | 1 director<br>2 managers<br>1 sr. network analysts<br>3 system analysts<br>1 junior systems operator<br>2 unix ops/admin<br>3 programmers<br>3 technicians | | System support campus wide | Problems with basic system and network |

could be taught, and then works with AITT staff to develop the necessary technical design and application.

ACME: Acadia Courseware Management Environment is an on-line framework for each instructor to post contact information, course outline, course text information and materials, course notes, questions, on-line discussion groups, and tests. Staff includes 1 programmer and 3 academic computing specialists.

USC: User Support Centre has 13 full-time and 11 part-time staff. This service is used extensively by students and faculty particularly early in the academic year. For example, between August 16th and September 28th, 1999 (43 days), USC responded to 9446 calls for support.

CSS: Computing Services provides system support with a total of 16 full-time staff including 1 director, 2 managers (network services; information systems), 1 senior network analyst, 3 system analysts, 1 junior systems operator, 2 unix operator/systems administrators, 3 programmer analysts, and 3 technicians.

Evolution of Curriculum in Teacher Education Programs
1995: The School of Education computer lab was equipped with 10 IBM clones 386/486 attached to a campus computer network and a single network printer for students to access. Five Macintosh computers in a LAN were equipped with such specialized inclusive education peripherals as Touch Window, Intellikeys, Braillers, etc. Three Macintosh computers were connected to the campus network. Fifteen students enrolled in each of two sections of an elective introductory computer applications course. The curriculum was comprised of 80% skills and 20% applications. Each student's background was assessed and an appropriate skill development stream implemented.

1996: The computer lab remained the same. Introduction to Computers in Education became a required course for all B.Ed. students; four sections with 25-30 students in each. Computers were shared by three students. The curriculum again was comprised of 80% skills and 20% applications. Group tutorials addressing general areas of growth were required.

1997: AA Initiative (Acadia Advantage) sponsored by IBM began. A new small classroom with 25 network drops was provided for the now required Introduction to Computers in Education course. Network support for Macintosh was no longer available and therefore could only run Mac's in LAN or stand-alone. The curriculum was comprised of 70% skills and 30% applications. File management and email became obsolete areas of the curriculum. Workshops at beginning of the semester were introduced to ensure that all students had a beginning base of computer skills to bring to the course. Some exposure of students to the Macintosh platform was maintained.

1998: Large classrooms became available with 60 network drops. Class sizes increased to 30-35 students. Some exposure to Macintosh platform was maintained. The curriculum was comprised of 60% skills and 40% applications. Students' backgrounds in all areas seemed to have improved to an extent that much less time was spent in skill areas: word-processing, spreadsheets, databases, internet use and file management. Student attitude about computers had changed significantly in a positive direction. A new elective course in Computer Multimedia was offered in response to student demand for more applications. Although this was not a required course, two sections had to be capped at 15 students each, based on resources available.

1999-2000: Large classrooms became fully equipped with data projectors and opaque projectors, VCRs and sound systems. The curriculum continued to be comprised of 60% skills and 40% applications. However, students now had a much more positive attitude and seemed to need much less ongoing support. Professors increasingly used more technology in their teaching. Students were exposed to a wide variety of applications in the context of other subject areas. Students became very adept at using the technology in the presentation of their own work in their on-campus classes, and in their teaching for those fortunate enough to have an internship in a technology supported school.

**Student Background Survey**

| Application | None | Experience<br>Some | Extensive |
|---|---|---|---|
| Word Processing | 1 | 2 | 3 |
| Spreadsheets | 1 | 2 | 3 |
| Databases | 1 | 2 | 3 |
| File Management (directory structures) | 1 | 2 | 3 |
| Internet searches | 1 | 2 | 3 |
| Webpage design | 1 | 2 | 3 |
| FTP | 1 | 2 | 3 |
| Listservs | 1 | 2 | 3 |
| Newsgroups | 1 | 2 | 3 |
| Email & attachments | 1 | 2 | 3 |
| Desktop Publishing (graphics) | 1 | 2 | 3 |
| Powerpoint | 1 | 2 | 3 |
| Qbasic programming | 1 | 2 | 3 |
| Probes for math and science | 1 | 2 | 3 |
| | Maximum | Score = | 42 |

**Survey Results**

| Year | Average Total Score (n = 110-130) |
|---|---|
| 1996 | 21 |
| 1997 | 22 |
| 1998 | 28 |
| 1999 | 34 |
| 2000 | t b a |


Summary:

An examination of the first five years since initial implementation of laptop technology infusion into the teacher education program demonstrated an interesting evolution of curriculum and its impact on education students and faculty. The influence of the technology on pedagogy and on curriculum might have at first seemed linear, but it became increasingly clear that technology, pedagogy, and curriculum are inextricably linked in a continuous ascending growth spiral. A change in any one element, created new opportunities for change in one or the other of the remaining two elements, which then precipitated a change in the third, and so on. New curriculum developments can stimulate a drive to create a new application of the technology. A new way of thinking about the pedagogy can stimulate a new aspect of curriculum development and a new application of technology.

Understanding the strength and importance of such linkages has significant relevance for teacher education programs. The increasing speed with which new developments in technology occur will likely provide ongoing challenges for teacher educators. If our efforts are successful in helping pre-service teachers understand and exploit these vital linkages between pedagogy, curriculum, and technology, then we might expect the diversity of young learners in today's classrooms to readily engage in learning activities created by teachers that address their various learning styles and capture their interest.

# Multiple-Delivery Systems—A New Approach to Education Courses

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**Abstract:** Multiple-delivery Systems: A New Approach to Education Courses at Indian River Community College (IRCC) addresses the needs of non-traditional pre-service education students through multi-media Internet-based courses in education. These courses are learner-centered and combine the synchronous format required to develop social interaction skills with the asynchronous access to information and to assignments. The course addresses multiple learning styles and promotes active student learning, while facilitating student success by providing web-based college support services online. An example, "Introduction to Education," features instructional lesson summaries and lectures using streaming video and graphics, graphic support materials, e-mail, chat rooms, message boards, and multi-media technology to address auditory, visual, and kinesthetic learning styles. A description of the web-based course and an introduction to the student support services available to students is presented. Also, this paper presents the rationale for the course components along with a description of the additional courses engendered by this prototype.

How do you develop an on-line course that uses state-of-the-art technology to address student learning styles and that uses a virtual campus to meet Southern Association of Colleges and Schools (SACS) criteria? Distance Learning challenges faculty to capture the atmosphere of a traditional classroom and to communicate that atmosphere in an asynchronous manner. An additional challenge arises when the course serves the dual purpose of providing prospective teachers with a pre-requisite knowledge base for entry into a teacher education program and of showcasing the skills that characterize effective teaching.

All too often Internet classes are little more than high tech correspondence courses that offer communication only in a half-duplex mode. In other words, the instructor poses a set of exercises and of assignments. At a later time the student completes the work and sends it to the instructor only to be forced to wait again for results. This delay yields a sporadic stimulus-response system that is mutually unsettling. The impersonality of the experience invariably results in high attrition rates.

These negatives, however, can be reversed so that the Internet experience can be rewarding both to the instructor and to the student. McArthur and Lewis point out that "information technologies can improve the efficiency of learning and teaching" (1998). The Internet-based "Introduction to Education" course from Indian River Community College (IRCC) features multi-media streaming, video, and Internet resources to promote efficient learning. Moreover, as Frayer and West (1997) suggest, students are more actively engaged in the learning process, practice more, and receive useful feedback when learning styles are matched to the learner. This course uses state-of-the-art technology to address auditory, visual, and kinesthetic learning styles, while providing synchronous and asynchronous active student learning, educational resources, and extensive support services. "Introduction to Education" uses Internet-based instructional lesson summaries and lectures, streaming video and graphics, graphic support materials, e-mail, chat rooms, and message boards to create a successful learning experience. The student is able to see and hear the instructor and take part in class discussions. Students learn various teaching methods as they engage in the activities thus improving their personal teaching skills (Collins, Brown & Newman, 1989). There is less isolation for the student, and a feeling of camaraderie frequently develops among fellow students. The intimidation of communicating that might exist in a classroom setting disappears, and the frequency and intimacy of communication among students and between students and instructor increase (Chickering & Ehrmann, 1997).

As this course was conceived and designed, the student's needs took priority. Among the design principles are those enumerated by Kozma and Johnston (1991): using multiple modalities to engage students in drills, simulations, critical thinking, collaboration, scholarship, and construction of knowledge. Subject matter, concepts, and skills were presented using various modalities and in varied format. A student who needs to utilize a visual method of learning receives visual reinforcement. The student who needs to apply a more tactile approach is accommodated as well. The clarity of the streaming audio and video replicates the classroom situation to the extent that students have reported that "it was like having the instructor in the living room." Insofar as that was the case, the design was successful. The successful completion rate for this class is among the highest for the college, whether Internet, Interactive Television, Telecourse, or the traditional classroom.

During the development phase, the quality of the streaming media was a major focus. The course must be delivered so that the quality remains consistent whether the student has a state-of-the-art computer setup or a rather marginal one with a less than 56K modem. An initial welcoming video serves to introduce the instructor to the class. Using Real Media, the quality of the video is excellent and free from the distracting jerkiness of some web-based video. Lectures for each chapter in the course text were written by the instructor and recorded in the Distance Learning studio. The recordings were carefully edited to remove extended pauses, incomprehensible phrasing, and extraneous noise. Using Sound Forge, the finished product, 9 lectures in all, was loaded into RealMedia and matched with a set of PowerPoint slides that highlighted key points in the lectures. These slides may be printed for study purposes.

The separate yet integrative components of this course include a set of video tapes provided by the textbook publisher. These videos are keyed to individual chapters in the text. Each is remarkable in that it generates fervent discussion among students. These discussions take place on the message board and in the chat room. With the instructor as facilitator, these discussions allow a personal level of involvement for everyone.

Written assignments for this course include reflections on journal articles as well as in-depth research on various cultures. Assignments are e-mailed to the instructor who grades them online and resends them to the student. Immediate feedback is crucial in distance learning. The rapid turnaround of assignments offers the distance learning student immediate reinforcement.

Student progress in the course is measured by a series of online tests. There are two testing formats available for each test, either multiple choice or essay. The student chooses the format preferred. The test is available to students during a specified number of days. Students are allowed only one attempt and receive their score upon finishing the test. A time limit is imposed for each test. The final examination is proctored and must be taken at a campus site.

The last piece of the process is the support provided by the college itself. The IRCC web site replicates campus support services through a virtual campus. Students can read the IRCC Catalog, can obtain financial aid information and applications, can check up-to-date class offerings, can register, can buy textbooks and supplies, can access educational support materials and resources, and can use library resources on-line.

The course is mounted on the Internet using Web-CT. This relatively user-friendly course presentation software offers the flexibility required for the various course components. IRCC faculty interested in developing courses for the Internet receive intensive training in the use of Web-CT and the Distance Learning technical staff are available at all times to assist, to offer advice, and to provide video and sound editing. Successful creation of these materials depends on the communication between the educational faculty and the distance learning support team. Through teamwork, technical knowledge and course content are fused to design and to develop a successful distance learning course offering. Realizing that any such endeavor will always be a work in progress, adjustments, refinements, and additional resources can be added as needed. In a sense, then, the course does not become stale. Just as the classroom can become rigid and tiresome, any web course must receive regular and critical evaluation. Student evaluations, peer review, and experiential data supply the information used to update the course.

The success of this education course, both from the instructor and the student perspective, has given rise to the development of similar courses in Mathematics, Earth Science, and Ecology. Taking full advantage of new technology, virtual field trips, real-time interactive and asynchronous classroom visits, and web-based resources all become the delivery method and the substance of the student's learning experience, transcending the limits of a typical virtual classroom.

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# A Holocaust Web Site: Effects on Pre-service Teachers' Factual Knowledge and Attitudes Toward Traditionally Marginalized Groups

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**Abstract:** The Holocaust remains one of the most effective and extensively documented subjects for an examination of basic humanitarian issues. Knowledge is the key to an intelligent understanding of such a tragic passage in human history, the key to a wisdom that will never let it happen again. To address the need for quality, accessible information about the Holocaust, the Florida Center for Instructional Technology developed an extensive website titled *The Teacher's Guide to the Holocaust*. This study was designed to investigate the effectiveness of the website. Specifically, data were collected via pre and posttest measures to determine if access to *The Teacher's Guide to the Holocaust* significantly impacted the knowledge level or attitudes of pre-service teachers.

## Introduction

In response to a bill passed by the Florida Legislature in 1994 (Florida Statute 233.061 requiring public school instruction of the history of the Holocaust), graduate students and staff at a major Florida university created a web-based instructional program for Holocaust education. This award-winning site, *The Teacher's Guide to the Holocaust*, is now an amalgam of over 6,000 files in a variety of media ranging from virtual reality tours, videos, survivor testimonies, and photos, to thought provoking teacher-resource and student-activity sections (http://fcit.coedu.usf.edu/holocaust). The site is meant to be a resource for certified and pre-service teachers, many of whom have had little or no training for teaching such sensitive material.

The instructional goal of the website is to provide a single starting point for Holocaust education with relevant background information and links to instructional resources. The content of *The Teacher's Guide to the Holocaust* is presented from three perspectives: Timeline, People, and The Arts. An introduction to the *Teacher's Guide* reads: "Holocaust study is a very sensitive subject, and the appropriateness of material is dependent upon individuals. All materials should be reviewed before use in class." In designing the site, it was hoped that, through the study of the Holocaust, students and teachers alike would be able to develop an understanding of the ramifications of prejudice and racism, and help to ensure that an event such as the Holocaust will not happen again (Barron, 1998).

The purpose of this study was to investigate whether or not pre-service teachers' factual knowledge and attitudes toward traditionally marginalized groups would be significantly changed through interaction with the *Teacher's Guide to the Holocaust* website. Second, the study was meant to examine the state of pre-service teachers' knowledge on the Holocaust. Third, any correlation between subjects' knowledge and attitudes was analyzed.

## The Study

Participants in the study were pre-service teachers enrolled in an undergraduate course – EME 2040: *Introduction to Computers in Education.* All students enrolled during the spring semester, 2000, were invited to participate. Of 143 participants who began the study, 115 completed both the pretest and posttest.

Two types of instruments were developed for this research: an objective test of Holocaust factual knowledge and two scales to assess attitudes toward diversity and perceptions of traditionally marginalized groups.

On the day of the pretest, each student received a packet containing a knowledge test, one version of the attitude instrument, a lesson plan assignment sheet, and a CD containing a website. Students were encouraged to answer the questions as honestly as possible. Following administration of the instruments, graduate assistants for the class collected the test forms.

Students were required to develop a lesson plan based on the CD included in their packets. Students assigned to the experimental group were required to complete an assignment using *The Teacher's Guide to the Holocaust* website, while students in the control group developed a lesson plan based on the *4th Grade FCAT website*. These assignments were designed so that the student needed to review and investigate the particular resource they were assigned. The Holocaust activity incorporated a question that built upon a section of the guide titled *Timeline* and required the student to read and synthesize material from each of the sections. The students were given one week to complete the assignment. Posttest data were collected during the class session in which the assignments were turned in.

## Results

Data were analyzed using both analysis of variance and correlational methods. Group difference in changes from pretest to posttest on knowledge and attitude scores were assessed using analysis of covariance. In addition, two factor ANOVAs, (treatment condition by occasion of testing) were used to examine changes in perceptual bias toward specific marginalized groups, and correlations between knowledge and attitude scores were evaluated. Finally, individual item difficulty indices were used to guide a content analysis of participants' performance on the knowledge test.

The results indicate that exposure to the *Teacher's Guide to the Holocaust* did not have a significant impact on either the factual knowledge or the attitudes of the subjects. The findings suggest that the limited amount of engagement required of the subjects (they had to write a lesson plan related to the material) was not sufficient to impact a change in either knowledge or attitudes. Perhaps a more thorough, directive approach to the material would be more beneficial.

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# Creating Collegial Networks

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**Abstract:** This paper examines how web-based educational environments were used to foster collegial conversations in three case studies conducted in the Graduate School of Education at Portland State University. The cases describe instructors' and graduate students' experiences with interactive, online discussions. Two cases center on interactions in cohorts (groups) of preservice teachers, while the third case highlights the course-based exchanges of inservice and preservice teachers. Reactions to online interactions are analyzed. Several important considerations are shared about how to cultivate peer collaboration and encounter success when teaching and learning with web-based environments.

## Introduction

Teacher educators know that discussion is vital to learning. Now, teacher educators are exploring whether telecommunications can broaden the discussion by taking it beyond the walls of the classroom. This paper describes the instructors' and graduate students' involvement with interactive web-based learning environments, examines their reactions to this type of interaction, and provides suggestions for implementation.

Given today's busy lifestyles, electronic discussions seem an efficient way to nurture such interactions without concern for geographical boundaries or time constraints (Johnson, 1997). Use of web-based educational environments may extend learning and teaching beyond our classrooms through electronic dialoguing (Norton & Johnson, 1997). An online dialogue helps to enhance our students' conceptual understandings of issues related to preservice and inservice teacher education.

## Background

Web-based educational environments are rapidly establishing a presence on university and college campuses. These user-friendly resources allow instructors to create a unique online learning forum for their students. Today, most web-based educational programs require minimal expertise on the part of the student or instructor. Teacher educators are discovering that web-based tools such as e-mail and listservs facilitate communication among instructors and students (Van Gorp, 1998). Using web-based resources is a straightforward way to supplement course content and to increase communication among students and instructors.

Instructors use the controlled environment feature of web-based technology to promote discussion and collaboration. Since user IDs and passwords limit access to the web-based environment, online conversations remain cohort-wide as opposed to worldwide. As students connect with one another in this safe and limited space, their unique personalities and feelings are revealed (Wepner & Mobley, 1998). Similarly, this forum creates a safe learning environment for students to display their work among a smaller, known audience. Features that cultivate collegial interactions include electronic bulletin board tools for communication and cohort forums; course and calendar tools for posting assignments and important dates; and student project pages for sharing ideas and displaying products. These options allow instructors to create a purposeful and learner-centered network. Web-based educational environments are more than sites to access information; they create a place for interactive communication and the construction of knowledge (Van Gorp, 1998). These online environments have the potential to facilitate learning processes as well as peer collaboration throughout the teacher preparation and continuing education programs. Importantly, students and instructors are afforded with continual opportunities for interaction and reflection across both university and field settings.

## Implementation

The following three cases reveal how instructors implemented web-based environments with their graduate students. The first case explores the interactions of preservice teachers in a graduate teacher education program. The next case examines the growth of preservice teachers in the special education program. In the final case, the collegial dialogue among inservice and preservice educators evolves.

### Case Study: Beginning the Conversation

Yearlong access to the bulletin board and specific features of the web-based system was established for three successive field-based cohorts (groups) in Graduate Teacher Education Program (GTEP) at Portland State University. GTEP is an intensive, one-year teacher preparation program comprised of academic work and field experiences that leads to licensure. GTEP students complete the program requirements in cohorts. During the past three years, the field-based cohorts have had 28-29 members. Though students in these field-based cohorts took course work together, their student teaching placements were spread across several school districts. As a result, students were afforded the opportunity to use on an online environment to maintain a professional conversation with members of their cohort. The web-based environment provided a means for students to stay connected across the academic year and began to shape a collegial network. Beginning in the fall term, students were introduced to the electronic bulletin board in the *Classroom Instruction and Technology* course. During the winter term, students routinely used the bulletin board feature to support the academic and field components of the teacher preparation program. When engaged in full-time student teaching in the spring, students were able to continue and deepen their collegial discussions. Students' encounters with the web-based environment expanded each year as the instructor drew upon prior experience from the previous cohort's interactions. Through this online forum, expectations were communicated effectively, information was exchanged efficiently, and meaningful dialogue flowed effortlessly.

Communication among students and instructors improved with the inclusion of an electronic bulletin board. More positive and productive interactions emerged. After sharing learning objectives, one student provided this supportive feedback, "Your objective was clear and precise. I understood exactly what you wanted the students to do. You not only stated what you want students to be able to do, but also what and how they were going to accomplish the objective." Students responded to posted topics and posed questions about their field experiences. When prompted to report effective teaching behaviors that they had observed, an aspiring science teacher posted, "My teacher, through modeling and thinking aloud, helps the students learn how to organize the given information and develop a "plan of attack" to solve the problem." A foreign language student teacher initiated a dialogue about modeling. "Modeling is a constant in the foreign language classroom. There seems to be much controversy about error correction in the classroom. Should the student be corrected on the spot when he/she mispronounces or uses the wrong word?" Other students sought feedback on their performance. "I just want to make sure that I have completed all of the required assignments that have been posted and that I am on track." Students and instructors alike used the bulletin board to convey personal sentiments. Midway through the program, one student offered his thoughts to the cohort, which generated a flurry of heartfelt responses.

> I know that I have not shared with all of you what an honor it is to be associated with this cohort. Throughout the three months that we have been together, I have witnessed genuine

caring and concern for the members of our group. It bodes well for the teaching profession that tomorrow's teachers exhibit this nurturing behavior, as it was often mentioned in our discussions of effective teachers. I thank all of you for continuing to make this one of the most memorable experiences of my life.

One instructor expressed her genuine and positive regard in this way: "I really appreciate your demeanor and sensitivity when you interact with us" and "Thank you for the contribution you have made to our cohort". Overall, students communicated more frequently and openly, were more cognizant of course and program expectations, and reflected openly on their teaching experiences.

**Case Study: Preparing Preservice Teachers To Be Online Teacher Collaborators**

Being "connected" with colleagues is of vital importance for special education teachers as they learn their craft. Due to the nature of their jobs, they are often physically isolated from other special educators who can potentially offer valuable support and mentorship. It is with this in mind that Portland State University's Special Educator Program began to integrate electronic discussion into preservice experiences. Across the span of an academic school year, a cohort of full-time graduate students learned how to participate in online discussions within the context of coursework and field experiences. This case study describes how graduate students preparing to be special education teachers learned to use electronic discussion methods as a means to maintain professional connections.

The first stage of the study required students to participate in asynchronous electronic discussion available through a online course environment designed for the Collaboration 1 course offered during fall term. Students learned the technical aspects of online discussion by: a) participating in practice sessions that explicitly modeled the skills of composing new messages and replying to received messages; b) being mentored by other students in the cohort and; c) using web-based tutorials. For many students, this was the first time they had participated in web-based discussion outside of traditional e-mail applications. A weekly routine was established where students purposefully participated in electronic discussions as they reflected upon the assigned course readings and web links. The goals for this term were for students to get comfortable with using web-based technology, to learn to actively troubleshoot unexpected technical problems and to begin to connect with others by participating in threaded discussions. These expectations were surpassed as students successfully posted a total of 165 messages with 68% of those messages connected to short threaded discussions (most commonly consisting of 2-3 messages each). It became clear that students were learning to interact purposefully online as they exchanged opinions and ideas.

During the second term, the same group of students participated in electronic discussions as a requirement for the Collaboration 2 course. Students were expected to build upon the accomplishments of the previous term by increasing their interactivity and deepening the conversational nature of discussion forum activities. The total number of messages posted across the term (n = 328) increased substantially from the previous term suggesting that students were becoming more adept at using the electronic bulletin board. In addition, an evolution in the quality of the discussions began to occur as threaded discussions became driven by "hot topics" with more students asserting their perspectives. There were still threaded discussions with 2-3 messages but now, deeper electronic conversation threads with 7-10 messages were regularly occurring. In an effort to generalize online discussion skills outside of the course discussion board, students were also required to subscribe to a listserv or discussion group of their choice.

During the final term of the program, students actively contributed to the electronic discussion board as they immersed themselves into a full-time student teaching experience. The culmination of their online discussion experience created a rich dialogue among student teachers and university faculty inspired by the ongoing epiphanies and quandaries of each student teacher. Student teachers began to expand their electronic conversations into the reality of day-to-day teaching responsibilities. In the process of reviewing hundreds of messages posted during the 10-week student teaching period, six recurring themes emerged from the discussion threads including: 1) requesting help; 2) sharing common experiences; 3) expressing opinions; 4) broadcasting useful information; 5) sharing ideas for innovation and; 6) offering support to others. In one instance, a student teacher that felt empowered by her online experience created a listserv for student teachers and first year special educators. Overall, the explicit teaching and guided practice of electronic discussion skills prior to student teaching transformed the discussion group from being "technologically inexperienced" to a cohort of savvy collaborators.

Case Study: Transitioning from "Chat" to a Professional Dialogue

For the past three years, students have had the opportunity to take an elective course titled *Applications of the World Wide Web for Teaching and Learning* in PSU's Graduate School of Education. Over the years, the course format has evolved into a flexible format approach that combines face-to-face and online class sessions. About 20-25 students have enrolled in this 10-week course each year. Although a majority of the students have been inservice teachers, undergraduates and preservice teachers have participated in the course each year (approximately 30%). Because the content of the course focused on web-based learning, it also seemed appropriate to have the course serve as a model of web-based teaching.

During the first year, students met face-to-face each week for the first three weeks of the course. Class activities included locating and evaluating web resources and learning to use the email, bulletin board, and chat tools included in the online course environment. The fourth week of the course was held online, to test the bulletin board sharing and email assignments with chat discussion format to see how it would work. While the email and bulletin board discussions were successful, the chat sessions were not. Due to equipment or access challenges, almost 50% of the students failed to access one of the chat sessions. Those who did access the chat session found the challenge of typing messages and tracking the conversation awkward. During the next face-to-face session, students brainstormed and established criteria for improving the chat session format: 1) sessions were scheduled for various days and times to allow access and keep the number of participants to about 4-6 students; 2) students who did not have adequate access at home or work were encouraged to use campus labs; 3) during the chat sessions, students included the name of the person they were responding to when appropriate (chat etiquette). Three online sessions that applied these formatting changes followed, with better use of the chat function.

The course was redesigned for the second year with three of the ten class sessions held on campus: the first, mid-term, and final class sessions. This allowed time to learn how to use the course tools, begin to create a community, and set expectations for weekly online sessions. During the online weeks students were expected to: 1) send email to the instructor sharing progress on course assignments; 2) participate in bulletin board discussions of readings focused on issues such as equity, ethics, copyright, and child safety; 3) participate in a chat session discussing the work they were doing for course assignments. By applying the lessons learned from the previous years chat session's attendance improved, and conversations were more coherent. Yet, the quality of the discussions was still primarily chat (e.g., How are you? What movies have you seen lately? Were your kids out of control today?). While this did help us maintain a feeling of community, any significant dialog related to course issues was minimal, and most sessions lasted only 15-20 minutes.

Changes to this course during the third year focused on the need to initiate and sustain a more professional dialog during chat sessions. Course readings, bulletin board postings, and chat assignments were modified to establish the students themselves as both teachers and learners. Each session focused on an issue of the week, with students taking turns being the expert or sharing their experiences with a given issue. The resulting discussions were rich in content and quality, and frequently lasted longer than the scheduled thirty minutes. By centering each week around a specific subject with students as experts during chat and bulletin board discussions, and observing appropriate chat etiquette, chat sessions have evolved from simple conversations to professional discussions centered around issues related to web-based teaching and learning. As a result, this course now serves as both a useful learning experience, and an appropriate model of web-based learning.

## Discussion

Teaching with web-based technology requires planning, implementation, and revision. Several important lessons were gleaned from teaching with web-based environments. 1) Start small and expand its use routinely. Instructors need to introduce their students to a limited number of features of the web-based system before adding additional components. 2) Create scenarios that foster student success with technology. Initial instruction that guides students to access and respond to messages on an electronic bulletin board works well in face-to-face sessions. 3) Engage students with meaningful work that naturally draws upon technology resources. Electronic discussions need to center on authentic, educational issues that resonate with students. 4) Ensure equity of access to technology resources. Instructors need to become knowledgeable about what resources are available to students and actively support their access to those resources. 5) Find ways to incorporate technology seamlessly into both the academic and field components of preservice programs. 6) Model technology's use for students, and problem-solve technology problems as quickly as possible.

Instructors need to focus students' attention on learning to use the available technology in order stay connected to their developing collegial network. 7) Reflect upon the experiences and outcomes of using web-based resources when planning its continuation.

Finally, student response rates and evaluative comments attest to the positive impact of their web-based interactions. Online environments appeal to a range of audiences as evidenced by numerous university courses and multiple student groups tapping web-based systems. Overall, web-based educational environments provide a forum for discussion among colleagues and expand the opportunities for learning.

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# Technology and Teacher Preparation: A Case Study

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**Abstract:** Over the past several years, I have attempted to raise both the computer knowledge level and the computer comfort level of preservice teachers by: 1) integrating technology into my own teaching, 2) using technology to foster preservice teacher inquiry and high level thinking, and 3) using technology to encourage preservice teachers to become educational leaders. This report describes several of the activities such as threaded discussion, publication of lesson plans on the Internet, access to lesson plans and further readings, and use of e-mail based class discussion and their impact on preservice teachers' perceptions of the role, use and purpose of technology in the classroom. Analysis of preservice teacher feedback following courses that require the use of technology in many different learning activities demonstrates that although undergraduate preservice teachers enter the program with slightly more developed computer skills than graduate preservice teachers, it is the graduate preservice teachers who are able to articulate how technology might be integrated into their own teaching.

**Keywords:** Integration of technology, Technology and teacher preparation, Technological literacy

## Introduction

Like many teacher preparation faculty across the nation, I have decided not only to *talk the talk but to walk the walk* with respect to technology by transforming my literacy courses so that preservice teachers experience information technologies in support of learning and teaching (Queitzsch, 1997; Zellner, Denton & Zellner, 1999; Gipe & Lamare, 1997; Rossiter & Bagdon, 1999). Multiple national and state reports such as *Transforming Learning: Technology Integration Across the Teacher Education Curriculum* (1999), *Resources for 21st Century Teachers* (1999), and *Technology Competencies for Connecticut Educators* (1997) and research (Vagle, 1995; Queitzsch, 1997) state that in order for preservice teachers to become comfortable and capable with information technology, teacher preparation faculty must model innovative teaching that is facilitated and mediated by information technologies. In keeping with these recommendations, I have redesigned my literacy courses to make use of the Internet and other digital resources. I regularly use technology in my teaching and students are required to use a variety of technological tools in order to complete and submit assignments (Powers, 1998; Vagle, 1995; Northrup & Little, 1996).

## Transformation of Courses and Teaching

Educational use of technology has been integrated into all of my undergraduate and graduate preservice teacher education literacy development courses. All courses can be accessed at the following address: URL: http://www.sje.edu. All course syllabi are on the Internet with direct links to scholarly and consistently available web sites for literacy information, research data, lesson plans, assessment information, national issues in teaching and assessing English Language Arts (Rossiter & Bagdon, 1999). In addition, research (Gipe & Lamare, 1997; Vagel, 1995)) has shown that use of e-mail, e-journals and the Internet have been found effective instructional tools; therefore, all online syllabi contain links to all assignment, evaluation rubrics, required method of submission of assignments including email and the process for accessing course threaded discussions or e-journals.

## Data Gathering: Preservice Teacher Technology Skills Self-Assessment

At the beginning of each semester, students complete a technology skills self-assessment which requires them to appraise their knowledge and expertise in the use of the Internet and email as having extensive experience, moderate experience or needing help. In addition, students were asked to respond to the following open-ended prompt:
*When I (you) think of the role, use, and purpose of technology (the Internet and email) in the classroom, I think (I am concerned) that..*

At the end of the semester, students are asked to discuss how the class affected their knowledge and expertise of educational technology, the role, use, and purpose of technology (the Internet and email) in our class, use of email to submit and receive assignments and updates from the professor and the use of Internet for further readings, the threaded discussion, accessing and submitting lesson plans. In addition, students are asked to respond to the same open-ended prompt as at the beginning of the semester:
*When I (you) think of the role, use, and purpose of technology (the Internet and email) in the classroom, I think (I am concerned) that..*

## Data Analysis

**Preservice Teacher Technology Skills and Attitudes, Beginning of Semester**
The results for one semester in **Table 1** show that for the most part approximately 88% of graduate and approximately 91 % of undergraduate students rate themselves as having extensive or moderate experience with computers. My students have computers at home. Some have several email accounts and can design web pages, use email to communicate socially with colleagues and friends, use the internet to complete class assignments, gather news information, look up personally relevant sites such as a child's school web page, order books, research topics of interest to family and friends, and use support group networks. (Cuban, 1999)

| | Extensive Experience | Moderate Experience | Need HELP!! |
|---|---|---|---|
| Undergraduate (n = 24) | 56% | 35% | 9% |
| Graduate (n = 25) | 58.5% | 29% | 12.5% |

**Table 1:** Preservice Teacher Technology Skills Self-Assessment of Knowledge and Expertise with Respect to the Internet and Email, Beginning of Semester

This project, also, involves the analysis of unstructured data including response to an open-ended statement about the innovation (integration of technology into courses) in order to develop an analysis or understanding of the feedback from students at the beginning of the semester and at the end of the semester. The structure for the data analysis is the Concerns-Based Adoption Model (CBAM): A Model for Change in Individuals **(Table 2).**

| Typical Expressions of Concern about an Innovation | |
|---|---|
| **Stage of Concern** | **Expression of Concern** |
| 6. Refocusing | I have some ideas about the technology that would work even better. |
| 5. Collaboration | How can I connect what I am doing to what other teachers are doing? |
| 4. Consequence | How is my use affecting the children? How can I change it to have more impact? |
| 3. Management | I seem to be spending all my time getting materials and myself ready. |
| 2. Personal | How will using technology affect me? |
| 1. Informational | I would like to know more about its use in the classroom. |
| 0. Awareness | I am not concerned about it. I have no computer and don't want or need one! |

**Table 2: Adapted from** *Taking Charge of Change* by Shirley M. Hord, William L. Rutherford, Leslie Huling-Austin, and Gene E. Hall, 1987. Published by the Association for Supervision and Curriculum Development.

Although my students are relatively proficient and successful technology users, the data analysis using the Concerns-Based Adoption Model (CBAM): A Model for Change in Individuals shows that at the beginning of the semester both undergraduate and graduate students are most concerned with the consequences or negative impact of technology on students and with how the use of technology in the classroom will affect them personally **(Table 3).** Many students are concerned that technology will be misused by adults preying on children, make children too dependent on it, or that children will not have sufficient access to technological training, or be hurt in many other ways such as,

*"I am concerned students will rely on the Internet a great deal during research - rejecting books and articles."*

*"I think they need to be closely supervised by their teacher or some other adult because there are a lot of thing on the Internet that they shouldn't be looking at."*

*"The Internet is a wonderful aid and (but it) does not replace imagination, creativity and time spent working hard for the student."*

*"I am concerned that children spend too much time at home on the Internet using it for a social tool."*

*"I see a danger using computer time as a reward of lack of as punishment because it doesn't give kids the right motivation for learning."*

With respect to the personal concerns as indicated in **Table 3**, at the beginning of the semester undergraduate and graduate preservice teachers are concerned with how educational technology will impact them directly rather than just its impact on students. Many undergraduate and graduate preservice teachers said, *I am concerned that*

*"My fear and limited knowledge about the Internet is my greatest fear about becoming a teacher. It is something that I really need to work on. I don't know enough about the Internet to properly assist the students "*

*"I am a bit concerned that computers at some point will replace teaches and I think the human contact is just as important."*

In addition, graduate students expressed management concerns such as

*"I am concerned about sifting through all that is out there to find information that is appropriate to the lessons I'll be teaching."*

*"There is so much out there and it is so time consuming."*

Finally, neither undergraduate nor graduate students seemed to posses much information about the application of educational technology to their own future teaching. Although graduate students did speculate about possible uses of email and the Internet as indicated by the following statements,

*"Email can be used effectively in the classroom when students need to do research, and to connect them with other classrooms an over the world and of emailing pen pals in other states, cities, etc "*

*"Hyperstudio and downloading of worthwhile links from the Internet can be used effectively in any classroom to extend and enrich specific units of study at a very low cost."*

*"Using the Internet for research for the older students and to go along with themes in the classroom for elementary students."*

| Stages of Concern | % of Undergraduate Students **Beginning** of Semester | % of Undergraduate Students **End** of Semester | % of Graduate Students **Beginning** of Semester | % of Graduate Students **End** of Semester |
|---|---|---|---|---|
| Refocusing | 0 | 0 | 0 | 0 |
| Collaboration | 0 | 0 | 5 | 0 |
| Consequences | | | | |
| • Negative | 48 | 17 | 42 | 0 |
| • Positive | 4 | 9 | 0 | 24 |
| • Social | 8 | 22 | 0 | 24 |

| | | | | |
|---|---|---|---|---|
| Management | 0 | 4 | 12 | 18 |
| Personal | 33 | 30 | 21 | 45 |
| Informational | 4 | 4 | 4 | 0 |
| Awareness | 0 | 0 | 4 | 0 |
| Anticipated Uses | | | | |
| Specific Applications | 4 | 8 | 21 | 91 |
| General Applications | 12 | 22 | 12 | 27 |

**Table 3:** Preservice Teacher Perceptions of Role, Use and Purpose of Technology at Beginning & End of Semester

## Data Analysis: Preservice Teacher Technology Skills and Attitudes, End of Semester

**Focus on Instructional Use of Technology**

Although I am always grateful that course evaluations are done at the end of the semester not at the beginning, **Table 4** shows that student feedback with respect to the use of technology in my literacy classes is extremely positive. Students say,

*"I think the technology is certainly enhancing the learning. This is good in that it is making the class aware of the information to which we have access. Technology is affecting our learning in a positive way."*

*"Technology aspects are refreshing. Many of my profs hate e-mail, are afraid of attachments, and so on. I feel that technology has extended the classroom to my home and increased my educational opportunities. I love it."*

*" Technology is having a tremendously beneficial effect. At first I was uncomfortable using the computer, but now I am at ease. I find it enjoyable and relaxing. I also think it's really cool to be able to post ideas on the discussion forums and respond to others ideas. I wish more professors wo7ld use the email and Internet to make their course materials and themselves more accessible to students."*

*"The technology certainly enhances the learning process and I am forced to stretch to learn...to become computer literate. this can only make me a better teacher."*

It is interesting to note that almost half of the graduate students who tend to be older than undergraduate students refer to the use of technology in terms of enjoyment and discuss a delight in learning something new. I would speculate that this might be due to the fact that the undergraduate students have been surrounded by the technology and view it in very ordinary terms. Whereas, the more mature graduate students may still be able to recall typing papers on a typewriter and are appreciative of the wonders of a simple word processor. And, although some graduate students stated that the use of email unnecessarily complicated assignments and caused stress, over 60% of them appreciated its timesaving and efficient nature and the immediacy of communication with peers and the professor.

| Comments on Use of Email | Undergraduate Students | Graduate Students |
|---|---|---|
| Convenience<br>• Efficient or Timesaving<br>• Enjoyable | <br>61%<br> | <br>63%<br>44% |
| Frustrating<br>• Stress & worry - Initially difficult<br>• Complicated the assignment | <br>9%<br> | <br>29%<br>25% |
| Requested more immediate feedback from professor | 18% | 0% |
| Appreciative of new learning experience | 0% | 44% |
| No comment | 22% | 0% |

**Table 4:** Use of email to submit and receive assignments and receive updates from professor

Submitting lesson plans for publication on the World Wide Web proved to be the most exciting technological innovation for graduate students.

*"Well, I did it successfully and was published! I guess that just about says it all for the impact!"*

*"Lots of satisfaction knowing I'll see it posted. When grandma surfs the web in Michigan, she'll see it!"*

*"It was fun to have my lesson plan accepted by ERIC. I can't wait to see it posted."*

*"Creating a lesson plan with the thought of submitting helped to motivate me. I could see adapting this as a motivating technique for my students."*

On the other hand, the attitude of undergraduate students toward this activity may be summarized in the words of the following student,

*"I think it was unnecessary. I think it should be an option for you if you want to do it but you shouldn't have to do it."*

However, a few students find that the integration of technology is having a negative impact on their learning and would prefer a stand-alone computer course to this instructional method. For example,

*"I feel it is inhibiting my learning. Some of the things we uncover are interesting and informative but after a while it just becomes time consuming and monotonous."*

*"Sometimes I feel a little bit overwhelmed with the amount of time I spend on the Internet."*

**Conclusion: Focus on Implications for Future Application of Education Technology by Preservice Teachers**

At the end of the semester, some my students demonstrated some dramatic changes as shown in **Table 3**. Although educational *consequences* and *personal* concerns are still the main concerns about the role, use and purpose of technology, these concerns are of a different nature. The concerns about perceived possible negative effects of the technology diminish greatly for both graduate and undergraduate preservice teachers. What does emerge in terms of education consequences are concerns about the impact of limited access to computers for some segments of our populations. These preservice teachers are giving voice to their social consciences as evidenced in the following words,

*"I'm afraid many of the urban schools will be robbed of the possibilities and activities offered."*

*"How do I level the playing field for those students who have no access to computers or no desire to become computer literate?"*

And, graduate students' *personal* concerns increase greatly in that they are concerned about being able to keep up with the rapid pace of technological innovation. As one student stated,

*"I assume that by the time I am teaching (2 years) technology will continue to advance at an alarming rate."*

Finally, as indicated in **Table 3**, graduate students seem to be able to articulate many specific ways that they foresee being able to use technology in their future classrooms. For example,

*"Most definitely I will implement an email system in my classroom or an informal communication similar to it. I plan to include the Internet in some long-term projects that include research. I bought the print shop and will create motivational banners and certificates. I want to create a website with my class. I think that would give them a sense of pride and foster a cooperative community."*

*"I have already begun to collect educational software to be used for grades 1-3 which is where I hope to teach. I plan on providing TECHNOLOGY TIME for my students each day. I will allow 2-3 students to work on a computer and explore the wonders of technology. I'd also love to have students begin to learn proper ways to type. I'd like to offer a typing tutor program to 2nd and 3rd graders."*

*"I will use technology in my classroom through computer software such as Bailey's Bookhouse."*

Unfortunately, this was not the case with undergraduate students who did not seem to make this intellectual leap. Undergraduate students tended to view educational technology in very general terms such as,

*"Email and the Internet are very good tools for learning and gaining current information."*

*"It is good to have as an addition to traditional ways of research and teaching."*

It would seem that undergraduate students need a somewhat different preservice experience with technology before they can speculate on how they might be able to apply it to their own teaching in the future. This experience has provided a direction for future research and has great implications for my efforts to use the integration of technology into my teaching as a vehicle for developing educational technology skills of future teachers.

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# Co-operative Teaching and Learning in Information Technology and Modern Foreign Languages

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**Abstract:** This paper examines three years' experience of collaborative teaching and learning of ICT on a PGCE course leading to qualified Teacher Status.
Groups of students intending to teach ICT as their subject specialism have worked with groups training to teach Modern Foreign Languages to develop MFL teaching and learning materials that make effective use of ICT. They have then worked together in local secondary schools, using the materials to teach pupils from across the secondary age range (11 – 19).
This paper examines how these experiences change the attitudes to ICT of Modern Foreign Language students and how it affects their subsequent use of ICT to deliver MFL teaching and learning in the secondary school classroom.

## Introduction

At Sheffield Hallam University we are in the third year of a project in which a group of student teachers with ICT as their specialist subject, work with the Modern Foreign Languages (MFL) group to support their ICT development. This includes the development of suitable teaching materials within the university and visits to local secondary schools to support the MFL students' use of ICT in teaching French, German and Spanish. The initial results, reported during the first year (Chatterton, J & Willan, C, 1998), were very encouraging and the project is very much "on-going". The work has been developed and extended in each of the last two years and this paper discusses the student experiences to date and their changing perceptions of the possible role of ICT in their teaching.

In 1998 (DfEE 1998) it became compulsory for all students in initial teacher training to achieve a range of competences in using ICT, both to support teaching and learning in their specialist subject area and for their own professional development. In September 2000, a new National Curriculum for England and Wales (DfEE, 2000) came into force that made it compulsory for all pupils to be "given opportunities to apply and develop their ICT capability through the use of ICT tools to support their learning in all subjects". The modern foreign languages document goes on to say that:

"Pupils should be given opportunities to support their work by being taught to:

(a) find things out from a variety of sources, selecting and synthesising the information to meet their needs and developing an ability to question its accuracy, bias and plausibility
(b) develop their ideas using ICT tools to amend and refine their work and enhance its quality and accuracy
(c) exchange and share information, both directly and through electronic media

(d) review, modify and evaluate their work, reflecting critically on its quality, as it progresses. "

All those involved in initial teacher training must ask, how are we to ensure that our trainees develop their own skills and the necessary professional judgement to know how, when and where to make effective use of ICT in their teaching?

**ICT and Modern Foreign Languages**

It is important that ICT is used genuinely to support and develop MFL skills and is not merely a token gesture. Many examples of the latter have been seen where, for instance, pupils spend 30 minutes drawing a picture, then use only a few words or a single sentence of French to describe it. Pachler and Field say that it is important "... for the MFL student teacher to ensure that pupils using information obtained particularly via CD-ROM and/or the internet have actually understood the material and developed and/or consolidated linguistic skills, knowledge and understanding in the process of using this technology." (Pachler, N. & Field, K. 1997)

In fact, there are many opportunities for pupils to make good use of ICT in supporting their learning of MFL. A non-exhaustive list of examples might include:

- The World Wide Web provides easy access to a range of authentic original sources (though there are issues about which sites are appropriate and usable at different levels).
- E-mail allows pupils to have direct and authentic contact with native speakers, allowing both the development of language skills and increasing cultural knowledge and awareness.
- Multimedia packages provide great help in catering for differentiation needs.
- Text manipulation packages help pupils to develop reading skills by text prediction and to develop memory skills through having to fill in gaps in a text having viewed the complete version for a time etc.
- Word-processing allows pupils of all abilities to redraft written work with relative ease (without going through the "red pen stage"!) and to produce a well presented finished article.

Cajkler and Addelman, however, make the point that "... many teachers may be wary of the computer and lack the skills and confidence to make full use of it in their teaching." (Cajkler and Addelman, 2000)

A recent report of an inquiry by the prestigious Nuffield Foundation deals at some length with the issue of technology and the importance of its role in language learning, making a number of recommendations for enhancing its use in a variety of ways. It says that "ICT has immense potential to enhance language learning ... it moves the focus from teaching to learning ..." However, it goes on to say that "The full potential of ICT has yet to be realised in languages. Levels of use of ICT in language learning vary dramatically from sector to sector and from one institution to another." and that "In schools there is evidence that logistical problems still make it difficult to provide levels of pupil access needed for success." (The Nuffield Foundation, 2000)

It is in this context of *compulsion* from the government, *resistance* from some teachers and *insufficient facilities* in schools that our students have to demonstrate their ability to use ICT in all aspects of their professional development.

**Development of the Project**

The co-operative teaching and learning project is now in its third year. In the first year of the project we took a decision to concentrate on information handling skills. This had a number of advantages for both groups of students:

- information handling skills are easily applied to real-life and rôle play situations
- they can play a valuable part in encouraging target language use in MFL teaching and learning;
- the teaching of information handling skills forms a central part of the ICT school curriculum

- the MFL students were almost universally lacking in experience of using ICT to deal with information
- ICT-based information handling skills are currently under used in schools.

The sessions were entirely based within the university and it was left to the students to make use of the skills within their school placements.

In the second year of the project, the scope was widened to include using word-processing, art packages and html to prepare good quality teaching materials, including a small web-site. While students reported relatively high levels of WP skills on entry to the course, their view of what a word processor could do was limited: it became apparent that they had not considered the use of such things as call-outs, text boxes, flowing text around graphics etc. Work by the ICT students helped the MFL students to gain experience with such techniques within the target language. The MFL students, supported in the classroom by the ICT students, then used the materials to teach a number of sessions in a local secondary school. This year, the scope of the university-based sessions is effectively the same, but the school-based sessions will be extended to include a much larger group of pupils.

**The Shared Sessions**

It was clearly important, for both groups of students, that they developed the skills and attitudes that would enable them to match the government's requirements for the award of Qualified Teacher Status. The IT students were asked to plan and deliver the sessions, to create any necessary materials and to evaluate the effectiveness of the teaching and learning. In doing so, the sessions would meet very many of the standards laid down in DfEE circular 4/98, although this might be regarded as fortuitous as the original sessions were actually planned before we had sight of the document.

From an ICT viewpoint, the sessions covered a wide range of topics from basic computer skills, through text and image manipulation to data-base and web-site creation and manipulation. However, these were presented in a format that focussed on the types of activities normally found in a modern languages classroom – creating worksheets and games, setting up rôle play activities, searching for and organising information sources in the target languages etc. This sort of activity matches closely the expectations that schools have of ICT teachers: they not only teach the pupils, but also have a part to play, formally or informally, in developing the ICT capabilities of their colleagues in other departments.

For the linguists, the sessions would tackle directly their weaknesses in ICT, as revealed in the IT skills assessment done at entry to the course. The sessions would also give them some insight into how a relatively low level of ICT expertise could be used prepare good resources and to provide a good teaching and learning experience. They would also enable the students to practise their new ICT skills in the classroom, while being supported by ICT specialists.

Two example databases have been jointly developed by the students: in the first year students created a very simple "Hotel Room Booking" database; last year the new students created their own version of this and then went on to create a tourist "Campsite" database with links to on-line, commercial databases. These were intended for use as a stimulus for pupil rôle play activities across a wide age-range. For example, within the classroom one pupil would have a cue card / rôle play card telling him/her to request, from a tourist office, a campsite with various specified facilities. The other pupil would use the database to find a campsite appropriate to the needs of the "customer". The national curriculum document states, in programme of study (PoS) part 1 that: "Pupils should be given opportunities to take part in activities in the target language that, where appropriate, combine two or more of the four language skills…." The rôle play activity fulfils the need in that both pupils are using speaking and listening skills within the context of a two way conversation and the "tourist office employee" is also using reading skills as s/he searches the database. The "Hotel Room" database would, of course, operate in much the same way, although with different vocabulary. With older children, the on-line elements allows them to interrogate live databases for details of campsites and to add the information to their own database, perhaps targeting the language for younger pupils to use. Thus they meet all four aspect of the language curriculum – listening, speaking, reading and writing – as well as many of the ICT aspects.

**Gains — Skills and Attitudes**

At the start of the one-year, postgraduate training course all students are asked to complete a self-assessment sheet in ICT: this is repeated towards the end of the year. The returns have been examined to look for changes in perceptions of ICT skills by the MFL students and to compare the MFL students with those from other groups who had not had input from the IT student group. It was decided to compare the MFL group with the English student group, as both tended to have non-technical backgrounds and, on entry, similar knowledge/attitudes to IT.

Over the three years, the initial assessment of ICT skills has shown no significant difference ($\rho \sim 0.5$) between the PGCE English and MFL and the course planning documents showed a similar level of expected ICT input, except for the joint IT/MFL sessions. Comparisons of the figures on the exit assessment with those at entry has shown that, while both groups gained in ICT skills, the *improvement* has been much more significant for the MFL group ($\rho < 0.0001$) than for the English group ($\rho \sim 0.025$). A direct comparison of the two groups at exit showed also that the MFL group's perceptions of their own ICT skills was significantly higher than the English group's ($\rho = 0.024$).

In the second year of the programme, the ICT and MFL groups worked together in language classrooms in a local school, with a number of different year-groups (grades). These sessions produced a marked enthusiasm from the pupils, apparent gains in language practice and a very positive attitude by the teaching staff involved. Indeed, the school staff retained the materials for their own use and they have been keen to be involved in further sessions. Methods of teaching which support or encourage pupil participation are important and, again, the effect has been noted elsewhere. "Many teenagers, particularly boys, who may be reluctant to engage in classroom interaction and are not inspired by conventional language teaching materials, have a keen interest in computers as well as excellent screen and keyboard skills." (The Nuffield Foundation, 2000) The ICT and MFL students, too, were very positive about university and school-based sessions, both in terms of "enjoyment" and in perceived gains.

Exit figures for this year's students are not yet available, of course, but initial survey data shows considerable positive feedback from the early sessions. After some 30 days in school, of which half was actual whole class teaching time, the Modern Foreign Languages students were asked to complete a questionnaire relating to their experiences, attitudes and use of ICT in a teaching context. Replies were received from 20 out of 22 students.

Considerably more than half reported that they were using computers frequently to make worksheets and flashcards for their teaching and all of the others were making at least occasional use in this context. Many also made overhead transparencies, language games or used ICT to present language in other ways.
In terms of 'monitoring, assessing and recording', one of the required competences, the pattern was rather more patchy. Few had, as yet, taken on ICT use for this purpose, although two were making frequent use in other administrative contexts.

About half of the trainees had used ICT with pupils to meet teaching and learning objectives, mostly on only one or two occasions thus far, though one student was working every week in the ICT Lab with a MFL group. Pupils had been involved in such activities as:

- designing birthday cards, using the internet to search for information;
- presenting statistics gathered from a class survey conducted in the foreign language;
- word-processing a description previously done for homework;
- playing language games found on a an internet site;
- writing coursework assignments;
- creating a database from a survey of class pastimes;
- moving text boxes (in text matching exercises); and
- writing the class timetable in the foreign language.

All trainees, with one exception, intended to use ICT with classes as they continued through their placement but some expressed their uncertainty about how possible it would be in view of logistical difficulties – in particular access to computers. This fits with observation in a number of other contexts, such as quoted from the Nuffield report (ibid.) or by Cajkler & Addelman "Many schools are unable to offer full access to the computer to language teachers." (Cajkler and Addelman, 2000)

Some two thirds of the trainees said they had continued to develop their personal ICT skills during their time in school. This was done variously by independent practice, by working with the school IT co-ordinator, by working with their mentor or by working with other students. Two students had bought their own computers to further enhance their skills. More than half of the trainees reported that their skills had been considerably enhanced and/or they had learnt new skills in the joint sessions at the University while all the others except two felt that their skills had been extended to some extent. Of the two others, one reported that s/he already had very high level skills and the other felt s/he was "treading water". About two thirds of the students felt more confident and/or more enthusiastic because of the sessions and, of those who felt that this was not so, it was because their enthusiasm and/or confidence was already at a high level.

The Modern Foreign Languages departments in which the trainees were placed showed a wide range of involvement in the use of ICT to achieve learning and teaching objectives in MFL. The departments were almost exactly evenly split between those using ICT frequently, those making occasional use of ICT and those never doing so. Some students felt that they had themselves contributed to developing their department's ICT use. Current evidence for this is rather thin, as, at the time of writing, this year's trainees have only completed a short period of time in their schools. However, examples of contributions to the work of the departments that has already been done includes:

- providing print-outs of materials from German websites for departmental use;
- sharing ideas with the new Head of Department in the school; and
- storing copies of electronically created worksheets on the school's computer for other department members to use.

**Conclusion**

The students' immediate, enthusiastic response to the sessions initially encouraged us to continue to develop and extend the work. However, it is not just enthusiasm: a number of measures have all indicated that the students make good progress in their ICT skills and confidence and that they are able to demonstrate this new confidence in the stressful setting of their first teaching placement. Comparisons with other, apparently similar, students show to good effect the benefits of co-operative teaching and learning. In what might be seen as a constructivist setting, students are able to build on their existing skills in an open and supportive environment and to transfer these gains successfully to a variety of settings.

It remains relatively unusual for training sessions to be so universally well received by the different groups involved – our students, teachers in school and the school pupils themselves. This is due, in no small part, to the level of co-operation and mutual support achieved within the students groups themselves. It is also noteworthy that, for the first two years of the project, a relatively small time commitment within the university has produced a clearly demonstrable effect on students' attitudes and skills several months and a long teaching placement later.

The use of ICT is now effectively a requirement in teaching and, in many schools, the ratio of pupils to computers is in single figures. As computers in the classroom, and at home, become increasingly the norm, motivational effects due to the novelty of using a computer will fall away. It will be interesting to see, then, how the upward trend in our students' skills and attitudes to the use of ICT in their own classrooms continues this year, particularly as the three populations involved become ever more used to having computers around.

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# Analyzing Bilingual Education Preservice Teachers' Learning Outcomes in a Computer Literacy Course: From the Technological Perspective and the Pedagogical Content Perspective

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**Abstract** This paper presents findings of a study designed to analyze student performance from two unique perspectives: the technological perspective and the pedagogical content perspective. The student population consisted of three separate cohort groups enrolled in a computer literacy course (CS 1105) and a bilingual instructional reading course (READ 3303) concurrently. Students were enrolled in the courses during the fall 1999, spring 2000, or summer 2000 semesters. All students were preservice teachers in the bilingual education program at the University of Houston-Downtown's Department of Urban Education. During the semester enrolled, the students were required to complete several major assignments integrating technological content knowledge with pedagogical content knowledge. Assignments included the creation of an instructional lesson plan, a World Wide Web search for information to be used instructionally, and the production of a graphic organizer to present educational information. For each assignment, students were to show their mastery of the technological tool while also showing competence in a pedagogical content area. All student assignments were evaluated by both the technology professor and the bilingual reading professor. This study collected information on the similarities and differences between the grades received and comments noted by the two professors, each from a different perspective.

## Introduction

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

During the school year 1999-2000, there were approximately 432 students in total who registered in the three successive Blocks of professional development courses (91 in secondary education, 101 in bilingual education, and 239 in elementary education). To help them gain the knowledge and experiences needed to be a teacher of at-risk students, the department requires undergraduate and post baccalaureate students who have been admitted to the teacher education program and who do not currently teach on a permit in a public school classroom to successfully complete three interdisciplinary blocks in urban public schools in the Houston area. Following the model developed by Haberman (1991), the UHD-CPDT enables projective urban teachers to participate during their junior and senior years in a 27 semester-hour field-based professional development sequence in the format of blocks. The district-wide demographic line graph (see Figure 1) indicates that in the year 2000, students of Hispanic origin (approximately 120,000 students) make up over 50 percent of the student population in Houston Independent School District. This is a district that is currently a UHD partner for which UHD graduates will most likely serve. African

American students (approximately 70,000) are second, followed by Anglo students (approximately 23,000) and students categorized as Other (approximately 5,000) (http://www.houstonisd.org/ab/images2/enroeth.gif).

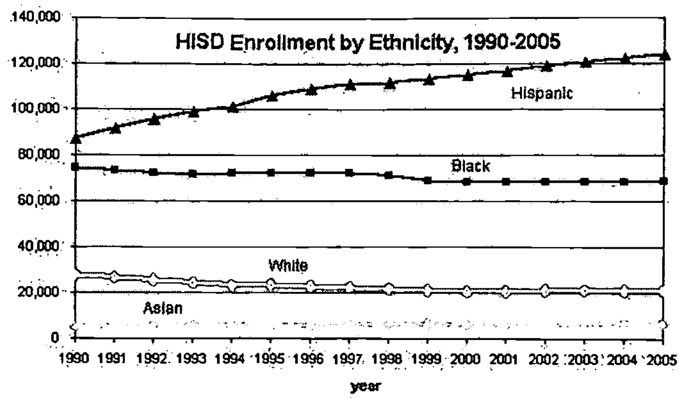


Figure 1: HISD District-wide demographic line graph

The 1990-98 Migration Scenario (see Figure 2) provided by Texas State Data Center at Texas A&M University shows rates consistent with 1990-98 patterns of total net migration and the 1980-90 patterns of ethnic distribution of migrants. This scenario predicts larger rates of Hispanic and Other population growth and smaller rates of Anglo and African American population growth in the Houston area as well as for the state of Texas as a whole. Under this assumption, the growth of students of Hispanic origin will continue to be strong in the next few decades (http://txsdc.tamu.edu/cgi-bin/prjctn2000.cgi).

**Population 1990 and Projected Population 1995-2030 by Race/Ethnicity and Migration Scenario for Houston PMSA**

| YEAR | TOTAL | ANGLO | BLACK | HISPANIC | OTHER |
|---|---|---|---|---|---|
| 1990 | 3,322,025 | 1,884,557 | 601,230 | 709,370 | 126,868 |
| 1995 | 3,675,520 | 1,976,963 | 655,288 | 874,517 | 168,752 |
| 2000 | 4,034,540 | 2,043,922 | 712,505 | 1,058,235 | 219,878 |
| 2005 | 4,413,919 | 2,094,732 | 773,324 | 1,263,269 | 282,594 |
| 2010 | 4,834,437 | 2,139,100 | 840,208 | 1,495,698 | 359,431 |
| 2015 | 5,314,616 | 2,182,731 | 917,161 | 1,763,701 | 451,023 |
| 2020 | 5,851,150 | 2,219,596 | 1,003,430 | 2,069,917 | 558,207 |
| 2025 | 6,433,557 | 2,241,093 | 1,097,746 | 2,413,005 | 681,713 |
| 2030 | 7,063,986 | 2,247,118 | 1,201,164 | 2,793,719 | 821,985 |

Source: Texas State Data Center

Figure 2: The projected population 1996-2030 in Houston area

Bilingual education teachers are in one of the critical shortage areas in Houston. The Bilingual Education program at UHD has recently been awarded a 5-year grant by the Department of Education in the amount of $ 3.1 million to prepare new teachers and current teachers to better serve Limited English Proficient students. The new grant from DOE and the Gordon & Mary Cain Future Teacher Scholarship are expected to attract more applicants to the program in Bilingual Education. It is the department's urgent need to lay out the infrastructure to better support the incoming pre-service teachers. The improvement of prerequisite courses for the teacher education program and pedagogy and methodology courses are under discussion.

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

Since its conception in 1995, the department has a technology component combined with its "block" structure. The technology training is a one-hour credit course, which is held in the on-campus computer lab. The course CS1105 is described by Chen in "The Way to Go: Integrating Instructional Technology Initiatives into a Teacher Education Program." As described in the syllabus for the course, the five technology sessions are integrated into the first block for the pre-service teachers at the Department of Urban Education (http://www.dt.uh.edu/degree/urbaned/home1.htm). The course is offered in the format of five workshops of three hours each, which are spread throughout the whole semester. This paper presents findings of a study designed to analyze student performance from two unique perspectives: the technological perspective and the pedagogical content perspective.

## General course framework for CS1105

The titles and brief descriptions of the five workshops (3 hours each) currently offered have been discussed by Bhattacharjee and Chen (2000) and are briefly summarized as follows:

Workshop I: E-mail & Internet Discussion

The instructor begins with an introduction to the use of different professional teachers' forums over the WWW by showing pre-service teachers how to follow the threads, respond to interesting topics, and start their own subjects. The instructor also assists students in creating accounts with a web-based e-mail program such as Hotmail and Yahoo. The instructor then demonstrates the ways to check in-coming mail, compose out-going mail, send documents as attachments, forward and respond to mail, set up distribution lists to send to multiple recipients, set up automatic signature files, and organize read e-mails into different folders.

Workshop II: WWW & Web Search

The instructor begins by showcasing the CS1105 class web site created just for them (http://www.dt.uh.edu/~chen/cs1105.html). The web site consists of different applications and examples of WWW uses in K-12 classrooms. Examples might include a demonstration for the bilingual education groups which emphasize Mexican culture and Spanish language arts. Students also learn how to download texts and graphics from the Internet while sharpening their web search and web research skills at the same time.

Workshop III: Desktop Publishing & Graphic Organizers

The instructor guides the students with the creation of a simple flyer and a newsletter while allowing them the flexibility of applying clip art, word art, colors, and content to enhance their ownership of the product. After this, the instructor explains the different looks and uses of graphic organizers and demonstrates the creation of a thematic unit with the fundamental building blocks of graphic organizers such as text, circles, lines, and colors.

Workshop IV PowerPoint Presentation

The instructor leads the students in creating two simple slides with headings, text, graphics, and charts by following an activity guide. The workshop ends with the showing of the more advanced functions of PowerPoint such as animation, sound, and transitions.

Workshop V: Software Evaluations
The software evaluation session starts with software demonstrations including *Story Book Weaver, Body Works, Amazon Trails, Just Grandma and Me, and Encarta.* Students are then informed about various criteria used in software evaluation. The workshop concludes with the students filling out software evaluation rubrics so that they will become comfortable judging educational software.

## Analysis of observations

During the semester enrolled, the students were required to complete several major assignments integrating technological content knowledge with pedagogical content knowledge. Assignments included the creation of an instructional lesson plan, a World Wide Web search for information to be used instructionally, and the production of a graphic organizer to present educational information. For each assignment, students were to show their mastery of the technological tool while also showing competence in a pedagogical content area. All student assignments were evaluated by both the technology professor and the bilingual reading professor. The following analysis study collected information on the similarities and differences between the grades received and comments noted by the two professors, each from a different perspective.

The following observations are based on student population that consisted of three separate cohort groups enrolled in a computer literacy course (CS 1105) and a bilingual instructional reading course (READ 3303) concurrently. Students were enrolled in the courses during the fall 1999, spring 2000, or summer 2000 semesters. All students were preservice teachers in the bilingual education program at the University of Houston-Downtown's Department of Urban Education.

**From the Technological Perspective**

When delivering the workshops, the technology instructor has tried to customize the activities to meet the special needs of Bilingual Education preservice teachers. For example, during Workshop II: WWW & Web Search, more culture and language related sites were demonstrated and discussed. Online resources such as Investigating Mexico (http://www.infinet.com/~baugust/mexico.html) and lesson plan archives just for Bilingual Education teachers are introduced. During Workshop V: Software Evaluations, the technology instructor demonstrated both the applications of the English version and the Spanish version of *Just Grandma and Me* by the Living Book, conducting student collaborative writing in Spanish with *Story Book Weaver* by MECC, and reviewing other tutorial/drill/practice for language learning with a critical mind to detect cultural or gender bias.

From the homework, the technology instructor can detect the different angles or perspectives taken by preservice teachers in regular Elementary Education preservice teachers and Bilingual Education preservice teachers. Teachers today face a challenge in ensuring students are given the opportunity to master basic skills. The preservice teachers are aware of the fact that some of the students in Bilingual Education classrooms do not have parent to read with them, either because the parent are too busy or do not have the reading skills. For example, in lesson plans intended to incorporate the *Exploring Yellowstone* CD-ROM by MECC in early childhood classrooms, regular Elementary Education preservice teachers more commonly emphasize on the knowledge parts while Bilingual Education preservice teachers have one more mission in mind, which is to enrich their students' vocabulary. Lesson Plan One (see Appendix A) and Lesson Plan Two (see Appendix B) are two original lesson plans designed by two Bilingual Education preservice teachers.

The technology instructor observed that reading/writing is by far the most popular subject when it came to picking content, whether the homework is for newsletter, lesson plans, PowerPoint, or graphic organizer. The author of Lesson Plan One sounds adept and comfortable with the content and therefore the quality of the technology integration is excellent. However, for the rare ones that take science or math

as the subject, the technology instructor can perceive that the preservice teachers are trying out a new field and are inept in doing so.

Take Lesson Plan One for example, the preservice teacher is focused, and can write an effective lesson plan with a clear goal in mind. However, the author of Lesson Plan Two has used many words but is still ineffective in grasping on a certain aspect of science. The instructor senses the need to find a balance among the subjects and better prepare the preservice teachers for the science/math subjects for them to feel more comfortable.

The technology instructor has also observed that the software mentioned in students' work are the cartoon/game type of software that are most commonly found in the market such as *Blue's ABC Time Activities, First Grade Reader Rabbit Program, Colorful Letters* and *Numbers, Dally Doo, you can too!!!Alphabet. The Jump Start* program series seems to be the software that has most frequently been incorporated into the lesson plans turned in by many students. Having noticed students' limited selection, the instructor feels the need to broaden students' knowledge of the different types of educational software including simulation, problem-solving, etc. There is also a need for the instructor to familiarize the students with the publishers of educational software, the various educational software catalogues where they can purchase specialized software through the mail, and the online software.

The instructor reminded the preservice teachers that although Spanish software is hard to find even in such a ethnically diversified city such as Houston, many educational titles can be "repurposed" to fit the needs of bilingual students. A piece of software currently available in the market can be repurposed and turned into useful instructional material for bilingual classrooms.

The technology instructor has noticed that the Bilingual Education preservice cohort group tend to have a good rapport with each other and are excellent collaborative learners in comparison with the regular Elementary Education and Secondary Education cohort groups. I have observed that they helped each other and learned from each other more often then the other cohorts.

The technology instructor is very pleased with the quality of work turned in by the preservice teachers. When compared with the work turned in by regular Elementary Education and Secondary Education preservice teachers, it does not represent any less of quality at all. During classroom instruction, the technology instructor can feel the preservice teachers' eagerness to learn. This eagerness to use technology is carried on to Block II and Block III as the technology instructor hears all the time of other instructors' comments on how well their students can use technology. It is hoped that the same attitude can be carried on to their future classrooms.

**From the Pedagogical Content Perspective**

When delivering instruction for the READ 3303 course, a focus is placed on how to deliver reading and content instruction to school-aged learners in an effective and meaningful manner. Bilingual pre-service teachers must be trained and knowledgeable in all of the same areas as a mainstream teacher. In addition, the bilingual pre-service teacher must also have special training and a higher emphasis on educating special populations including culturally diverse and linguistically diverse student populations. As the bilingual students vary widely in their educational backgrounds, it is important to present instruction using a variety of methods that take learning styles into consideration. This includes making allowances for visual learners, audio learners, and tactile/ kinesthetic learners.

One way to approach instruction in this manner is to make use of instructional technology. By incorporating graphic organizers into instructional presentations, pre-service teachers are better able to visually represent content knowledge to their students. Also, by being familiar with what is available through the web and how to do web searches on specific teaching methods, the pre-service teachers are able to take advantage of instructional activities designed for audial and tactile/kinesthetic learners. There is a wealth of information as well as activities already developed and available on the web for use with language minority students with various learning styles and other educational needs. Being able to access this information has been very beneficial to the pre-service teachers when developing lesson plans in reading and in the content areas. Also, being able to communicate electronically with peers, other professionals, and professional organizations has enabled the students to tap into an additional wealth of human resources and share/compare ideas with others for the purpose of enhancing the instruction that children receive in the classroom. For these reasons, participation in the instructional technology

workshops has been invaluable to the students and has also improved their performance in the reading content course.

An observation from the pedagogical point of view is that when the students in the reading content classes are given an assignment to research information related to reading and bilingual education or bilingual populations, they seem to feel comfortable with the task from the beginning and have confidence in their own skills to use the internet web resources. Also, when students need assistance in developing additional ideas or activities related to a certain lesson plan, they are quick to consult their peers, other professionals, and professional organizations for ideas. They make these consultations using their e-mail skills and Internet search skills.

Another observation is that the students tend to use their newly acquired technological skills with rigor. Although the quality of work in the content area demonstrated by the students is high, it is also clear that overall, students tend to spend more time on the technological aspect of the assignment than the content itself. Students have stated numerous times that they enjoy using the technology so much, that they will spend extra hours developing the technological aspect of the assignment, sometimes to the point of overshadowing the actual reading content. This attitude of enthusiasm toward the use of technology is welcomed by the reading content professor, because as mentioned before, the quality of work in the content area is still very high. Also, these students are in their first semester of the blocks. As they move into the second and third semesters, they will be much more adept in using the technology for instructional purposes. The reading content professor hopes this enthusiasm for integration of technology continues in future semesters and into the field as well.

## Conclusion

The efforts of the technology instructor and the pedagogical content instructor in conducting the analysis of the Bilingual Education preservice teachers' learning outcomes in a computer literacy course is part of the planned infrastructure to better support the in coming pre-service teachers. With nearly 10 % of children ages 5-17 nationwide speaking Spanish at home, and as many as 22 % in California and Texas, teachers today face a challenge in ensuring students are given the opportunity to master basic skills. Technology is a great tool in helping the students in Bilingual Education classroom facing the challenge. I noticed that computer is one of the topics that are in urgent need of support for this special population. There are lots of expectations regarding the use of computers in bilingual education. Proper use of computer can help bilingual students to retain their cultural heritage, to fit into the new community, and to become more productive citizens.

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**Appendix A**

## Lesson Plan One

Title: Virtual trip to the Yellow Stone National Park

Subject: Reading and writing: Students expand vocabulary through reading, writing and listening

Grade Levels: 4th. Grade bilingual

Learning Outcomes: Bilingual students get an exposure to a variety of wild animals and their Habitat. New vocabulary will be learned in an effective and enjoyable fashion.

Instructional Materials: CD- Yellow Stone Park, Projector, and computer with windows 3.1 Minimum.

Prerequisite Skills: Basic knowledge of mouse function (i.e.) left button once for select Twice to select.

Pre-computer Activities: Teacher presents poster board with animal drawings with the definition Or explanation of the same. Teacher directs attention of students to the advantages we have with technology by demonstrating the versatility and effectiveness of the software by projecting to the screen a colorful photo of a wild animal and its habitat. Teacher models for students how by clicking different animal name on the menu a new wild animal and its own characteristics can be appreciated on the screen. Teacher repeats this step with 2 or 3 animal to be sure students understand what the software provides.

Activities and Procedures: Teacher divides class into small groups of 2 to 3 students. Each group selects 2 to 3 animals, which as a group will investigate using the software. They will discuss some characteristics of each animal (i.e.) color, size, food they eat, weather, habitat peculiarities etc. etc. As a group they pick 2 characteristic of each animal and write one page about their findings.

Extension Possibilities: Teacher plans a field trip to the local zoo with the objective that the students Will analyze animals with some a particular characteristic feature to analyze and report back to the teacher.

Closure: Teacher highlights the advantages of technology. Teacher explains that Without having to travel to far places and risking their lives they were able to visit and explore exotic wild lands and animals.

Evaluation: Students are graded on the content and depth of their work.

Resources/References: Animal encyclopedia, http://frog.simplenet.com

## Appendix B

## Lesson Plan Two

Lesson plan Two

Grade Level: 2nd grade bilingual

Purpose: The second grade students will be able to use the Encarta software to do research for their science project.

Objective: The second grade students will use information found in the Encarta software to do research on their science project.

Focus:
- Ask students what other ways they can conduct research other than using encyclopedias, textbooks, journals, newspapers, etc.
- Have them come up with ideas as to how a computer can help them do research.

Guided Practice:
- As a class we will find information on the planets.
- As a class we will discuss the information we found.

Independent Practice:
- Students will each find valuable information for their science project using the Encarta software.
- Students will print information they need for their project.

# Tech Ambassadors: The Next Generation of Professional Development

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**Abstract:** This presentation will focus on the results of an ongoing pilot study that involves training both pre-service and in-service teachers, as well as K-12 students, in the integration of technology in the classroom. Through the institution of the "TechAmbassador" program, students in our undergraduate education program team up with in-service teachers and use a problem solving approach to provide technology enriched lessons in these teachers' classrooms. Through observation of and active listening to the needs of current teachers, these pre-service teachers brainstorm lesson ideas with their college classmates, research appropriate technology solutions, practice delivery, and finally model the utilization of technology in the P-12 classroom under college faculty supervision. The project exemplifies a constructivist approach to learning that uses real-world problems, project-based curricula, and an active learning environment.

## Background:

In a January 1999, a report by the Department. of Education entitled, Teacher Quality: A Report on the Preparation and Qualifications of Public School Teachers, indicates that "few teachers (20%) report feeling well prepared to integrate educational technology into classroom instruction." Further, A National Survey on Information Technology in Teacher Education, a Milliken Exchange on Education Technology report which commissioned ISTE to survey schools, colleges and departments of education in the U.S. states, "Most institutions report that IT is available in the K-12 classrooms where student teachers get their field experience; however, most student teachers do not routinely use technology during field experience and do not work under master teachers and supervisors who can advise them on IT use." It further concludes that, "the most important finding of the survey is that formal stand-alone IT coursework does not correlate well with scores on items dealing with technology skills and the ability to integrate IT into teaching." Recommendations include:

- "Student teachers need more opportunities to apply IT during field experiences under qualified supervision"
- "In order to provide models for change, researchers, professional societies, and education agencies should-on an ongoing basis-identify, study and disseminate examples of effective technology integration that reflect the current needs in both teacher education and K-12 schools." (Moursund, 1998)

Another survey conducted by AACTE in found that "Too few students are expected to use computers, televisions, and VCRs to share information in their campus classroom settings." (American Association of Colleges for Teacher Education, 1997) Supporting that finding, a 1997 NCATE task force on technology in teacher education report found that "teachers-in-training are provided instruction in 'computer literacy' and are shown examples of computer software, but they rarely are required to apply technology in their courses..."(National Council for Accreditation of Teacher Education, 1997)

## Rationale:

As a fully experienced technology teacher, I want to begin by emphasizing that teaching with technology requires more effort and is fraught with more problems than using chalk, an overhead projector, or a book.

Technology does not always work on request, is rich with glitches that can result from the system, the software, as well as from teachers' or students' lack of experience. A teacher must be willing to give up the tried-and–tested methods he/she currently uses to enter into a somewhat intimidating, somewhat frustrating "unknown" world that utilizes technology. Without experience or trouble-shooting skills, it is easy to get overwhelmed and give up. It is also difficult for many teachers to relinquish "control" when a student is more technologically proficient. Whether we agree or not, we can not overlook these realities. Teachers need more preparation time and more assistance. We cannot just expect results without a commitment to help them develop these new strategies and skills. While many school programs offer staff development programs outside the classroom, this program suggests doing it "live" so that everyone participates and collaborates and the setting is "real." The pre-service teachers' lack of classroom experience is compensated by the current teachers' classroom control and the current teachers' lack of technology skills is supplanted by the student teachers' knowledge, and both of them are supported by technologically proficient college faculty. It's win-win for everyone.

## A Response to the Need:

The TechAmbassador Program was developed in response to a twofold need: to train undergraduate pre-service teachers in the classroom use of technology, and to integrate technology into the P-12 classrooms where further education/assistance may be necessary. These needs were authenticated through direct observation and experience. As a member of the full-time faculty in the School of Education at *New York Institute of Technology,* I have the gratifying experience of training teachers in the use of technology in the classroom and supervising pre-service teachers in the Student Teaching semester. This allows me entrance into various classrooms in and out of the NYC school system. In addition, I am able to draw on my varied computer experience in the corporate world as well as that in the education system.

Firstly, what I have discovered throughout my experiences is this: In-service teachers often have neither the adequate time nor the resources to implement new programs in their classrooms. They are severely limited by the restrictions of curriculum, the pressures of testing, the lack of technology skills and the lack of planning time, in addition to minimal choices in hardware/software. Many are trained in technology outside the classroom or in graduate settings where assignments are theoretical or specific to particular software products rather than based on needs. These teachers need assistance in a way that supports their efforts by bringing training and resources to them *in the classroom.*

Secondarily, through questioning and observation, I have come to believe that that while pre-service teachers are taught the practice of teaching, they do not adequately *practice their teaching.* This practice, whether classroom or field-based, even within the scope of one educational sequence, is often not only limited but lacking in organization for a rounded experience. Several factors contribute to this, namely: lack of overall planning, varied faculty supervision, cooperating-teacher flexibility and placement issues. Additionally, these same pre-service students, while they may personally use technology, rarely practice its use in the P-12 community. Lessons presented, even in the student teaching experience, tend to follow the pattern of the cooperating teacher, which often only promotes the under-utilization of technology in the classroom. The need for pre-service teacher technology training is now being stressed by the new ISTE standards for pre-service teachers and most states carry that requirement. Several studies (as cited above) have uncovered this under-utilization of technology at the pre-service level. In fact, parenthetically, *any* teaching experience in P-12 classrooms is often limited. "Art Levine, president of Teachers College at Columbia University, would like to see a greater emphasis on clinical training with apprentices and mentors, similar to the kind of experience new doctors get." (Kantrowitz and Wingert, 2000). Why not, then, work technology into teaching at the grass roots level, so that new teachers endeavor to teach as they are taught at the pre-service level--with technology.

All students (P-12, undergraduate, and graduate) need to be prepared to meet the demands of the 21$^{st}$ century as well as the present. Many national mandates and initiatives support the notion that more technology is needed in schools, but *even if technology resources were unlimited,* the methods of utilization would still be severely lacking. This initiative focuses on a method of training pre-service and in-service teachers, as well as P-12 students, in the utilization of technology both as resource and as tool.

## The Methodology:

The TechAmbassador Program trains the undergraduate students in our education program who are aspiring to become teachers in the proper utilization of technology in the classroom, and sends them into the classroom of current teachers as "ambassadors." These students **model** the integration of technology under college faculty supervision, in various classrooms thereby reaching and teaching current teachers *and* their students. The program provides many benefits and fulfills the following objectives:

- Each pre-service teacher will be trained in the integration of technology and the curricular requirements.
- Each in-service (current) teacher would collaborate with pre-service teachers to determine which units of study would best utilize the strengths of technology and then host this guest student teacher to demonstrate, model and deliver unit plans that utilize this technology.
- Each pre-service teacher will develop or do research to find specific units that effect technology integration into targeted classrooms.
- Each pre-service teacher will develop plans for implementation in a target classroom.
- Each student teacher will practice delivery of the developed or adapted units in a supportive college setting.
- Each pre-service teacher will model appropriate technology usage for current teachers so that the learning curve is reduced.
- Each pre-service teacher will deliver 2 units under the supervision of the classroom teachers and NYIT faculty
- Each pre-service teacher will provide turn-key, tested, technology enriched lesson plans for future utilization by current teachers.
- Each in-service teacher would receive assistance and learn how to effectively integrate technology into the curriculum.
- Students in the classroom will become more proficient in using technology as a resource and a tool to meet curricular goals.
- Students in the classroom would experience collegial, cooperative collaboration as a means of achieving goals. Teachers would model what they preach.

These objectives can be measured by the degree to which pre-service teachers meet the goals of the college course, by the degree to which technology is utilized in the target classrooms, and by the increased competence of pre-service teachers, classroom teachers and P-12 students. As the study progresses, all planned units and the journals describing their implementation will be assembled in a book, available in print and online. Surveys of computer integration are distributed to current teachers, the results of which will also be documented. As the study continues, each pre-service teacher will assemble a portfolio to be reviewed by school district administrators for evaluation for potential employment, as an authentic assessment.

## The ISTE NETS Standards addressed:

*II Planning and Designing Learning Environments and Experiences:* Pre-service teachers collaborate with in-service teachers to enrich established curriculum content with technological tools.

*III Teaching, Learning and the Curriculum:* In-service teachers implement curriculum plans infused with the technology through collaboration with and hosting of TechAmbassadors who deliver technology enriched lessons to K-12 students in their classroom.

*V Productivity and Professional Practice:* Pre-service teachers practice and model technology integration in real K-12 classroom settings, thereby enhancing both their and their collaborating in-service teacher's professional development.

## The TechAmbassador Project:

The TechAmbassador Project is a pilot study to test a new method of addressing the needs of in-service, pre-service and P-12 students. The study can easily be replicated in a college-level education course. The course in which this pilot project was launched is entitled "Curriculum Articulation through Multi-Media" which carries a Field Experience requirement of 20 hours. The students in this class were elementary education students with the exception of one Occupational Education major (Culinary Arts). On the first day of class, the project was introduced, indicating that this study was a fresh approach for completing their field placement hours. During this time, students, as TechAmbassadors, would each be required to collaborate with a partner teacher to help infuse technology into his/her classroom curriculum. All students were eager to be part of this innovation, but at the same time, apprehensive. For example, one wrote, "I feel it will be a great experience...", while another said, "I feel it is a great program so long as the co-operating teacher has a little knowledge at how to use technology."

I immediately contacted four schools to request placement for my "TechAmbassadors". In one case, I revived a contact, a District Director of Technology, who I had met at a conference; for others, I contacted 2 principals who had each hosted one of my student teachers at their respective schools. Finally, I made a new contact for the Culinary Arts student. In each case, the project was well received; however, the Culinary Arts teacher felt he was "helping my student out", while the others voiced more enthusiastic responses, such as "This is a dream come true!" and "Can I have more?" Placement was a lot easier than expected. In each case, my ambassador and I met with the partnering teacher, who had been invited by the principal contact, to introduce the project. I must stress that partnering teachers were not selected based on technology competency. In fact, the opposite was closer to the truth. I reviewed the course syllabus with each teacher, showing that at least two lessons would be targeted for integration: one mid-semester, one at the end of the term. Additionally, I explained that pre-service TechAmbassadors would be keeping a journal, practicing lessons in the college setting and preparing a research paper. Subsequently, each ambassador filled out a survey and delivered a survey to his/her partnering teacher so that I could ascertain each participant's level of computer literacy.

For most part, cooperating teachers were anxious for technology integration and looked to the pre-service teachers immediately. We established the guideline that the TechAmbassador would complete at least four period-long observations prior to the delivery of the first lesson. The observations were for orientation purposes in that the TechAmbassador needed to learn the classroom routines, observe the strategies used, observe those students who could use special attention, test the technology, determine the content into which technology could be integrated, etc. TechAmbassadors would then reflect on observations in a journal, prepare to write an observation paper as well as their "research" paper (which basically chronicled their quest for information on their anticipated lessons), and of course, design their turn-key lesson plans which would integrate technology into existing curricula. It should be noted that these lesson plans are four page documents; half of which is targeted to in-service teacher preparation, the other half to student learning.

Each week in class, I facilitated discussions on the weeks' observations, with each TechAmbassador taking turns at center stage. Anticipated lessons were discussed and practiced in class, while issues of integrated curriculum, classroom management, thematic units were introduced as part of the coursework discussions. As the need for software was uncovered, I, as the instructor, would work with the student either alone or with all students as a group to demonstrate the software that could be used. Often times, students would show each other what they learned independently. During one lesson, we hosted a representative from PASCO who demonstrated computer-connected tools for scientific recording of variables such as temperature, distance/depth, heart rate, etc. At the end of this session, I arranged for a "donation" of a specific software product. (One ambassador was extremely interested in using it in his P-12 classroom.)

The course structure, thus followed a quasi-constructivist approach, in that while certain guidelines and discussions were established by the syllabus, the majority of class time was used to uncover real-world classroom problems and learn about possible technology solutions.

In each partnership between the in-service teacher and the ambassador, relationships developed; some surprisingly quickly and well-connected. In most cases, students were asked to teach even prior to the first scheduled "observed" lesson, which naturally occurred in or about the 7th week of the semester. Fears were soon allayed. Remembering that these ambassadors are undergraduates, there was indeed a certain amount of questions about expectations, grading policies, hours in class, but for the most part, they "assumed the roles". One particular student was extremely frightened about presenting to a fifth grade class, until one day, she came to my class,

wearing a great big smile, saying, "I taught two lessons today!" Apparently, the partnering teacher trusted her enough to have her teach a Math and an English lesson. Having observed the class, and establishing rapport with the teacher, she was able to do it with little difficulty. The students begged her to stay and do more! Was she changed by the experience? Incredibly so! When I observed her official "technology" lesson, the students remained completely engaged, she assumed control, and the teacher exclaimed, "They behaved better for you than they do for me!" Personal satisfaction! In addition, as an outsider, I observed that while the TechAmbassador introduced the lesson, the teacher busied herself with her own work. But when the technology was introduced, the teacher stopped, sat, and watched attentively. Incidental professional development! I highlight this case simply because it demonstrates an incredible (r)evolution.

Initially, this ambassador was scheduled to work with the computer teacher for a social studies lesson, but since he really did not need assistance, he suggested a newer teacher as an alternative. This "new" teacher was a veteran teacher of 19 years, but this was her first year at this school and she had not yet acclimated to the school's policies and procedures. She accepted this ambassador so reluctantly that it was 3 weeks into the semester before the ambassador could negotiate a time to observe at a convenient time for the teacher. This teacher happened to have considerable computer background at her previous position but did not seem to see the connection between engaging students with technology and classroom control. In her survey, she wrote that she could incorporate technology (NEC) into some lessons but "I have to gain control of the class first." Simply stated, this was a major victory for the TechAmbassador.

Other partner teachers had previous training in particular software programs. All responded that they wanted more technology training. One teacher had only seen PowerPoint *modeled* in her college career, and although she uses word processing and the Internet at home, she has never used these in her teaching. She uses *Acelerated Reader* (a self paced tutorial) with her class once a day and visits the librarian occasionally for a computer lesson. Another teacher became so frustrated with needing technology "repairs" that she rarely used the computers in her room. Our ambassador noted that merely "rebooting" the machine fixed the problem she was describing. This in-service teacher had a remarkably quiet, industrious third grade class who worked conscientiously and listened attentively. The Ambassador and I both noted how well behaved the class was. This teacher knew *KidPix*, *The Amazing Writing Machine* and *Encarta* in addition to being able to use the Internet. Her philosophy of "teaching the students a new software program and nothing else" seemed to work for the Tech Ambassador as well. This ambassador spent a session just teaching *KidPix* and then was able to teach Limerick composition, leaving children to use the *KidPix* program on their own after a brief refresher. Previous to this lesson, the teacher had attempted to use "The Amazing Writing Machine" with her class, only to find that the Techie at the school erased the student work when called in for a repair. The teacher was understandably frustrated once again, especially since she is so accustomed to calm and control. The Ambassador, in addressing this problem, elected to use *KidPix* for its "better" features, after comparing both programs for the Limerick task at hand. An example of critical thinking about a "real world problem" and other well run lesson!

One science teacher was trained in *Gizmos and Gadgets, Millie's Math House, Sammy's Science House, Science Court, Magic School Bus* but did not have a working computer in the classroom. Therefore that Ambassador partnered with the Social Studies/Computer teacher who was willing to let us use "his" lab so long as we integrated Social Studies. The resulting lesson relied on Internet Research to search for volcanoes in Central and South America, the focus of the Social Studies lessons. We had to use our imaginations!

Another teacher had only used television and video as technology tools. This was the class targeted by the student who wanted to use the PASCO equipment. The student wrote in his journal, "It is evident to me that he uses little or no (computer) technology when he teaches." This TechAmbassador was faced with multiple problems. First, the PASCO tool arrived later than expected. When the ambassador tried to install the software associated with it, he tried that process on at least four separate computers, before he called PASCO to find out that the PC version only works with the Windows 98 Operating System. At the eleventh hour, he arranged to "borrow" a laptop from the principal of another school in the district to use for the lesson. Would an in-service teacher have the time to pursue this?—would he take the time, especially since his oceanography unit has been working just fine for several years? Unlikely. Another victory for TechAmbassadors!

Thus, the TechAmbassadors were placed in a variety of grades with students of varied abilities and personalities. Each partnering teacher had a curriculum plan he/she was using for the time we spent there, so it became our responsibility to work within that framework. With the exception of the Culinary Arts student, none of the students had taught with technology to P-12 students prior to this experience, even though many had personally used technology and had other field based experiences.

## Examples of lessons at mid-term were:

Using Tom Snyder's program, "Choices, Choices: On the Playground" for a developmentally delayed first grade class learning about cultural diversity. This program takes students through a class thinking exercise on how to treat a new student who is "different".

Using PASCO's EchoSounder to determine the formations and depth of an ocean floor for a unit on Oceanography that the teacher admittedly used for several years.

Using KidPix to create illustrated limericks by 3rd graders learning about styles of poetry.

Using Inspiration to develop a concept map about the Solar System and individual planets that would later become the basis for a writing assignment for 2nd graders.

Using the Internet to shop for holiday gifts for a hypothetical family to develop predictions and collaborative thinking in a cooperative learning group setting.

Using spreadsheet formulas to adjust a recipe for more or less servings with high school culinary arts students in a vocational training program.

Using an Ambassador-created Internet Hotlist to do research on volcanoes to prepare for a subsequent PowerPoint presentation with a fifth grade Science class.

The study is ongoing, therefore, at the time of this writing, only midterm reports are complete. For these mid-term observed lessons, as the faculty member in charge of my ambassador, I took the liberty of co-teaching when warranted. I believe that as a professor, it is my job to facilitate teaching and learning, to coach, to allow students to achieve success by guiding them toward a challenging goal. A self-reflection rubric assessment is factored into the mid-term grades. At times, the in-service teachers also participated in the group learning activities. While this may not be the goal of an education program that trains teachers to be independent teachers, it *was* the goal of the TechAmbassador program to build bridges from Higher Education to P-12 using the next generation of teachers as facilitators. In contrast, end-term lessons will be delivered as independently as possible to achieve success. Results and sample lesson plans will be posted at http://iris.nyit.edu/~jclement/techambassadors.html

In conclusion, the TechAmbassador pilot study is an initiative that brings together in-service and pre-service teachers with the goal of integrating technology into the P-12 curriculum through observation, active listening, collaboration, modeling and reflection. Presenting at the AACE conference will provide much needed feedback to improve the format for yet another "generation" of TechAmbassadors.

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I extend heartfelt thanks to the teachers who opened their doors to us. We truly appreciate the warm welcomes we received and the expert guidance you provided. I especially would like to thank the first generation of TechAmbassadors for their courageous and steadfast efforts to integrate technology into the P-12 classrooms. You embody the promise of education reform.

# IT in the classroom and its implications for pre-service teacher education.

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**Abstract:** I completed six months in a classroom as part of my Doctoral research and I attempted to use IT as a teaching tool with a class of year 1/2/3 children. As a lecturer within the pre-service teacher education course at NTU I left the classroom in 1986 when computer technology was just entering our classrooms as a new teaching tool. In the pre-service course I have been involved in working with students in a competency based IT unit without knowing how IT can work as a tool in our classrooms. This paper attempts to explore my practical experiences and the implications for pre-service teacher education.

## IT in the classroom – my knowledge of IT in theory.

In my return to the classroom I was interested in exploring the role that computers could play in the teaching and learning experience. I recognised that the use of IT would require a 'mind shift' and a challenge to explore new models of teaching and learning.

> Unless educators are willing to reconceptualise curriculum and instruction (and perhaps the organisation and process of schooling itself), they will probably need to be quite patient in expecting transformation to occur through the use of computers and other tools.( Mojkowski,1990, p14.)

Computers as word processors, as a means of presenting knowledge and understanding through a variety of software programs, and as a source of information(through the internet and CD Roms) means that the teacher is confronted with a totally different teaching tool. A rethinking of the teacher's role in the classroom is part of this whole 'mind shift'. Rather than passively listening to the teacher, students are encouraged to discuss and learn ideas from themselves and for themselves through technology. This requires teachers to become participants in the learning and to create collaborative learning situations for both the teacher and student. Mojkowski(1990) refers to the need for teachers to tackle the pedagogical issues of education in the light of these new technologies. He argues that teachers, administrators and researchers have not addressed these three major questions,

1. How should existing curriculum and pedagogy be redesigned to accommodate and maximise the use of the technology?
2. What are the most appropriate ways to bring technology into the curriculum?
3. How can computers and other new technological tools be used as catalysts to revitalise existing curriculum and instruction within and across subject areas?

Dede(1997) would argue that these 'mind shifts' also require a total rethink of current 'chalk and talk ' practices as well as the pedagogical issues that relate to teaching and learning and how technology can enhance the learning environment. Dede(1997) continues to state that teachers will need to reconsider their own teaching strategies, their role in the classroom, the contributions students make to their own learning, the authenticity of the curriculum and their evaluation of student work. Teachers will also need to participate in and recognise the value of collaborative learning.

Zimmerman(1998) argues that schools need to use technology for at least three major reasons,

- As a catalyst for the larger education reform effort of restructuring the way students learn and teachers teach
- Good tools give talented and caring teachers and administrators the power to create successful learning environments
- Students who do not have technology skills will be unable to compete in the economy of the future

(Zimmerman,1998,p115)

Technology in the classroom can allow for more flexible, collaborative and self - directed learning experiences for the learner. Technology can,

- provide other entry points for a learning experience,
- provide opportunities for parents to become more involved in the educational process from home and work via the internet and
- allow for more involvement with the wider community again via the internet and CD Roms.

Warlick(1999) would argue that technology can provide extensive experiences in collaboration. Limited classroom computers requires that students often have to work in teams to access information from web sites or CD Roms. As they access the information in groups, they discuss the relevance of information, how to record the information and they make decisions about who does what. In a multi-age classroom more able readers can assist those less able. Students with more advanced computer skills can assist others. Using email facilities means that interaction is occurring with others as well as collaboration as the children compose responses to email messages. Technology can support and enhance student learning, thinking and problem

solving in many ways and teachers need time and training to explore how this can be done. Too often attempts have been made to train teachers in technology skills, when what is needed is time for teachers to think creatively about using technology to enhance what teachers already do – provide for meaningful learning experiences for every child.(McKenzie,2000) This emphasis on meaningful learning experiences is fundamental to the learning process and it is important to realise that technology can enhance the experience not take it over.

IT offers the teacher another tool to assist in the preparation and planning of meaningful experiences for all children. It can provide many opportunities for students to explore and present knowledge in a variety of as it provides unique opportunities for

- collaboration
- a child-centred approach to a learning experience
- a flexible learning experience, and
- motivation.

And so I entered my classroom with my research and understanding of IT. I saw the role of technology as a new tool that would allow for more flexible learning to occur as well as more collaborative and self - directed learning experiences for the learner. I used technology to provide another entry point for a learning experience and to allow for more involvement with the wider community by accessing and communicating with them through the world wide web. The reality of the classroom provides the teacher with opportunities to explore these new ideas.

I had four MacIntosh computers that were connected to the internet and to the school's server. All computers had CD Rom access as well as Microsoft word, excel and powerpoint software. I had a small bubblejet printer that worked occasionally. I had a number of personal educational CD Roms as well as access to some school CD Roms from the library. While I often prepared learning experiences that allowed for student direction, I was often frustrated by the equipment. The computers would freeze, access to the internet was often slow, the sound would not work, and/or too many children were around the computers. When the computers worked the learning experience was successful. However I often found the effort involved in planning activities very time consuming.

Activities that I planned for included,

- Activities for reading, maths and or spelling where the children rotate in groups.
- Sending and receiving emails.
- Using as a drawing tool.
- For information gathering through CD Roms and the internet.
- Morning activities – learning games.

From my own reflection during my teaching and research it was evident that some collaborative and self-directed learning did occur when the children worked together during computer activities. Some children continued to pursue research on their computers at home, others were keen to bring in CD Roms with relevant information while others produced further powerpoint generated booklets at home. The children also recognised that they could communicate with their parents, teachers and pen pals from interstate through emails and some children sent emails to the classroom from home during the weekend, or when they were sick. Internet searches, which allowed children the opportunity to access information from the wider community was difficult at times because of the old computers and irregular internet connections. Lack of teacher expertise in utilising the computers and inadequate technical assistance and equipment made it difficult to utilise the technology fully.

However the children did progress ; by the end of nineteen weeks all children were able to write up their own stories to send as an email to parents( the initial task in Week 3 took one week, our final newsletter in Week 19 took one hour!) and three children were trained in how to access a CD Rom through the school server, indicating improvement in the use of technology within the classroom.

### Implications for pre-service teacher education.

The unit offered at a first year level for our pre-service teachers is a compulsory unit. However the IT component is only six week in length, with a weekly three hour tutorial. Students can access the six topics on-line and either attend or not attend tutorials. The topics include,

- Cut, paste and graphics.
- Emails with attachments.
- Searching the internet and CD Roms.
- Powerpoint and prolight.
- Hyperstudio.
- Databases and spread sheets.

These topics were chosen three years ago after consultation with the Education Department IT personnel.

When I returned from the classroom this unit was the first I taught and I found I was able to give students direct experiences of IT use in all of the above topics. This skills based unit enables students to utilise the open-ended activities on-line, in their own time and to their level of understanding and competence. The students final portfolio is a sample of all these topics around the theme of 'ME', which provides the students with a useful resource for when they enter schools for practicums. This approach to IT is reflected in the use of specialist IT labs and teachers in Primary Schools and I experienced the value of these labs alongside classroom use where follow up activities related to the topic and curriculum area can be pursued.

I now have considerable more confidence in talking about IT in the classroom having had the experience and having tried out what I am talking about. I have also been invited by colleagues to talk about IT in other subject areas and I feel that this will probably be the greatest implication from my experience in the classroom.
It is imperative to re-look at our approach to teacher education and to explore a more integrated approach, similar to the way we encourage our students to work in the classrooms. IT can provide a tool for this integration as reading is integral to the internet and/or CD Rom research required in all subject areas, maths activities through spreadsheets and databases as well as tables and statistics. As the lecturer in Arts Education I can use IT to explore drawing and design techniques, visit an art gallery through the web or a CD Rom and create soundscapes through specialised music programs. Teachers recognise that teaching and learning is always about change and IT is but another tool to add to our growing list of skills, knowledge and understandings. Our classrooms in primary schools and Universities have the opportunity to be exciting places of change and discovery as we work with IT in our teaching and learning.

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# A Planning Model for Integrating Technology and Educational Methodologies in the Pre-service Teacher Education Program

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Integration of technology into the classroom has been promoted, written about, encouraged, and in some cases mandated for the last 25 years. Standards have been developed by the National Council for Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) to address educational reform at both higher education teacher education programs and PreK-12 learning environments for the inclusion of technology into the learning process. At the university level, constructivist teaching methodologies have been introduced in pre-service teacher foundations and method classes, and technology literacy classes have been added to the pre-service teacher education requirements. Yet findings indicate that teachers who integrate technology into their K-12 teaching on a regular basis are in the minority (OTA, 1995). As Lortie (1975) documented twenty-five years ago, "teachers teach as they were taught". Traditionally, teachers teach by lecture and incorporate technology as an "add-on" or isolated entity from the total learning process. Recent research has identified that attitudinal issues, such as teacher beliefs (Ertmer, Addison, Land, Ross & Woods, 1999, pp.54-72) have hindered the goal of integrating technology and curricular goals in a more enhanced student-centered learning environment. Teachers must re-examine how they plan and deliver learning objectives and need a procedure on how to alter their own teaching practices to include new educational methodology paradigms that use technology as a tool in a restructured learning environment.

## Development of the Planning Model

As an education department faculty member of Notre Dame College of Ohio, I am the coordinator of the technology endorsement certificate program. One of the biggest challenges I face has been to help teachers and pre-service teachers identify a process they can use when planning for integration of technology in the curriculum. After spending several weeks introducing the students to the technical aspects of technology (what is a computer system? what is a network?) and educational methodology paradigms (constructivism, directed teaching), the students needed "something" to link educational theory with the creation of a student-centered learning environment that included multi-sensory stimuli and tools; allowed for multiple paths for learning; fostered student collaboration, inquiry-based learning, and critical thinking; and provided students with authentic, real world learning experiences. That "something" was a planning instrument to help them rethink the total lesson in terms of learning objectives, classroom activities, educational methodology, assessment rubric and technology effectiveness.

## The Planning Model

In development of a planning model to encompass methodology, standards, technology and learning environment, I looked at 3 stages in the planning for learning process: (1) Knowledge Acquisition and Research (2) Knowledge Organization and Analysis and (3) Information Presentation and Assessment. Learning objectives begin in Stage 1 with students acquiring knowledge in some manner - through lecture, books, interviews, surveys, Internet, etc. The knowledge acquired is then organized in Stage 2 in some fashion for analysis. Organizational components can include reports, spreadsheets, databases, etc. After analysis a synthesis of new knowledge is then presented and evaluated in Stage 3. The presentation/assessment vehicle might be a test, oral presentation, document, web site, slide show, newsletter, etc. In each of the 3 stages of the model, lists of example components were developed with accompanying attributes. These component attributes included: learning objective, type of methodology, and NETS Connecting Curriculum and Technology standard with accompanying performance indicator.

## Application of the Planning Model

The Modeling Instruction with Modern Information and Communication Technologies (MIMIC) Project involves a consortium of 5 colleges in the Cleveland Area colleges, including Notre Dame College of Ohio, which provide pre-service teacher education program. MIMIC , funded by a US DOE Preparing Tomorrow's Teachers to use Technology

(PT3) grant, targets three populations that supply teaching models for pre-service teachers: (1) Higher education faculty who deliver methods and foundations instruction; (2) K-12 teachers who supervise field experiences; and (3) Higher education Arts and Sciences faculty. Drawing on the National Educational Technology Standards (NETS) for teacher education developed by the International Society for Technology in Education and in-service professional development efforts generated by Ohio SchoolNet, the MIMIC Project has been designed to implement a context-based and content-specific approach for modeling the integration of technology for pre-service teachers. As coordinator for the MIMIC project at Notre Dame College of Ohio, a small Midwest Catholic liberal arts college, I serve as the mentor of university faculty and cooperating teachers of field experience for pre-service teachers, to support and train them in modeling technology to pre-service teachers.

In my role as mentor, teachers had to re-examine their way of teaching in terms of identifying that curriculum goals, technology integration standards and educational methodologies need to be a unified concept. Each MIMIC Project teacher designed and implemented 3 lessons that modeled technology to pre-service teachers. The planning model ensured that participating teachers would be exposed to a consistent, effective process when planning and revising their lessons. While each teacher selected their topic and grade level, their choices of components were linked to specific methodologies, standards, and technology components that were unique to their specific learning environment. The model provided a consistent framework to plan not only "what", but also "how". As mentor, the model helped me identify skills that the MIMIC Project teacher needed at each stage of the process. I could design training/support activities that would meet the needs of individual teachers - these needs included not only technology skills, but also classroom management and alternative assessment skills. After implementation of the lesson, the teacher and mentor could evaluate whether different component choices would have been more effective in unifying methodology and standards. Reflection and evaluation within a framework allow the teacher to "tweak" their succeeding lesson designs to create more effective results while developing confidence.

## Benefits of the Model

The benefit of a planning model for the integration of technology and educational methodology paradigms that is linked to a body of standards is that it provides a consistent, step-by-step procedure for a teacher to re-examine what and how they are teaching. The students in my classes provided the following feedback after using the planning model: (1) gave teachers a starting point for lesson planning (2) allowed them to customize - plug-in individual components (content area, grade level, student procedures, assessment methods, teacher delivery style) (3) identified the choices they can make in each stage of the lesson planning process in terms of methodology, standards and technology (4) identified the skills needed as components choices were made and (5) helped them become independent planners.

The cooperating teachers and university faculty that were exposed to the model reiterated the benefits listed above and also added the following: (6) the incremental nature of model increased their confidence that they could effectively add a component that not only fit with their learning goals, but used a technological tool and (7) they could easily structure their existing learning goals into the model framework

## Conclusion

The model provided a flexible framework for both pre-service, cooperating and university teachers as pre-service teachers relied on the model for comprehensive planning and existing teachers used the model to unify what they currently were doing integrating curriculum standards and technology initiatives. The components and attributes provide dynamic entities that are added to and modified as technology, standards and methodologies change. As more data is gathered through the MIMIC Project and classroom teaching experience, the model will be updated to enhance its use as a planning instrument

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# CURRICULUM MODELS FOR COMPUTING AND INFORMATION TECHNOLOGY: ARE WE KEEPING UP WITH THE CHANGES?

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**Abstract:**
Recent efforts in the development of national and state curriculum standards focus mostly on the content taught in each discipline and are meant to define the skills and knowledge of the discipline to be acquired by every student. For this to happen, school curricula must be aligned with these standards. In order for the students to gain these skills and knowledge, teachers must acquire a body of knowledge that encompasses what is defined by content standards plus the pedagogical skills that will allow teachers to guide their students in the acquisition of the discipline's skills and knowledge. This paper focuses on the current state of teacher preparation programs and the requirements needed to teach computing and information technology.

## INTRODUCTION

The United States continues to lack an agreed upon and well disseminated national curriculum standards in computing and information technology from which to build a foundation on in our schools. This is so even though professional organizations have called for infusing computing education at the pre-college level (Tucker, 1996 & 2000; Stephenson, 1997; Deek & Kimmel, 1998 & 1999). The Nation at Risk Report issued by The National Commission on Excellence in Education (NCEE, 1983) recommended "that the state and local high school graduation requirements be strengthened and that, at a minimum, all students seeking a diploma be required to lay the foundations in the Five New Basics by taking the following curriculum during their first four years of high school; (a) 4 years of English; (b) 3 years of mathematics; (c) 3 years of science; (d) 3 years of social studies; and (e) one-half year of computer science. According to the Association for Computing machinery (ACM) Model High School Computer Science Curriculum (ACM, 1985a), "The need for computer science education is similar to the need for education in the natural sciences. The proposed ACM curriculum takes the form of a recommended comprehensive one-year computing course for secondary schools. It identifies the essential computing concepts that every high school student should understand. The intention is that this course be similar in its scope, depth, breadth, and methodology to typical high school science courses. It should serve all students in the same way that introductory biology, chemistry, and physics courses do. The International Society for Technology in Education (ISTE) has also suggested recommendations for curriculum and teacher preparation (ISTE, 1992, 1997 and 2000). The guidelines developed by ISTE distinguish between computer science as a discipline and educational technology as a tool. As for pre-service programs that prepare teachers to teach computing and information technology, such

college programs are still very limited and teacher certification mechanisms for computer science education are still a long way from being implemented in most states where computing and information technology teachers still come from the ranks of other disciplines. Deek and Kimmel, 1998 and 1999 have addressed curriculum and standards issues and presented a teacher-formulated model that is currently being implemented in the State of New Jersey. This paper focuses on the issues of teacher preparation programs and the requirements needed to teach computing and information technology, giving these models and recommendations for computer science education at the pre-college level.

## MODELS OF TEACHER PREPARATION PROGRAMS IN COMPUTING AND INFORMATION TECHNOLOGY

Recently, there have been increased efforts in the development of national and state content standards. The curriculum standards, both nationally and by every state, focus mostly on the content taught in each discipline and are meant to define the skills and knowledge of the discipline to be acquired by every student. For this to happen, school curricula must be aligned with these standards. In order for the students to gain the skills and knowledge, teachers must acquire a body of knowledge that encompasses what is defined by content standards plus the pedagogical skills that will allow teachers to guide their students in the acquisition of the discipline's skills and knowledge. It is understood that there must be a match between the skills and knowledge defined for the students and the acquired skills and knowledge of the teachers. At the same time, it is recognized that teachers must have a greater depth of knowledge than required in the curriculum they are teaching. Deciding what subject matters, and in what depth, is a substantial challenge for educators. For educators in computer science education the situation is exacerbated, since the discipline at the pre-college level is still ill defined, and the distinction needs to be made between pre-service programs that prepare teachers to teach computing and information technology and those that prepare teachers to use computers as an instructional tool in other disciplines.

Deek and Kimmel (1999) have reviewed the current status of secondary school computer science education in the State of New Jersey and discussed curriculum guidelines formulated by classroom teachers. This effort was intended to serve as the stepping stone towards establishing and promoting computer science as a recognized discipline in New Jersey's secondary schools. Computer science is a widely acknowledged discipline in the post-secondary education community and as a profession in our society (Tucker, 1996; Deek and Kimmel, 1998), but the same has not happed at the pre-college level yet.

The lack of recognition of computer science as a high school discipline by state departments of education may be reflected in:

- the exclusion of the discipline of computer science in the implementation of content standards;
- limited, and not well-defined in the few instances where they exist, teacher certification mechanisms for computer science; and
- limited college teacher-preparation programs for secondary school computer science.

As a result, virtually all pre-college computing teachers are certified in other disciplines. For example, the lack of teacher preparation programs in New Jersey has led to teachers of computing and information technology with certifications in diverse areas including mathematics (60% of those teaching Computer Science courses), science, business, and English (Deek and Kimmel, 1999). This situation is common to many states, and as seen in this paper, still encouraged by many states.

As previously stated, the curriculum, certification standards, and well-trained classroom teachers are essential steps towards a recognized subject area. There have been two directions taken in the development of guidelines for the preparation of teachers of computing and information technology: a recommended curriculum of courses and the identification of core competencies needed to teach computing courses. Both approaches have been part of recommendations by national organizations, and both approaches have been adopted within different states. Information and data on teacher certification requirements and teacher preparation programs were obtained from a search of the web sites for state departments of education (CCSSO, 2000). Further information was sought for those states that indicated either certification or endorsement requirements for teaching computing courses in the high schools. This was accomplished by either contacting the departments of education directly and/or contacting (and/or

accessing the web site of) universities with teacher education programs in those states. The later strategy assumed that the adoption of criteria for the teaching of a discipline by a state department of education would lead to programs of study offered by schools of education at universities in that state. Finally, if a university is offering a program for prospective teachers of computing and information technology, the authors have assumed that they are authorized (or at least acknowledged) by their state to offer such a program, and that such a state does provide a certification or endorsement for teaching in the field. In conducting the search, certifications and programs in educational technology were identified and eliminated from further consideration. The authors recognize that this type of search is neither comprehensive nor necessarily complete. Hence, the results may not be totally representative of the situation across the country. However, the authors believe that the results of the study provide snapshots of the current status of teacher education in computing and information technology, and serve to define future directions.

The first major document to focus on the preparation of teachers of computer science was released by an ACM/IEEE taskforce, which was concerned with secondary school curriculum and teacher certification in computer science (ACM, 1985a & ACM, 1985b). The Task Force made recommendations regarding computer science in the secondary schools and the preparation of high school computer science teachers. While the taskforce recognized at that time that many teachers are expected to continue to come from within the in-service ranks, with little training in computer science, they called on colleges and universities to begin the preparation to offer pre-service teacher certification. In recognition that the current cohort of teachers would have to be the primary source of instructors in computer science until college and universities would be able to implement teacher preparation programs, another ACM Taskforce defined a program of study for retraining of teachers (Poirot, Taylor and Norris, 1988).

Chen (1989) reported on the use of the Delphi approach to develop guidelines for establishing a model curriculum for secondary school computer science teachers. The study sought to establish consensus guidelines for the key courses for a computer science teacher certification program.

An examination of degree requirements, for different disciplines, in different states (Blank and Langesen, 1999) shows a range of 18 to 45 credits required for teaching science and mathematics in the secondary schools. It seemed that programs below 30 credits referred to a minor in the subject, and that a minimum of 30 credits would constitute a major. In fact, eight states required majors in the field without specifying the number of credits, while one state specified a "competency-based program" without stating the number of credits. None of these states' requirements listed computer science as a discipline, an indication that the recognition of computer science as a high school discipline is still not widely accepted. This listing indicates that the recommendations of the ACM/IEEE Taskforce and the Delphi approach would be consistent with a minor in computer science.

A combination of Web search and personal communications indicated that eight states delineated certification standards, indicating some fundamental training for teachers of computing and information technology in the secondary schools. Thirty-one states listed some kind of an endorsement, of which four states show both certification standards and endorsements. Of the 31 states, 10 of the endorsements appear to have an instructional technology/computer applications focus. The results of this search indicate that many states still do not require a computer science degree or a computer science certification. The nature and requirements for the endorsement are quite varied. On the one hand, two states require a specific number of semester hours (18 hours in North Carolina and 12 hours in Louisiana), while on the other hand, the computer science endorsement science requirement for six states is placed in business education. (Note that the certification requirement for computer science for Rhode Island and Oklahoma lies within business education.) One state required knowledge of programming, while another required competency in both programming and data structures. Seven states label the endorsement as instructional technology/computer applications, or computer education. Others provided no specific information on the endorsement. In this search, it was necessary to distinguish between requirements and standards that prepared teachers to teach the subject of computing and information technology versus those that prepared teachers in the use of instructional technology in the classroom. In some states, these situations appear to be interchangeable. It was decided to disregard any listing that appeared to focus on the application of technology in the classrooms rather than on the teaching of computing as a discipline. Below, we provide some specific examples.

Reports have described teacher preparation initiatives in states such as Delaware (Taylor and Norris, 1988) and Texas, Missouri and Florida (Thomas, et.al., 1993). Of those four states, we find that Delaware shows both certification standards and an endorsement in computer science. Florida lists certification requirements through the

University of Florida, while Texas provides an endorsement in computer science. Missouri appears be using the ISTE recommendations in their pre-service program only for the use of instructional technology in the classroom. The certification requirements of Florida and Delaware are discussed next.

Variations in certification requirements are evident for the eight states identified in the study. As indicated earlier, certification requirements in Rhode Island and Oklahoma fall under business education. The description of certification on the Oklahoma Department of Education web page is particularly interesting here. They provide a listing of courses to be taught in Oklahoma high schools (grades 9-12), which include Advanced Programming, Computer Programming I & II, AP Computer Science, and Introduction to Computers. For each course the exact same credentials are listed as follows:

"Computer science – a credential in business education, mathematics, or science with at least six semesters hours in computer training, *or* any valid secondary or elementary-secondary certificate and 12 college hours in compute training."

Certification in Florida is further developed. They provide several options to meet specialization requirements for certification in computer science for grades K-12 as follows:

(a) An undergraduate or graduate major in computer science or computer science education which includes credit in computer applications and computer programming, or
(b) An undergraduate degree with thirty (30) semester hours in computer science or computer science education to include:
    1. three (3) semester hours in computer literacy,
    2. six (6) semester hours in survey of computer applications,
    3. twelve (12) semester hours in computer programming (including six credits in Pascal and data structures).

These requirements show that computer programming is the most prominent subject of computing. This is consistent with the arguable idea that programming is the only important subject in teaching computing and information technology at pre-college level. However, these requirements provide a starting point for addressing the discipline of computing and information technology as it should be taught at the high school level. This model also implies that a K-12 certification covers the needs of all student populations, elementary, middle and high school grades.

Three states come closest to the concept of a curriculum requirement for certification of teachers of computer science, Delaware, Maryland, and Michigan. They are also reflected in the programs offered by universities in these states. Each of them requires, as a minimum, 18–24 credit hours of courses in computer science, closely paralleling the recommendations of the ACM Taskforce. Delaware and Maryland appear to be the closest to the recommendations of the ACM Taskforce. Delaware requires either a major in computer science or a teacher education major with an 18-credit concentration in computer science. Maryland requires a 24-credit program in computer science. Both the 18 and 24 credit hour programs would constitute a minor. The Delaware requirement includes 12 hours of required courses and 6 credits of electives. The Michigan requirements are reflected in the teacher preparation programs of the University of Michigan and Michigan State University. They include courses in programming (as reflected in the first Introductory Computer Science Course), Assembly Language, and Data Structures, and 1-2 elective courses (a variation between the two Michigan universities.

Several states do appear to require some kind of computing and information technology content for an endorsement, although that might be as little as some competency in structured programming and a basic understanding of data structures (e.g., Utah). As stated earlier, North Carolina and Louisiana require 18 hours and 12 hours, respectively, for an endorsement. Louisiana actually has a "12-hour rule", which permits a teacher with 12 credit hours in computer science to teach two classes a day in the subject. Kansas lists a set of competencies as standards that teachers must meet to receive an endorsement. The competencies include problem solving in a logical manner with a computer, computer systems, high-level programming language, development of program design.

## CONCLUSIONS

State boards of education across the country are recommending a diversity of ways of gaining computer skills (having a computer science degree, taking classes or completing training program) for teachers. However, there is need to have teachers develop a common level of knowledge about the subject. In particular, teachers should be

competent in problem solving/programming, data structure, operating systems, and software applications, including the Internet. Other skills would also be required in order to teach advanced courses. Courses in these subjects would provide teachers with the ability to infuse information technology into the classroom. Unfortunately, it appears that most current computer science endorsements cover a small part of the discipline.

This baseline study appears to indicate very slow progress towards the establishment of teacher certification standards and teacher preparation programs in computing and information technology for high school teachers. Only a handful of states have requirements that could be aligned with the national standards recommended by ACM or ISTE. Not much progress has been made in the decade and a half since the issuance of ACM curriculum recommendations. Perhaps the fact that certification standards and approval of programs are usually covered by regulations or administrative code that must pass through a complex and sometimes bureaucratic process before adoptions can take place is partly to blame. But collaboration among professional organizations in education and computing, colleges and universities, state education departments and teachers can help move this issue forward. There remains another obstacle to overcome and this is the shortage in computing professionals that is facing industry and the difficulties that colleges and universities are dealing with when recruiting computer scientist is now common to K-12 schools.

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# Economics, Information Literacy, and Teacher Education

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**Abstract:** When preparing future educators to teach the concepts and principles of economics to prek-12 students, it is recommended that not only should these educators be provided with experiences in economic theory but also with skills in the area of information literacy. A brief explanation and several examples are given on how and why content area study, information literacy, and teacher preparation can be orchestrated.

## Introduction

There are three perspectives to observe when preparing teachers to instruct in the area of economics education. One perspective is that of content development. Teachers must know basic principles and applications of economics. The other perspective is that teachers must have the knowledge of student skills needed to learn information and to make real life applications. And a third perspective is that teachers must have the skills needed to use the best and most modern pedagogy in order to meet the needs of students. Modern pedagogy includes the use of technology.

A teacher education program must recognize all three perspectives. Educators must not only acquire content knowledge, they must also understand the skills needed by preK-12 students to learn and apply that knowledge. Educators must also acquire, understand, and use technology to be able to instruct effectively and efficiently in the 21st century classroom. Therefore, a model teacher education program should include the study of content, the study of student skill acquisition, and the use of technology for learning.

As part of the national standards movement in education, individual states created state-based curricula that provide educators with goals and/or standards in the area of economics education. For example, Kentucky=s Curriculum Framework (Kentucky Department of Education, 1995) maintains that students should understand economic principles and be able to make economic decisions that have consequences in daily living. Kentucky educators refer to this expectation when developing curriculum plans and assessment goals. When studying economics education, preservice and inservice educators often make reference to the academic expectations as defined by their state department of education.

The importance of information literacy is demonstrated by the National Educational Technology Standards (NETS) Project. The NETS Project (Thomas and Knezek, 1999) has

attempted to draw a national consensus on the role of technology in schools. After studying the impact of technology on the education of students, members of the NETS Project proposed a set of standards to guide educational leaders to recognize and address the conditions for effective use of technology to support preK-12 education. The educational technology standards for students include six broad categories: basic operations and concepts; social, ethical, and human issues; technology productivity tools; technology communications tools; technology research tools; and technology problem-solving and decision making tools. Students are to use these technology skill areas in an integrated manner with content learning. Content Aknowing@ should include application in the context of learning, living, and working in authentic situations.

The significance of technology in teacher education was demonstrated in the release of the NCATE (National Council for Accreditation of Teacher Education) Task Force on Technology and Teacher Education=s report, ATechnology and the New Professional Teacher: Preparing for the 21st Century Classroom,@ (NCATE, 1997). This report explains new understandings, approaches, roles, forms, and attitudes in programs based upon the need to include the implementation of technology in teacher education programs. Information based upon this report is being used as standards for the NCATE accreditation review process. Teacher education programs seeking accreditation from this agency must study and apply these standards.

When observing the NETS Project standards report and the NCATE technology report information and standards, the importance of implementing the use of technology for student learning is clearly apparent. When preparing educators to learn and teach economic principles, the use of technology applications during the process of content acquisition is a logical and necessary process. Therefore, when studying the content area of economics at Eastern Kentucky University, students are required to use technological applications during the learning process. The following information will explain: (A) teacher education and the study of economics at Eastern Kentucky University, (B) basic economics principles recommended by the Kentucky Department of Education in its curriculum framework and core concepts for assessment, and (C) examples of classroom applications of information literacy skills required of students during the study of the content area of economics.

## Economic Study and Teacher Education at Eastern Kentucky University

Eastern Kentucky University is a regional, comprehensive institution located in the southeastern part of the state. The student population is approximately 14,000. Economics education courses and workshops are offered at the undergraduate and graduate levels through the Economics Department in the College of Arts and Sciences. Students take economics courses in fulfillment of program requirements in: general education, an economics major, an economics minor, teacher certification emphasis, and graduate subject matter study. Undergraduate teacher education students attend courses and workshops in the area of economics with other majors. There is a specific graduate workshop available for inservice teachers.

## Basic Economic Principles for Teacher Education

Educators in Kentucky have recognized the need for students to study economic principles. Kentucky=s Curriculum Framework specifies an academic expectation which declares that students should understand economic principles and be able to make economic decisions that have consequences in daily living (Kentucky Department of Education, 1995). The importance of the study of economic principles such as the study of production, distribution, and consumption of

goods and services is confirmed in the Core Concepts for Social Studies Assessment (Core Content for Social Studies Assessment - Version 3.0, 2000). These assessment goals recommend that students need to understand how economic decisions affect them, others, and the nation as a whole. Students at the elementary, middle, and high school levels are assessed on their ability to address topics such as making informed choices, comparing revenues to costs, analyzing resources, examining opportunities, and performing other economic applications. The area of economics is presented in four broad content statements or assertions as follows:

(A) The basic economic problem confronting individuals and societies is the scarcity or imbalance between unlimited wants and limited resources available for satisfying those wants.

(B) To deal with the problem of scarcity, people and societies create economic systems and institutions.

(C) Markets are institutional arrangements that enable buyers and sellers to exchange goods and services.

(D) All societies deal with questions about production, distribution, and consumption.

When studying economic principles these assessment areas are incorporated into lesson development plans. Educators are to help students learn, understand, and apply these concepts.

## Classroom Applications of Information Literacy Skills

Economics is a theoretical science. Consequently, economic theory plays a critical role in studying the results of economic events. Students are required to apply theory to predict the outcomes of economic events. In order to evaluate theory, students must compare theoretical predictions with the actual results of those events. Understanding the implications that flow from such a comparison represents a crititcal achievement in analytical thinking. In order to successfully proceed in these developmental exercises, a student must learn and apply skills in the acquisition and use of economic data. Such study develops a student=s thinking processes associated with comprehending, applying, synthesizing, predicting, analyzing, and evaluating.

The economic decisions that students study involve the application of information literacy skills by society. In making economic decisions, an individual must acquire information, process the information by abstraction, apply economic theory to produce a set of expected outcomes, express the outcomes as a functional understanding, make decisions based on their understanding, and after the fact, evaluate the usefulness of the theory based the actual outcome of the decision.

The modern educational environment has many electronic resources that are used in connection with the acquisition and processing of economic data. The use of computers, networks, and software are high technologies that assist the student in finding, analyzing, and applying economic data sets. These technologies require the skills needed to read and interpret as well as analyze and evaluate, thereby making use of information from print, visual, audio, or electronic sources. Such skills are the essence of information literacy (Rafferty, 1998). In turn, the skills of information literacy provide students with the abilities to produce forms, charts, graphs, maps, and other visual displays of data. These skills are of particular importance in a world where one may need to find or present data in non-print formats. Students need skills with information technologies not just to analyze and evaluate data, but also to acquire the data initially and again later to present the product of their work.

The following are some examples of how the application of information literacy is used to study economic principles:

Students make use of library resources and CD based information sources to compile a profile of the time period in which an economic event occurred.

Students format a word processing document to display the profile as a 'timeline' event that they are studying.

Students make use of library resources, CD based information sources, and internet access to institutional and governmental data bases to assemble a set of economic data that would measure the occurrence of the event they are studying and economic data that would measure the impact of the event.

Students organize their economic data in a spreadsheet format. They apply their skills at presenting the information in this format and their skills at transforming the data into the visual format of a graph that shows an economic measure over the time period of their event.

Students predict what the appearance of the graph would be if it were to comply with the theory that they have studied in their economics course. They apply their analytical skills to examining the consistency of the graph with the theory=s predictions. Students apply their evaluative skills in explaining the interpretation of the evidence and the resulting implications regarding the theory that they have applied in the exercise.

These exercises utilize and develop information literacy skills as well as makes use of information from print, visual, and electronic sources. Economic concepts are learned by using authentic data. Also, students have the opportunity to apply their learning to real life situations.

## Conclusion

The acquisition of economic principles is an important aspect of preparing educators to teach economics. When this acquisition process is infused with the use of information technology, students are able to understand the content being studied as well as the use of information technology in the procedure. Theory states that students will teach as they have been taught. Studying economics orchestrated with the use of information technology is a modern and effective method of preparing educators for authentic classroom experiences.

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# Constructivist Use of Technology: Encouraging Preservice Teachers to Construct an Understanding of their Leadership Role in Promoting Reading Outside the Classroom

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**ABSTRACT:** In order to facilitate preservice teachers' understanding of the importance of reading aloud to children and of their role as educators of parents and community members, a project utilizing the constructivist use of technology was undertaken. Preservice students were presented with research concerning the correlation between the amount of reading done at home and reading achievement in school (Anderson, Hiebert, Scott, and Wilkinson, 1985). These preservice students were then asked to formulate their own understanding of how they could educate parents about their role in the educational process. The students then converted their ideas into a digital video public service announcement to be run on the local media. This paper/presentation will share how this project was undertaken and will model the use of the digital technology.

Constructivist learning principles—supported by the writings and theories of Dewey (1982), Piaget (1972), and von Glasersfeld (1995)—give teacher educators a way to facilitate learning through experience and reflection. When using this approach, educators do not rely solely on the direct transfer of knowledge from the teacher to the student (as is done with teacher-centered approaches). More wisely, they take into account that "learners do not passively absorb knowledge, but rather construct it from their own experiences." Accordingly, teacher educators who use constructivist approaches act as coaches who provide students with appropriate learning experiences that lead to learning. These teacher educators also act as knowledgeable guides who can empower students to reflect on those experiences as they relate to the goals of education.

Constructivist principles can also be used to facilitate preservice teachers' developing role as teacher leaders. According to Odell (1997), teacher leaders are "considered first and foremost to be instructional leaders who are open to continuous systemic change for school improvement" (p. 122). Fullan (1993) has identified teachers as moral change agents. In order to reconceptualize preservice teacher curriculums that would support this role development, Grossman and Richert (1996) emphasize the need to foster certain commitments within the curriculum. These would include commitments towards a) ongoing learning, b) openness to other points of view, c) working through areas of conflict with other school and community members, and d) risk-taking. To develop these commitments, preservice teachers would investigate a real world problem and work with school personnel and/or community members to solve it.

One avenue would be to provide multimedia forays into the world outside the classroom. Just such a foray was recently provided to introductory education students. After having students conduct a review of the literature concerning the positive effects of parents reading to their children (Anderson, Hiebert, Scott, and Wilkinson, 1985), they were then provided with a desktop computer with digital video editing software (iMovie) and a digital video camera. After being taught to use the equipment, the students then used this technology to write, produce, and act in a public service announcement encouraging parents to fulfill this crucial educational role. This student-produced video was to be run on a local cable television station.

Overall, this project was intended to provide an opportunity for preservice teachers to work together to promote parents' reading to their children. Reflective discussions with students suggested that they were motivated to solve this real world problem. They attempted to fulfill this change-agent role by researching the literature, using technology, and collaborating with one another in order to encourage positive educational practices in the community.

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# TECHNOLOGICAL CAPACITATION OF DISTANCE EDUCATION TEACHERS

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*Abstract:* This article reviews current literature on the technical know-how of teachers working with Distance Education (DE) and presents an argument for the importance of teacher training. Based on research being conducted at the Distance Education Laboratory (LED) of the Federal University of Santa Catarina (UFSC), in Brazil, the authors show that there is a shortage of teachers with knowledge of educational technology and the background needed to work as distance educators.

## Introduction

The principal objective of this paper is to highlight the necessity for technically capacitating teachers working with distance education, and to present a theoretical and practical approach for this challenge. Preparing distance education teachers for technology use is necessary in order to generate effective communication with students and fully exploit the teaching/learning experience. Teachers should be encouraged to embrace and incorporate information and communication technologies to the extent possible, perceiving them as tools for augmenting the potential of the educational process. Teachers who avoid technology or see it as a threat become increasingly alienated in the context of the information society and sense a continuing loss of control in their professional paths.

Recent research conducted at the University of California shows that 67% of professors perceive they are under constant pressure to keep themselves up to date in relation to emerging technologies and 62% feel that their teaching positions are threatened. According to the researchers, this preoccupation could be preventing professors from using new technologies. The study shows that only 35% of professors actually use the internet for research, and only 38% use computer technology to prepare presentations for the classroom. These statistics are dismal in the light of the rapid expansion of distance education and the benefits offered by the ever-increasing array of Educational Technologies.

Research in process at the Distance Education Laboratory of the Federal University of Santa Catarina indicates that the more than 75% of distance education professors do not have the technical knowledge necessary for conducting distance courses. The authors are in the process of examining the difficulties that our teachers, and others around the world, have in learning about educational technology in order to establish effective solutions.

The resistance of many teachers to the use of technology in the classroom and in their pedagogical approach is well recognized. This phenomenon has been ameliorated by events and programs for technological capacitation which demystify the image of machines, present strategies and options for professors to choose their own methodological solutions, and which " condition (professors) to be adaptive to various tasks and to constantly seek self improvement" (Preti, 1996, p.16).

Hawkins (1995), describing the errors committed in the process of introducing computers in North-American schools, comments that the greatest mistake was not having initially put the technology in the hands of the teachers, and leaving them to think about how they would like to proceed and adopt these technologies in the context of reform. Hawkins advises that much investment is necessary for helping teachers to think in different and new ways about their profession.

Willis (1994) considers teacher training to be the primordial factor for the success and continuation of any distance education program, because of the big challenges distance educators face. They must recreate their course, adopting the role of "content facilitator" acquiring confidence and efficiency while using technology as the principal communications means with the students. It also involves learning to teach effectively without the visual control provided by direct "eye-to-eye" contact, and developing an understanding and appreciation of the lifestyle and profile of distance education students

According to Mason (1998) in order for distance teaching and learning to improve on existing levels and dominions, it is necessary to include interaction in the process, have teachers play the role of "guide" and understand how to take advantage of the benefits that computer technologies allow. As professors increasingly become familiar with operating computers and with integrating multimedia into curriculum related activities, they will be able to participate more actively in the implementation process of educational technology. The ongoing development of user-friendly machines and softwares is facilitating this journey.

According to Barcia et al., (1998) it is necessary to create interdisciplinary teams in order to diminish the distance between education and informatics, so that teachers maintain confidence and decision-making powers. They should have adequate tools for the selection, indication and presentation of academic content. Educational technology's real value is evidenced when teachers discover its optimal use in the classroom. The authors hope that at the end of the technological capacitation process, teachers will be able to devise their own strategies for the best use of the computer according to their particular didactic content and teaching style. It is also important for them to recognize the necessity of using technology in distance education to provide the students with simultaneous and constructive feedback.

## Conclusion

Due to a lack of information and an adequate framework for dealing with technology, many teachers have rejected using educational technology, in part from fear that it would eventually replace them in the classroom. Today the benefits of educational technology and its possibilities for enriching educational content and delivery are becoming increasingly evident and teachers are coming to understand the importance of learning how to incorporate it in their classrooms. In this context, it is important for teachers to understand that any incorporation of education technology should be integrated within a wider educational context requiring different pedagogical strategies, and its incorporation in no way diminishes the importance of the teaching profession.

The principal objective of technological capacitation is to prepare professors for better serving the information society, where technology plays such an important role in all activities and professional areas, and which has generated a great demand to learn how to adapt and manage knowledge and information. The process of technological capacitation of teachers for distance education is challenging in relation to social aspects because it requires a change in attitude and teaching methodology. However, with teacher training programs and support, professors more easily come to understand how to adjust their teaching methodologies in order to better help students construct knowledge at a distance. They can also be encouraged and supported during the dificult process of learning to manage the differences, which unquestionably exist, in communication flows mediated by technology.

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# Technology Integration into Preservice Teacher Preparation: Recommendations for Practice

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**Abstract:** The purpose of this paper is to provide recommendations for practice to integrate information technology into teacher preparation programs. The author describes a model for technology integration into teacher preparation programs. This model is based on what he has learned in his recent studies and his beliefs about the things that teacher preparation institutions must do in order to increase the level of technology integration in their own programs. Based on the integration model discussed, the author provides specific recommendations for practice.

As the United States enters the 21st century, teacher preparation programs across the nation are assessing their capacity to adequately prepare new teachers to embrace the use of information technology in the education of young people who will live in a global, information-based society. While investigating the status quo, recent studies have produced somewhat disheartening data. Relatively few teachers (20 pecent) report feeling prepared enough to integrate technology into classroom instruction (NCATE, 1999 January). In general, teacher preparation programs do not provide preservice teachers with the kinds of experience necessary to prepare them to use information technology effectively in their future practice (Duran, 2000; Moursund and Bielefeldt, 1999).

The purpose of this paper is to provide recommendations for practice to integrate information technology into teacher preparation programs. In this paper, the author describes a model for technology integration into teacher preparation programs. This model is based on what he has learned in his recent studies and his beliefs about the things that teacher preparation institutions must do in order to increase the level of technology integration in their own programs. Based on the integration model discussed, the author provides specific recommendations for practice.

## Integration Model

In general, in order to increase the technology proficiency of new teachers in K-12 classrooms, teacher preparation institutions should increase the level of technology integration in their own programs. To provide a model for technology integration into preservice teacher preparation, the researcher recommends three program components for reaching better preparation of preservice teachers in the use of information technology in the teaching and learning process.

a) A core course in educational computing prior to methods courses.

b) Education faculty who model uses of information technology in their methods and curriculum courses and require their students to do so in the design of their integrated units and field experience.

c) Student teaching experiences with supervising teachers whose students use information technology in their classrooms.

The first component of this model addresses a required educational computing course prior to methods courses. An educational computing course plays a critical role in introducing preservice teachers to fundamental information technology components and skills. It particularly provides preservice teachers with the opportunity to become confident and proficient with information technology tools. Recently, more than 91 percent of higher education institutions require an educational computing course for some or all their preservice teachers as a core component of their technology preparation programs (Vagle, 1995).

The second component of this model addresses faculty use of information technology in their practice. Education faculty need to serve as role models using information technology to facilitate instruction in their curricular areas, allowing students to observe the use of technology in particular disciplines. Faculty use of and attitudes towards information technology in the college classroom will strongly influence the implementation of technology by preservice teachers in their future practice. In methods courses, students should also learn specific software that experts in their fields use as tools of the trade. In these methods courses, students can be more

specific in their analysis of technology integration as it relates to particular tenets of a discipline. However, this component appears to be lacking in preservice teacher preparation programs (Duran, 2000; Moursund & Bielefeldt 1999; Persichitte et al. 1997; Wetzel, 1993; Willis & Mehlinger 1996).

The third component of this model addresses integrating information technology into the field component of teacher preparation programs, particularly into the student teaching experience. It is important to place preservice teachers in classrooms where information technology use is modeled appropriately. Work in the field is a "salient way" to help preservice teachers experience deep learning of how to effectively use information technology in instruction and how to manage actual classroom learning activities within a technology-enriched environment. However, this component also appears to be lacking in preservice teacher preparation programs (Duran, 2000; Moursund & Bielefeldt 1999).

## Specific Recommendations for Practice

Based on the integration model discussed above, the author specifically recommends followings:

1. Preservice teacher preparation programs should be engaged in technology planning that focuses on not only facilities but on the integration of information technology into the entire undergraduate curriculum.
2. Most preservice teacher education programs currently require an educational computing course for their education major students. The researcher recommends that the teacher preparation institutions should continue to require this course to its preservice cadre prior to teaching methods courses.
3. Education faculty must be encouraged to model and integrate technology in their courses. Even though a computer on a faculty member's desk is a step, providing professional development in technology usage is crucial. The researcher recommends continues effort for ongoing quality faculty development combined with adequate resources (especially in university classrooms) and support from the administration.
4. Student teachers need more opportunities to observe/apply information technology during field experiences under qualified supervision. This requires a partnership between the teacher preparation institutions and cooperating schools. The researcher recommends that working with school districts, the teacher preparation institutions must plan and provide ongoing professional development opportunities for cooperating teachers and place its student teachers in classrooms where they observe/apply effective use of information technology.
5. The researcher strongly recommends consistency between what preservice teachers learn in their educational computing course (theory) and what they observe in their methods and curriculum courses or in K-12 classrooms (practice).
6. Teacher preparation is a university-wide and community-wide responsibility. Thus, the researcher strongly recommends a collaborative effort of the teacher preparation institutions and other units within a university that contribute to the preparation of teachers.

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# Standards Based Reflection:
# The Virtual Teacher Project

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**Abstract: In Indiana, the current dilemma facing teacher education programs is how to best teach about and assess students on the standards adopted by the Indiana Professional Standards Board (IPSB), and in particular, the dispositional component found in those standards. The Virtual Teacher Project combined over 32 inservice teachers representing 30 different schools, 170 preservice teachers representing six teacher preparation programs and 8 teacher educators representing 4 universities in an electronic discussion group that focused on connecting standards adopted by the IPSB and INTASC.**

## Background

Imagine a professional development school and teacher education program where the teachers play an integral part in the preparation of future teachers. Each teacher has the opportunity to impact the learning and preparation of hundreds of future teachers and each pre-service teacher has the opportunity to interact with dozens of veteran teachers. Teacher education students can ask teachers burning questions related to current issues and practices in education. Teachers in turn have the opportunity to reflect upon their professional practice. This type of K-16 learning community was developed in the Virtual Teacher Project.

In 1997, The National Council for the Accreditation of Teacher Educators (NCATE) issued a report entitled *Technology and the New Professional Teacher: Preparing for the 21" Century Classroom.* This report describes the need for teachers to be able to understand the impact of technology on society, the need for teachers to adopt new roles which allow them to use technology to become more reflective and critical consumers, and the need for teachers to participate in activities that are delivered via informational technologies. This transformation to technology-rich teacher education classrooms is new, but the importance of using technology as a vehicle for delivery of information is apparent. Teacher education programs are then actively seeking means by which they can integrate technology in a meaningful way into their programs.

Reflection is another element that teacher education programs are working to include. Thoughtful reflection is a difficult process that must be developed and nurtured (King & Kitchener 1994). Donald Schön (1987) identifies the important role that reflection plays in professional development and growth. Reflection that leads to critical analysis of performance can be fostered through the creation of multiple opportunities for students to examine different points of view reflectively. Reflection is tied to dispositions in that teachers (in-service and pre-service alike) must want to act upon their reflections to change behavior (Kottkamp 1990).

Finally, a growing set of teaching standards looks not only at performances, but also considers the disposition of the teacher and teacher candidate. While some research supports the notion that dispositions are stable traits (Haberman 1993), a number of theories contrast this notion and suggest that group climate, social influence and social networking can impact attitudes and behavior, and in turn, possibly dispositions (Salancik & Pfeffer 1978). It is therefore a possibility that the dispositions outlined in the various standards are dispositions that could be "taught" to students.

## The Virtual Teacher Project:

The goals of utilizing a virtual community of learners were to: 1) increase the understanding of in-service and preservice teachers as it relates to the teaching standards developed by the Indiana Professional Standards Board and the Principles of the Interstate New Teacher Assessment and Support Consortium (INTASC); 2) to provide a forum were teachers could publicly reflect upon their professional practice as it relates to the standards and learn from the reflection of others; 3) to give pre-service teachers access to teachers (who do not assess their performance) to learn about professional practice and related dispositions; and 4) provide a vehicle by which teacher educators could integrate information technology into classroom practice. The project has a two-year span. During this time, preservice teachers, inservice teachers, and teacher educators posted over 4000 messages related to these content standards.

During the first year of the project, three different electronic discussion groups for preservice teachers were developed. The groups were devoted to the EAG standards (Early Adolescent Generalist), the AYA standards (Adolescent Young Adult), or the INTASC principles. Thirty-two select teachers from across the state were recruited to participate. After an introductory workshop focused on learning more about the standards and effectively communicating on an electronic discussion group, the thirty-two teachers were assigned to one of the three groups. The three online groups began discussion in January. The first three weeks of the discussions were slow and limited due to the lag time of the start of college classes and getting students online. By the second week in February, the online discussions were moving along well. Teachers and students discoursed about how to involve parents, classroom discipline, innovative instructional strategies, assessment of students, and the very real issues of school safety raised by the shootings at Columbine. Following feedback from the first year, a team of approximately five teachers covered each of four electronic discussion groups that related to four IPSB developmental standards (Early Childhood, Middle Childhood, EAG, and AYA).

Over a third of the participating students actually participated by sending and responding to messages. The other students remained in the status of "lurking." However passive, lurking does not prevent students from learning and gaining an understanding of teacher dispositions and reflections. In the second year of the project the discussion list provided opportunities to help students, even the passive lurkers, to draw more direct connections to the standards. Adding online teacher education faculty facilitators to draw clear connections to the standards and the discussion in the second year relieved some burden from the teachers and provide more clarity for the students.

## Summary

The Virtual Teacher Project illustrated the impact that electronic discussion groups can have on pre-service teachers. It was learned that students often contacted teachers directly to continue discussion. The teachers themselves felt it was in important component in their professional development and the future teaching profession. Finally, it provides a vehicle to accomplish the multiple tasks of technology integration, teacher modeling, reflection, and disposition instruction.

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# Infusing Technology into Preservice Teacher Education

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## I. PROPOSED PLAN AND SERVICES TO BE PROVIDED

**Grant Goals/Objectives**

The Oswego County Goals 2000 Consortium proposes to implement an extensive preservice teacher education model to improve preservice teacher preparation in instructional technology and the New York State Learning Standards. Building upon the 1999--2000 Goals 2000 Preservice Grant, the overall goals and objectives of the 2000-2001 Preservice Proposal are to:

- Continue to revise education courses (Curricular Foundations of Education, Elementary and Secondary Math Methods, Elementary Science Methods, ELA Methods, School in Urban Society, Secondary Reading in the Content Area, General Elementary Methods, Elementary Reading Methods, Technology Methods, Graduate Special Education Course On-line, and Special Education Methods) to better prepare preservice teachers to integrate technology in their teaching and to assist students in reaching/exceeding all New York State Standards, in particular ELA, MST, and CDOS;
- Continue an integrated MST course at Hannibal High School that serves as a model of MST integration for preservice teachers, and continue to provide numerous opportunities for preservice teachers to observe and interact (through well established video-conferencing system, e-mail, websites, on-site visits, etc.) with exemplary classroom teachers and their students as they integrate technology and reach the Standards;
- Extend the project at Hannibal High School to include an Earth Science course, where a science teacher and a special education teacher collaborate to teach the curriculum (according to NYS Standards) to both regular and special education students using a multimedia approach;
- Continue to provide numerous opportunities for preservice teachers to experience a variety of technologies in the instruction of their education courses, including the use of videoconferencing;
- Continue the urban education link between JH56 Corlears Junior High School in Manhattan and Curricular Foundations of Education and Elementary Math Foundations courses using "NetMeeting" videoconferencing technology; and expand to include a librarian, a Spanish teacher, and an urban education and foreign language methods course at JH56, a high needs district;
- Continue the urban education link between Bellevue Elementary School in Syracuse and a Special Education Methods course using current technologies; additionally, extend the collaboration of our Special Education Program to Sandy Creek Elementary (a high needs school), and add another special educator from our program to the project, who will be mentored by an experienced project participant;
- Expand support for Oswego County's two Professional Development Schools and support 12 regular and special education teachers at these two PDS schools;
- Provide all teams on-going training in technology, technology integration, NYS Standards infusion, and School-to-Work
  Connections;
- Continue and strengthen the mentoring program in which technologically experienced faculty mentor new participants in their efforts to integrate Standards-based, technology-infused activities into their instruction; and
- Present information concerning this project to colleagues at national and international forums in an effort to share timely information regarding the infusing of new technologies into the curriculum for preservice teachers and K-12 students.

**1. Grant Activities and the Use of Modern Technologies**

A Technology Needs Assessment administered to education faculty revealed that most faculty see a lack of time and knowledge of technology as the primary reasons for not integrating technology into their instruction. However, during the summer of 1999, the faculty members who received release time for participating in the grant attended all of the technology training sessions. This project's mandatory summer training included presentations, mentoring for new participants; consultant conducted sessions on Frontpage and Photodraw software, and team sharing and work time. The 1999 proposal involved more faculty members, more classroom teachers, and more diverse sites experimenting with a variety of technologies such that the impact on our preservice program and on school improvement was greater and more systemic. For the 2000-2001 proposal, we aim to continue building on the projects completed last year, while extending the project to a greater number of interested college (from 11 to 19) and K-12 (from 15 to 33) faculty in an effort to positively impact an even greater number of preservice teachers and K-12 students. Technology infusion activities will include multimedia presentations, desktop videoconferencing, interactive large group videoconferencing, and the development of two on-line graduate courses (action research and special education).

The Consortium proposes the following activities to be implemented during the grant period (September 1, 2000 – August 30, 2001):

**September—December 2000**

- Finalize and order equipment for new participants and model classrooms. Each new model classroom will be equipped with 4 computers, 1 laptop computer, 1 color ink jet printer, 1 digital camera, 1 LCD projector, any necessary equipment to connect with existing networks, and various educational software.
- Install equipment in respective classrooms.
- Administer pre-survey for faculty and teacher participants.
- Maintain weekly open labs (staffed) for all participants to continue technology training in teams.
- Plan mentoring activities where each new participant is paired with an experienced participant (college and K-12 levels) to orient new participants.
- Plan and implement a two-day fall inservice/work session for college faculty/K-12 teacher teams. Update participants regarding videoconferencing technologies, pair/share team plans, review assessment procedures, and highlight model technological infusions that focus on student achievement (NYS Standards).
- Co-Directors and experienced faculty participants will present at a countywide conference.
- Participate in a variety of countywide technology infusion offerings to further support the professional development of technology teams.
- Set up a Goals 2000 listserve to enable all participants to have a forum for discussing technology infusion, delivering updates, etc.
- Implement revised education courses as well as activities that integrate technology and the Standards in both the preservice courses and public school classrooms.
- Education faculty and classroom teachers observe and consult with technology collaborators.
- Preservice teachers observe classrooms through videoconferencing system.
- Gather qualitative data through observation of implementation and focus groups.
- Administer post-survey to preservice teachers.

**January-June 2000**

- Implement revised education courses as well as activities that integrate technology and the Standards in both the preservice courses and the public school classroom.
- Education faculty and classroom teachers observe and consult with technology collaborators.
- Preservice teachers observe classrooms through video conferencing system.
- Gather qualitative data through observation of implementation and focus groups.
- Administer post-survey to participating faculty, teachers, and classroom students.
- Complete data collection and analyze data.
- Begin planning for a 3-day summer workshop and weekly labs for teams.
- Maintain weekly open labs (staffed) for all participants to continue technology training in teams.

**July/August 2001**

Plan and implement a 3-day workshop and weekly labs for teams. The workshop will continue the technology integration model, including presentations by participants on "The Rewards of Technology Infusion"; review technology and Standards training for all teams; provide up-to-date information on School-to-work and CDOS standards; provide time to set goals for 2001-2002 implementation; participants will revise courses, create technology integration activities and performance assessments aligned with Standards that are ready for implementation, and share/plan parent involvement activities related to technology infusion in the schools. Learning activities will be coordinated between preservice teachers and public school children as much as possible. College faculty and K-12 teacher teams will plan for future collaborations.

**2. Business and Industry in Technology Partnerships**

Since 1994, the Oswego State University's School of Education continues to participate in a Teacher Education Partnership with Microsoft. This partnership allows the School of Education to serve as a training site for Microsoft software and thus provides access and use of Microsoft products (e.g., Microsoft Office, Picture It! Greetings Workshop, Encarta, Encarta Africana, Encarta Reference Suite, Creative Writer, Bookshelf, Visual Basic). During years one and two of the Goals 2000 Grant, our participating K-12 schools also received copies of Microsoft software. Such extensive software access, valued at $20,000, allows minimal expenditure on other computer software.

The Consortium also works closely with the Targeted Instructional Staff Development Grant group which supports Oswego County's Professional Development Schools and involves business and industry in developing technology partnerships. In addition, the Co-Directors of Project SMART, a program that helps elementary and middle school teachers to develop hands-on interdisciplinary math and science units in collaboration with local businesses and industries, are participants in this grant. "Kids at Work," a component of Project SMART, is a validated NYS State Sharing Success Program, and is the key CDOS training component in Goals 2000.

**3. Shared Decision Making Committees**

Representatives from the Shared Decision Making Committees at Oswego State University's School of Education and the participating school districts of Hannibal, Oswego, Pulaski, and Altmar-Parish-Williamstown, Fulton, Corlears Jr. HS, Syracuse, and Sandy Creek participated in the development of this proposed program to ensure that their collaboration in the grant activities would further their school improvement. In addition, the PDS management team at Lanigan Elementary in Fulton and Parish Elementary helped shape the proposal and recruited 12 participants. All education improvement plans call for the acquisition of technology, the integration of technology in the curriculum, and the training of teachers.

**4. Higher Education Involvement**

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This collaborative project involves several Oswego State University constituents: 18 education faculty, two arts and science faculty, and over 1000 preservice teachers enrolled in ten different courses. The Curriculum and Instruction Department Chairperson is a new participant for the 2000--2001 school year. Additionally, the Dean of the School of Education, the Provost, and President of SUNY Oswego endorse this project.

**5. Local Educational Agencies**

Oswego County has maintained a tradition in collaborative efforts in teacher education. The Oswego County Goals 2000 Consortium consists of 20 elementary, 9 middle, and 9 senior high schools in Oswego County's nine public school districts: Altmar-Parish-Williamstown (APW), Central Square, Fulton, Hannibal, Mexico, Oswego, Phoenix, Pulaski, and Sandy Creek. Collaborating institutions include: the Oswego County Board of Cooperative Educational Services (Oswego BOCES), Oswego County Teacher's Center (OTC), the Special Education Training and Resource Center (SETRC), the State University of New York at Oswego (SUNY Oswego), and the Oswego County Workforce Preparation Partnership.

Oswego City Schools will also provide some of the technology training for the grant participants as well as outstanding teachers who are experienced in technology integration will serve as technology collaborators. Oswego City Schools have implemented extensive technology plans during the last five years—plans that include not only the acquisition of equipment but also an arduous staff development plan. The 2000--2001 proposal plans to utilize Oswego's technology expertise in providing training and support to participating faculty and classroom teachers.

**6. Supporting High Need Populations and Low-Performing Schools**

Schools chose to participate in the Consortium on the basis of a combination of need, interest, and ability. Pursuant to a consensus of Oswego County Superintendents, the Oswego BOCES invited component school districts to designate a liaison to assist in the development of a Consortium proposal; Oswego State University also accepted this invitation.

Oswego County is a predominantly rural county of approximately 1,000 square mile located around the southeast corner of Lake Ontario. About two-fifths of its 121,771 (1990 Census) people live in the cities of Fulton and Oswego. The remainder lives in suburban or rural communities. Oswego County has very high percentages of adults with less than a high school education (23.8%) and of children living in poverty (17.4%). With several major plant closings/layoffs in recent years, Oswego County's unemployment rate is consistently high, nearly twice the New York State average.

Eight of Oswego County's nine school districts rank among the state's least wealthy school districts, five of which are Fulton, Hannibal, Pulaski, Altmar-Parish-Williamstown, and Sandy Creek School Districts. Bellevue Elementary in Syracuse and JH56 in NYC are also high needs schools. The proposed initiative will be implemented in: Hannibal High School, Kenney Elementary (Hannibal), Lanigan Elementary (Fulton), Lura M. Sharp Elementary (Pulaski), Parish Elementary (APW), Sandy Creek Elementary, Oswego High School, Bellevue Elementary (Syracuse) and Corlears Jr. HS (Manhattan). These schools/districts were chosen because they are:

a. High need schools in high need districts;
   - Hannibal: 80% state aid; 46% free/reduced lunch; poverty index of 12
   - Pulaski: 65% state aid; 44% free/reduced lunch; poverty index of 15.
   - APW: 69% state aid; 49% free/reduced lunch; poverty index of 12.
   - Fulton: 65% state aid; 43% free/reduced lunch; poverty index of 15.
   - Bellevue: 87% free/reduced lunch
   - Corlears: PCN state aid: $211,763; free/reduced lunch 92.5%; children w/disabilities 16%
   - Sandy Creek: 69% state aid; 49% free/reduced lunch; poverty index of 12

b. Demonstrating a high level of technology integration; Oswego City Schools has led the state in technology acquisitinn and staff development.
c. Low-performing schools; each participating district had to write at least one LAP (local assistance plan) as a result of low scores on state tests;
d. Schools with highly motivated teachers who are committed to improving instruction of children with diverse needs;
e. Schools with active shared decision-making teams;
f. Schools experiencing difficulty in integrating technology into student learning due to lack of resources and staff training;
g. Schools that implement inclusion of all children—a model with which preservice teachers have few real-life experiences;
h. Schools that have partnered with SUNY Oswego for several years in preservice programs such as field experiences, student teaching, and internships; and
i. Schools with diverse populations (Bellevue in Syracuse, 43% historically underrepresented population; Corlears in Manhattan, 97% historically underrepresented population).

**7. Degree to which the Proposed Budget Supports the Project**

Professional Salaries include adjunct replacement ($2500/course) for the 2 Project Directors (1/4 time—1 course each during the fall, and ½ time-two courses each during spring). The Directors will also receive a summer stipend equivalent of teaching one course ($2500). In addition, 10 education faculty (who are new Goals participants for the 2000-2001 school year) will receive adjunct replacement for one course during either the fall or spring semester. Oswego State University has agreed to receive reimbursement for only the cost of adjunct replacement of $2500 per course instead of 1/4 of faculty salary, which could range from $8000 to $12000. Four faculty members will also receive stipends ($1,000) during the 2000-2001 school year for mentoring new Goals participants and extending the technological infusion into their courses. Additionally, for attending the summer workshop and revising courses, 20 faculty members will a $1,000 stipend. Thirty-three teachers will receive a stipend ($1,000) for their participation in the summer workshop of 2001 plus travel costs, as well as six days of release time during the academic year.

Support Staff Salaries include the cost of one Technical Coordinator who will oversee/maintain all equipment and technical procedures and oversee all clerical duties including the data collection process, a graduate assistant who will provide technical and research support for the fall and spring semesters, and an undergraduate student who will help with technical support.

Purchased Services include the costs of all additional human resources needed to carry out the project. Substitute teachers will be provided to participating classroom teachers and technology collaborators so that they may participate in training and planning sessions as well as presentations; fees for Learning Resources (Oswego State University) professional to transport and set up the mobile videoconferencing system; maintenance of dedicated phone line for videoconferencing system
in 4 classrooms; computer installation in 5 new classrooms. Supplies and Materials include all program supplies and materials necessary to implement the project.

Equipment includes the costs of all necessary technical/computer equipment to implement the proposed project. A detailed list of equipment for each site is attached. In general, equipment is being purchased so that each participating classroom will have at least 4 computers, 1 laptop, 1 printer, 1 digital camera, and 1 LCD projector. Since the participating classrooms from Kenney Elementary (Hannibal), Lura M. Sharp Elementary (Pulaski), Hannibal HS, and Oswego HS, Parish Elementary, Lanigan Elementary, Bellevue Elementary, and Corlears Jr. HS classrooms were equipped last year through Goals 2000, this grant will focus its equipment resources on Sandy Creek Elementary, another first grade classroom in Parish, a fourth grade classroom at Lura Sharp in Pulaski, an Earth Science classroom at Hannibal High School, a second grade classroom at Lanigan Elementary, and in a second grade classroom at Fairley Street School in the Hannibal School District. Equipment will also be purchased to provide additional laptops, zip drives and discs, and software for SUNY Oswego faculty and student use as well as to enhance the mobility of the videoconferencing system that was purchased last year.

Travel Expenses will be provided to participating faculty and teachers presenting at a conference on the grant activities. Additional travel money is provided for visits between NYC and Oswego County to provide academic year technology infusion support.

**8. Coordination of Other Funds**

The 1999 Goals 2000 Preservice Grant enabled the purchase of over $91,341 worth of technology equipment, all of which will continue to be used in the implementation of the 2000--2001 proposal. In addition, Microsoft provides SUNY Oswego with nearly $20,000 worth of educational software that can be used at all participating sites. Four teachers and five faculty members also participate in Project SMART and will be further supported in that project in developing Standards-based technology infusion activities highlighting technology in the workplace.

Each district as well as Oswego State University's School of Education is implementing comprehensive technology plans that include the allocation of funds for: hiring staff to direct/maintain technology, wiring buildings for Internet access, purchasing equipment for computer labs and classrooms, and providing staff development for computer use and integration.

Goals 2000 is working closely with the Oswego County Targeted Instructional Improvement Grant to support technology infusion in their two designated Professional Development Schools.

DDE Funded Project SMART disseminators will provide several workshops to help K-16 educators link classroom learning to the workplace.

**9. Systemic Change and Continuity of Project**

The proposed plan is the most extensive plan of restructuring the Oswego State University's Department of Curriculum and Instruction has taken in many years. Two-thirds of the department will receive release time or stipends for training, course development and implementation, and collaboration with practitioners and technology experts. In one year 16 education courses will be revised to infuse technology applications and the NYS Standards. Since faculty members will receive such extensive technology training, they will infuse technology and Standards in the other education courses taught. In addition, this proposal will create and/or sustain and enrich sixteen model K-12 classrooms—classrooms that will continue to be used in the instruction of preservice teachers in all content-area methods (math, science, English Language Arts, social studies, reading, technology, and special ed.) as well as elementary methods. All equipment purchased through this grant will continue to be used to facilitate such systemic, collaborative preservice instruction.

**1. Enhance Preservice Teacher Knowledge of Technology Integration**

Sixteen teacher preparation courses will participate in the project. Approximately 1485* elementary preservice teachers, 120 secondary preservice teachers, 100 special education preservice teachers, and 50 technology education preservice teachers will be participating in the proposed project. See table of participating courses below.

| Course # | Course Title | Instructor | # Of Students |
|---|---|---|---|
| EDU 301 | Foundations of Education | Pat Russo | 100 |
| | Elementary Math Methods | | |
| EDU 306 | | Mary Reeves | 275 |
| | Elementary Social Studies Methods | | |
| EDU 304 | | Yigasu Tucho | 250 |
| | Elementary Methods of Instruction | | |
| EED 394 | | Audrey Hurley, | 50 |
| | Reading Instruction in Elem School | Barb Beyerbach, | 50 |
| | Schools in Urban Society | Jo Farrell | 50 |

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| | | | |
|---|---|---|---|
| EED 395 | Reading in Content Area | Dennis Parsons | 100 |
| EDU 505 | Secondary ELA Methods | | 20 |
| | Elementary Science Methods | | |
| RED 396 | Achievement, Motivation, and Management | Sharon Kane | 75 |
| SED 412 | Methods for Special Educators | Sharon Kane | 25 |
| EDU 305 | Methods of Teaching Technology Education | Ann Keen | 180 |
| SPE 506 | | Ginny MacEntee | 50 |
| | Methods of Teaching Foreign/Second Language | Roberta Schnorr | 50 |
| SPE 514 | | | |
| | Graduate Research | | |
| | Foundations of Literacy | | |
| TED 306 | | Vern Tryon | 25 |
| SED 414/534 | | Jean Ann | 20 |
| EED 596 | | Faith Mania | 60 |
| RED 501 | | Claire Putala | 50 |
| RED 510 | | Pam Michel | 30 |

*This number is calculated by adding the number of students in each participating Goals course; some of these students will be signed up for more than one course (at the same time) that is participating in this grant.

In contrast to traditional teacher education methods courses, the proposed project will provide preservice and practicing teachers multiple ways of learning innovative instructional methods that integrate technology. Although preservice teachers currently participate in a field placement within their education programs, it is currently impossible to place every preservice teacher in classrooms where technology is effectively integrated. In addition, although several education faculties have already mastered many technology infusion skills, the majority are struggling to infuse technology in their instruction. Funding this grant would facilitate the continuation and development of new collaborative teams in the development of model technology integration classrooms and the restructuring of education courses to infuse technology.

Revised education courses will provide preservice teachers with learning activities that integrate technology, instruction of how to integrate technology in teaching, and modeling of technology integration by both the college instructor and the classroom teacher. In addition, Goals 2000 funds would bring technology equipment into the instruction of teacher education courses so that preservice teachers would experience firsthand technology integration used to enhance their learning of teaching methods and assessment.

More specifically, the following substantive changes with regard to technology integration will be made in the sixteen education courses:

a. Addition of a field-based experience at either Hannibal High School, Kenney Elementary, Lura M. Sharp Elementary, Lanigan Elementary, Parish Elementary, Oswego High School, Bellevue Elementary, Sandy Creek Elementary, Fairley Elementary, or Corlears Jr. HS via desktop videoconferencing ("Netmeeting"), e-mail, websites, and other technologies;
b. Required use of word processing programs and/or presentation software (eg. PowerPoint) for all course work submitted;
c. Required activation and use of electronic mail accounts for professor/student and student/student communications;
d. Instruction and experience relating to connection, operation, and maintenance of technology systems environment;
e. Instruction and experience relating to use of assistive technology;
f. Instruction and experience relating to use of hypermedia, telecommunications, and software for lesson presentation and student activities;
g. Instruction and experience relating to use of individualized and cooperative learning computer assisted applications in the inclusive classroom;
h. Increased emphasis on technological applications which promote social development and social integration of all learners;
i. Instruction in classroom teacher's use of authoring programs, desktop publishing, and CMI for planning, assessment, record-keeping, and IEP development;
j. Increased emphasis on technology opportunities relevant to the school-to-work transition;
k. Utilization of Internet and computer resources in the development of lesson and unit plans; and in two cases developmental online courses;
l. Required development of an instructional plan to integrate technology that will subsequently be modified and implemented during field placements; and
m. Providing opportunities for all participants to share, learn about, and plan new parent involvement activities related to technology infusion in the schools.

Since the Secondary Math Methods Courses will be working with Hannibal High School to develop and implement an integrated MST Course, math and science preservice teachers will also experience first hand and observe Hannibal High School students utilize CADKEY, computer simulations, video and audio equipment, and portfolio development. Additionally, preservice secondary students will have an opportunity to participate with an urban (New York City) school district that is offering the class, "Spanish as a Second Language."

## 2. Change Requirements of Teacher Education Programs to Support Standards

Because two-thirds of the Department of Curriculum and Instruction will be participating in the 2000--2001 Goals 2000 grant, the primary intent of this grant is to implement systemic change throughout the preservice teacher education programs to include educational technology, special education, NYS Standards, and classroom assessment. A Technology Integration Task force has been initiated in the Oswego State University's School of Education to determine the technology skills that will be infused in specific education courses and address the need for revision in program requirements in relation to educational technology. Teams will address the Task Force's recommendations as they revise education courses to prepare preservice teacher in technology integration and implementation of the NYS Standards.

The Department of Curriculum and Instruction has also recently added a requirement for all majors beginning in fall 2000: SOE 345 Applied Instructional Technologies for Educators. In general, however, the Department of Curriculum and Instruction believes that instruction of educational technology should be addressed not only in a required technology course but also through the integration of educational technology in all education courses.

## 3. Enable Diverse Populations to Reach/Exceed MST, ELA, SS Standards

The school districts of Hannibal, Pulaski, Oswego, Altmar-Parish-Williamstown, Fulton, Syracuse, Sandy Creek, and Manhattan have a high number of students receiving special services. In addition, these districts have created inclusive classrooms to adequately serve their diverse populations. The Syracuse and NYC classrooms provide culturally and linguistically diverse contexts for virtual and real field placements. Anti-bias curriculum will be infused in all courses and will be explored in depth in the C & I Department's "Schools and Urban Society" course, in which 20 students will have a two-week field placement in NYC in January and May. Several hundred students will videoconference with the NYC classrooms, tutoring middle school students and interacting with their teachers. The preservice teachers enrolled in the participaring courses will have the opportunity to observe classroom teachers utilize a variety of instructional and assessment methods with a diverse population of students. Specific NYS Standards will be addressed as follows.

### Math, Science, Technology

The MST standards are the foundation of the integrated MST course at Hannibal High School. An MST team that consists of education methods faculty, content-area faculty, and classroom teachers from math, science, and technology designed this course. A team of 3 teachers representing math, science, and technology and addresses technological design and systems focusing on physical science and mathematical concepts teaches the MST course. MST students are actively involved in hands-on activities and projects that foster problem-solving skills and enable students to maximize their creative potential. Preservice teachers enrolled in Secondary Science Methods and Methods of Teaching Technology Education will experience the integration of math, science, and technology by observing the implementation of the MST course on numerous occasions, conducting integrated MST experiments, and learning methods of integrating MST in math and science instruction.

In addition to Secondary Science Methods and Technology Methods, MST standards will also be addressed in Elementary Methods of Instruction. Team members from each of these teams will receive training on the MST standards and create activities for the participating classrooms that exemplify MST integration. Preservice teachers enrolled in these courses will observe the implementation of these activities as well as receive instruction on the methods of integrating MST standards in their classrooms.

### English Language Arts

The ELA standards will be addressed in the following college education courses: Reading in the Content Area, Foundations of Literacy, Reading Instruction in Elementary Schools, Applied Reading Instruction and Elementary Methods of Instruction. Members from each of these teams will receive training on the ELA standards and create activities for the participating classrooms that demonstrate effective implementation of the ELA standards. Preservice teachers enrolled in these courses will observe the implementation of these activities as well as receive instruction on the methods of integrating ELA standards in their classrooms. Obviously, students enrolled in Reading in the Content Area and Reading Instruction in Elementary Schools will receive more in-depth instruction in ELA.

Career Development and Occupational Studies

Experienced CDOS disseminators will provide training for all participants from Project SMART's Kids at Work project to ensure that CDOS standards are infused into existing curriculum.

Social Studies

Social Studies Standards will be studied in the Social Studies Methods course and infused in the Elementary Methods block.

All NYS Learning Standards

All of the NY State Learning Standards, with particular emphasis on CDOS, will be addressed in the Special Education Methods, Methods of Instruction, and Foundations of Educations courses via e-mail, website, videoconferencing ("Netmeeting"), and word processing programs. In addition to learning the Standards, preservice teachers will communicate with classroom teachers regarding their integration of all learning standards into their curriculum and how they use technology as a means of helping all children achieve and exceed learning standards.

4. Collaboration between Methods and Content Area Professors

Content area professors from the Departments of Mathematics, Science, Technology (supported by Project SMART), and English (supported by the grant) will be collaborating with education professors of the respective methods to revise education courses and develop activities for these courses and the participating classrooms. Collaboration will occur in teams and will be facilitated by extensive workshops, follow-up sessions, team meetings, and classroom visitations.

5. Enhance Preservice Teacher Knowledge of School-to-Work

In congruence with the 1994 Federal School-to-Work Opportunity Act, this program will extend existing community and education partnerships to help students gain the skills necessary in bridging the gap between school and work. The Consortium will be working closely with the Oswego County Workforce Preparation Partnership and Project SMART to provide teams with training on School-to-Work implementation. Teams will create STW activities to be implemented in the participating classrooms. Preservice teachers enrolled in the participating education courses will observe the implementation of these work-based and school-based activities as well as learn methods of implementing STW activities in the classroom. Preservice teachers will be required to create lessons that integrate work-based and/or school-based activities.

6. Staff Development of Teacher Education Faculty

Last summer, under the 1999 grant, 11 college faculty participants attended five days of training in technology processes and integration to support NYS Standards into classroom instruction, as well as weekly open labs. However, there is still a great need to provide and expand such training utilizing last year's participants as mentors for this year's new faculty. Building upon lessons learned from the 1999 grant, the 2000--2001 proposal would provide staff development to 18 committed education faculties and 2 content-area faculty. Staff development will consist of a 2-day fall workshop plus a 3-day workshop in July or August, as well as weekly open labs. Work sessions will also provide time to collaborate with classroom teachers and technology collaborators in the development of classroom activities and the revision of education courses. Faculty who participated in the 1997, 1998, and/or 1999 grant, Oswego City Schools, Oswego BOCES staff, and Project SMART disseminators will provide training. Follow-up sessions will provide team participants with the opportunity to share implementation activities and troubleshoot implementation problems.

7. Collaborations between Oswego State University and K-12 Teachers

Each preservice team for the 2000-2001 proposal consists of at least one K-12 teacher, at least one college education faculty member, and either a technology collaborator from the college or K-12 school or a content area collaborator from the college who also teaches preservice teachers. All teams participate together in summer training and planning as well as on-going collaboration on various implementation and evaluation projects throughout the school year.

Goals 2000 Preservice Teams

| | |
|---|---|
| MST Team<br>Math Methods faculty: Mary Reeves<br>Technology faculty (Consultant): Vern Tryon<br>Hannibal Tech Ed: Bob Jones<br>Hannibal Science: Carol Burch<br>Hannibal Math: Joanne Birchenough<br>Earth Science teacher: Tom O'Neil<br>Special Education teacher: Terri Dunning<br>New Science faculty: TBA (search underway) | Elementary Science/Social Studies Methods Team<br>.Science Methods faculty: Sue Weber; Ann Keen<br>Science faculty: Diane Jackson<br>Kenney Elementary teachers: Nancy Labbe; Mary Lee O'Brien; Pam Burlingame<br>Social Studies Methods faculty: Yigasu Tucho<br>Farley Elementary teachers: Barb Blaise; Bonnie Holmes |
| ELA Secondary Team<br>ELA Methods faculty: Sharon Kane<br>English faculty: Inez Alfors<br>Oswego HS English teacher: Sharon Morley | Foundations/Reading/Math Team<br>Foundations faculty: Pat Russo<br>Corlears Jr. HS, Manhattan teacher: Dale Schofield<br>Reading /Urban Ed faculty: Dennis Parsons<br>Math faculty: Mary Reeves<br>Technology Collaborator: Michael Fallo |
| PDS Elementary Team<br>Graduate Research Methods faculty: Faith Maria<br>Parish Elementary teacher: Peggy Scorzelli<br>Parish Elementary teacher: Maria Hendricks<br>Technology Collaborator: Fay McElveen | Bellevue Special Education Methods Team<br>1. Special Education Methods faculty: Ginny MacEntee<br>Bellevue Elementary teachers: Michelle Alcock; Colleen Elmer |
| Reading Graduate Team<br>Reading Graduate faculty: Pam Michel<br>Reading Graduate faculty: Claire Putala<br>Elementary Methods faculty: Audrey Hurley<br>Oswego City Literacy Director: Barbara Parry | Sandy Creek Special Education Team<br>.Special Education Methods faculty: Bobbi Schnoor<br>Sandy Creek Elementary teachers: Lisa Overton; Val Fowler; Ben Archibee |
| Elementary Methods (Pulaski) Team<br>Elementary Methods faculty: Jo Farrell<br>Lura Sharp Elementary Teacher: Alan Woods; Christa Bertrand; Christine McArdell | Elementary Methods PDS (Lanigan) Team<br>Elementary Methods faculty: Barb Beyerbach<br>Lanigan Elementary Teachers: Susan Patrick; Sue Shaw; Pat Roy; Becca Koe; Frances (Cissy) Forgar; Terry Merritt; Jeff Hendrickson; Tina Geers |
| Secondary Language Methods Team<br>Secondary Language faculty: Jean Ann<br>NYC teacher: Sonia Toviar | |

8. Performance A. Indicators/Benchmarks

A. The Consortium's project in preservice teacher education will be subjected to rigorous formative and summative evaluation. Like other aspects of this 2000--2001 proposal, the evaluation plan for this project will build upon the evaluation methods utilized in 1999 and revised for 2000-2001. During the 1999 Goals 2000 grant, several survey instruments were developed and administered to determine the impact that the grant activities had on the participating faculty, preservice teachers, classroom teachers, and K-12 students. These instruments and other methods of data collection are described in the table on the following page.

In addition to these quantitative methods, qualitative methods will also be utilized, as focus group interviews will be conducted during the fall semester with preservice teachers and students in participating K-12 classrooms. Products created by teams (e.g., revised course syllabi, classroom activities for preservice teachers and K-12 classrooms, course web pages, online courses), preservice teachers (e.g., lessons/units integrating technology and Standards, presentations, papers), and K-12 students (papers, pamphlets, web sites, posters) will be evaluated for progress in the use of technology and implementation/understanding of Standards. In addition, videoconference transmissions will be observed with field notes written. Jo Farrell will serve as the primary evaluator of the project, however an external evaluator (Rachel Vannatta) will be consulted.

B. Student Performance

Program impact on students enrolled in the participating K-12 classrooms will be evaluated in a variety of ways. First, surveying and interviewing, through focus groups, students at the beginning of the school year, will determine a baseline of data. This baseline of data will identify students' attitudes and current use of educational technology. Surveys and focus groups will be conducted again in the spring of 2001 to determine the impact the grant activities may have had on students' attitudes toward technology, use of technology, and learning through activities that integrate technology and Standards. Student performance will also be evaluated through student products and grades.

Teachers will be engaged in action research projects that examine when and how technology infusion supports students' standards-based learning. They will learn to disaggregate data on NYS assessments and use this information to plan for instruction. Additionally, they will design performance tasks linked to standards and will analyze performance data of their students with particular attention to abilities, disabilities, race, language proficiency, race, class, and gender.

C. Teacher Knowledge of Standards and Instructional Technology

To determine if the grant activities have increased education faculty's and classroom teachers' knowledge and implementation of educational technology and the Standards, the Consortium will gather evaluative data from several sources. A survey will be administered to team members at the beginning of September and then in the spring of 2001. This survey will measure faculty's/teachers' attitudes toward technology, current use and implementation of technology, knowledge of Standards, and current implementation of Standards. Faculty and teachers will also be observed on numerous occasions during classroom instruction to determine the effectiveness of technology integration and Standards; field notes will be written during these observations. Faculty and teachers will also be interviewed during the spring of 2001. In addition, courses, units, lessons, and activities created by faculty and teachers will also be evaluated. Evaluation methods are explained in table on the next page.

| DATA COLLECTION METHOD | PARTICIPANTS | DATES | VARIABLES ASSESSED |
|---|---|---|---|
| **Survey Instruments** | | | |
| Preservice Tech Attitudes | Preservice Teachers | 9/00,12/00, 1/01, 5/01 | Attitudes toward technology; Frequency & variety of technology activities experience; Knowledge of Standards; Perceived impact of grant |
| Student Tech Attitudes | Elementary Students<br>Secondary Students | 9/00, 5/01 | Attitudes toward technology; Frequency & variety of technology activities experience; Perceived impact of how technology and Activities have improved learning. |
| Faculty/Teacher Attitudes | Faculty and K-12 Teacher Participants | 9/00,5/01 | Attitudes toward technology; Frequency and variety of technology activities experience; Knowledge of Standards; Perceived impact of grant |
| Evaluations of summer training | Faculty<br>Classroom Teachers | July/August/01 | Quality of training/planning sessions; additional session needs of participants |
| **Focus Group Interviews** | Faculty<br>Classroom Teachers | 9/00,5/01 | Attitudes toward technology; Frequency & variety of technology activities implemented; Knowledge of Standards; Perceived impact of grant; Impact of training; Success/problems of technology and Standards implementation; Success/problems in using video-conferencing technology. |
| | Preservice Teachers | 9/00, 12/00, | Attitudes toward technology; Frequency & variety of technology activities experienced; Perceived impact of how technology and activities have prepared them to assist students in reaching Standards; Success/problems in using video-conferencing technology |
| | K-12 students | 9/00, 5/01 | Attitudes toward technology; Frequency & variety of technology activities experienced; perceived impact of how technology and activities have improved learning. |
| **Observation** | Preservice Courses | 9/00-5/01 | Success of implementation of technology and Standards; impact on preservice teachers. |
| | K-12 Classrooms | 9/00-5/01 | Success of implementation of technology and Standards; impact K-12 students learning. |
| **Product Evaluation** | | | |
| Course Syllabi, lessons, course evaluations | Faculty<br>Classroom Teachers | 9/00-5/01 | Success of implementation of technology and Standards |
| Lessons, papers, presentations | Preservice Teachers | 9/00-5/01 | Knowledge of and effective integration of technology and Standards |
| Projects, papers, presentations | K-12 Students | 9/00-5/01 | Use of technology and attainment of Standards by all students. |

**As a result of the following, we were awarded $388,000.00 from Goals 2000 funding for the 2000—2001 year.**

As a result of this project, there was a definite change in the way students received instruction in their classes, which resulted in an improvement in student achievement. Students' lessons and units of study were focused on the State learning standards and enhanced by the judicious use of technology. Student achievement and attitudes were evaluated through observation of student use of technology in inquiry oriented projects, student performance-based products, focus groups with students from all of the participating districts, and pre/post student surveys. The participating students integrated a wide variety of computer applications (Microsoft Office, Encarta, KidPix, ClarisWorks, Claris Slide Show, HyperStudio, Inspiration, ZAP, Internet research) on a regular basis to complete performance-based assessment tasks in language arts, social studies, and integrated MST instruction. Student achievement of respective standards was demonstrated at higher levels through the performance-based assessments that used digital camera technology, videoconferencing, and selective software. In addition, students' attitudes were positive towards the technology integration. They claim that technology empowered them, since they could learn more because they could go to "www.stuff" and ask any questions they had. Fourth graders indicated that they used word games like ZAP that helped them with the State science test. One student commented that, "I didn't even know about ZAP last year."

What evidence do you have that systemic change has resulted from this project and will continue after the grant period ends (e.g., comprehensive coordinated improvement, coordinated access to appropriate health and social services, effective mechanisms and appropriate paths to the workforce as well as to higher education, innovative use of technology, utilization of quality management services)?

The acquisition of equipment and video-conferencing abilities, creation of nine K-12 model classrooms (a low-income, rural first grade classroom with 20 students, a suburban first grade classroom with 20 students, an urban middle-school class with 25 students, a 6th grade elementary classroom with 25 students, a fifth grade elementary classroom with 25 students, a team-taught 4/5 urban inclusion classroom with 30 children, a 4th grade team-taught inclusion class with 50 students, a High School English classroom with 25 students, and a High School integrated MST classroom with 20 students), and implementation of technology integration training for higher education and K-12 faculty and their public school and college students, incorporating videoconferencing links between contexts, have all created numerous opportunities for the participating institutions and individuals to collaborate. The following activities have been accomplished:

- Video links between eight preservice teacher education courses and respective K-12 classrooms, with eight new higher education faculty being added in the upcoming year.
- Revision of all preservice teacher education courses to infuse technology, and provide technology rich field placements. Sixteen faculty from the school of education and arts and sciences will be involved in this year's grant and will focus on developing a comprehensive scope and sequence of technology related activities, based on the NCATE standards for technology.
- Teams of teachers and teacher educators partnering via the videoconferencing presented findings of their research on the effectiveness of technology infusion at international, national and state level conferences (ED-MEDIA, NSTA and the NYS-SUNY Technology Infusion Conference).
- All of the teacher educators participating in this year's grant are mentoring other teacher education faculty on technology infusion. This mentoring is built into this year's grant. A similar mentoring network will be created at the K-12 level.
- Collaborations among K-12 and higher education faculty will continue in the instruction of preservice teachers. Preservice teachers will continue to observe model classrooms through the video conferencing system.
- Preservice teachers will continue to experience technology integration in their education courses that is more coordinated across the program, at more advanced levels, in more courses.

What changes in teaching and learning have resulted from the acquisition and use of technology supported by this grant? How are teachers teaching differently? How are students learning differently?

Oswego State University's School of Education has developed a conceptual framework centering on authentic learning for all students with a commitment to social justice. Technology infusion activities have also focused on those goals, supporting a constructivist pedagogy. Since educator training focused on use of the computer as a tool to support learning, educators implemented numerous lessons that used technology for the creation of student products and the facilitation of student performance-based assessments. Teachers implemented lessons that focused on students using technology in meaningful and authentic ways that are reflective of technology use in the workplace. Students have come to realize that computers are not just for e-mail, games, and "skill/drill" activities. Preservice teacher surveys and focus group data evidenced profound changes in their vision of technology infusion; it indicated that they are focused on how they can use technology to enhance students' learning. Finally, teachers also learned that computer-generated products increased the quality of work among special needs students since handwriting and spelling did not impact their projects. Therefore, students with special needs were able to produce very impressive products that clearly demonstrated what they learned, which in a sense provided them with a level playing field.

> Because of this project, what are teachers and/administrators doing differently to engage in constant review of professional practice and inquiry for improving teaching, learning, and student performance?

The project used an action research model, in which all participants (K-12 teachers and college faculty) were involved in survey construction, focus group question generation, administering surveys and conducting focus groups, and analyzing data. Themes generated through this process were compared to those generated by an outside evaluator, as a member checking procedure. Teachers found this action research model to be a powerful form of professional development. Such action research projects, focused on the analysis of student learning of standards-based curriculum, were also incorporated into the preservice courses. Pre/post surveys as well as focus group data indicated huge increases in teacher proficiency in all areas, particularly methods of technology infusion. Teachers found that conducting focus groups and examining survey data of their students offer new insights into the teaching/learning process.

> What changes have occurred as a result of this project to improve preservice programs for teachers, pupil personnel services professionals or school administrators to equip them with the subject matter and pedagogical expertise-including the use of instructional technology-necessary for preparing all students to meet the standards?

The impact of this grant on our preservice program was measured through pre/post faculty surveys, pre/post preservice teacher surveys, focus groups with preservice teachers, observation of technology use in preservice courses, and analysis of course syllabi and student work. It was found that:

- Preservice teacher proficiency of technology--All areas increased significantly. All areas increased at the highly significant (.001) level, except Database and Spreadsheet.
- Faculty use of technology in the classroom increased in all areas except Spreadsheet, Instructional Software, and Hypermedia. 10 out of 17 areas increased at the highly significant (.001) level.
- Examination of preservice teacher portfolios evidenced ability to plan standards-based lessons and unit plans that infused technology to enhance student learning.
- Focus group data reflected significant changes in preservice teacher visions of technology infusion, towards a more constructivist orientation that viewed technology as a tool to support student learning. Their views of how you can use technology have broadened. Where they once limited their thoughts to word-processing—"now the sky is the limit."
- On the basis of the Goals 2000 data, the School of Education passed the NCATE standard on technology in our spring site visit from NCATE.

Using these results, the Department of Curriculum and Instruction is committed to engaging more faculty in the Goals 2000 project, and is empowering this group to develop a program-wide scope and sequence for technology infusion in all teacher education courses. We will expand involvement to 16 faculty in the upcoming year, and technology infusion will occur at each level of the program. We have learned that it is important to use a team approach that showcases effective technology infusion in K-12 classrooms as well as providing technology rich field experiences. This project has resulted in broad-based faculty reflection and dialogue on how technology fits into the education curriculum, as well as extensive program restructuring.

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# Anchored Instruction Using WebQuests in a Post-Baccalaureate Teacher Education Course

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**Abstract:** This paper discusses the process of designing a post-baccalaureate Educational Technology class for pre-service teachers. The class used an anchored instruction model based on WebQuests to ensure student exploration, modeling of technology integration, and the wide range of abilities of all students were addressed. The design process, class content, and student evaluations will be discussed.

## Introduction

Teacher education coursework in Educational Technology has traditionally required students to learn software tools that will support their future role in the K12 learning environment. These courses have usually been taught in a didactic manner where the instructor demonstrates the software and then asks students to replicate a product. A didactic model is in contrast to the technology infusion model the instructor hoped to achieve. While learning the tools of the trade is necessary, it is also important to model for pre-service teachers the way technology integration can look.

The history of anchored instruction goes back to Dewey (1933) who advocated learning by doing. More recently, the Cognition and Technology Group at Vanderbilt have advocated anchored instruction as a way to support learners with a wide range of abilities and backgrounds. Students are taught over time how to take responsibility for their own learning and teachers become co-facilitators or coaches of learning. Bransford, Sherwood, Hasselbring, Kinzer and Williams (1990) suggest that curriculum materials need to allow the learner to explore, actively manipulate, and question information.

## Design Process

While preparing a post-baccalaureate pre-service teacher education course in Educational Technology, the instructor decided to anchor the coursework on WebQuests in order to allow student exploration within the learning environment and meet a wide range of abilities. WebQuests are being used in elementary, middle, and secondary classrooms and it has been suggested that anchored instruction could be an effective approach in higher education (Bauer, 1998). The process of designing a 500 level class (Applications of Educational Technology) followed that advocated by Dodge (1997) and March (1995) in order to bridge the transition between the traditional didactic approach and a student-centered focus. The overall design of the class had four stages: a) determine outcomes, b) draft the project framework, c) develop the rubrics and d) design the tasks.

The six project outcomes of the class were based on the approved University of Northern Colorado curriculum for ET 501, Applications of Educational Technology. These outcomes were then tied to the Performance-Based Standards for Colorado Teachers, as well as National Council for Accreditation of Teacher Education (NCATE) and International Society for Technology in Education (ISTE) standards. The six projects included one activity based on each of the following: word processing/desktop publishing, spreadsheets, multimedia authoring, presentations, web authoring, and software evaluation.

The framework for the class followed a somewhat different pattern than that advocated by Dodge (1997) and March (1995) because of the variety of projects. It did include the subject (project software program), and expected finished project. The audience for each project was student dependent due to the wide range of content and grade level programs. Each of the finished projects was anchored to a specific WebQuest

with support from online tutorials, class notes, discussion questions, rubrics, web resources, course text, and in some instances, PowerPoint presentations.

Once the framework for each activity was completed and linked to specific standards, the rubrics were developed. Each was a scaled set of criteria for evaluating students' projects and communicating to students what was expected for the end product. All of the rubrics had four performance levels (non-proficient, partially proficient, proficient, advanced) modeling the way most projects are graded in the K-12 educational system of Colorado. Categories for the individual projects differed depending on the intended final product. The final step in the creation of the rubric was to write the descriptors for each category and proficiency. The criteria for level three was written first as the standard of what the students were expected to be able to do.

The final phase of this process was to design each task or end product. Each task had an introduction, a short, clear statement describing the activity to the students. The activity section described what the end-result of the learner's activities should be. Proficiency was shown through a variety of products (i.e., brochure, newsletter, lesson plan, story, budget, grade book, graph, HyperStudio stack, multimedia presentation, WebQuest). The resource section included sites on the Internet (tutorials, design criteria, relevant information, rubrics, class notes, WebQuest URLs, PowerPoint presentations, discussion questions) and physical resources (texts, research articles, content books).

## Findings

The 50 students in the three sections of ET501, to this point, have been positive and enthusiastic about the instructional techniques (anchored instruction, WebQuests, self-paced learning) of the class. At the end of the term, a Likert scale, attitude survey will be administered in order to assess the success of anchoring the class instruction on WebQuests. Data gathered from students will be analyzed at the end of the term (Fall, 2000) and discussed at the time of the presentation.

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# Virtual Leaning, Web Videos, and Elementary Mathematics Teacher Education

by
Janice L. Flake

This project has been to build a collection of virtual learning experiences for teacher education in the form of viewing and analyzing videotapes of interviews of children discussing their mathematical concepts and problem solving. The intended audiences are both preservice and inservice teachers.

Many times in prospective teachers in teacher education programs often have little experience with students prior to their internship, or they have lots of field experience that is not necessarily connected with theory. The bridge between theory and practice varies greatly, and sometimes the bridge is a big gap. It is difficult to make connections between the abstract theories and the real world of practice. To treat theory in the absence of experiences with children will likely result in the theory quickly being abandoned or forgotten. At the same time building a class based heavily on field experiences has its problems as well. The experiences are often random, may or may connect with the underlying theories, and risk the possibility that the students never make the links between theory and practice. Furthermore, consequences of actions can affect real students and sometimes do damage to the students, and the supervision of field experiences often is labor intensive and/or not easy to do. In addition the actions in a classroom are multidimensional and often difficult to isolate and control one variable at a time.

In 1972-73 I had a vision of building a simulated teaching laboratory. Initial efforts occurred with a PLATO program where I created a program that allowed perspective teachers to instruct simulated students (see Flake, 1973). The results were very encouraging. Participants in the study commented that they began to think of these simulated students as real; they also liked the notion that they were not doing permanent damage to the simulated students; and after going out into the schools the participants reported back that the real students behaved just like the simulated students. In addition a very popular button that was added at the request of the students was the restart button, where participants were not happy with the way things were going and just wanted to throw out that class and start all over again—phenomenon that does not normally happen with real classes. Furthermore, the simulation provided a common experience for class discussion of alternatives for interacting with the simulation. Brown (1999) found similar results as described above.

Flake (In-Review) describes a project involving 268 videos already posted on the Web of interviews of 23 children in K through 5 doing mathematical tasks illustrating their understandings of mathematical thinking following the major strands in mathematics that have been identified by national and state mathematics standards. Prospective teachers use these videos to study the students' responses and build connections between theory and practice. Samples of these videotapes will be presented at the VideoFestival.

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# Object: An Important Concept for Pre-service Teachers to Learn Technology

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**Abstract:** This paper discusses the importance of the concept of objects for pre-service teachers who are learning technology. Educational information is composed of different objects: text, graphics, audio, video, data, and table. Each object has many attributes. Many operations can be performed on objects. These operations are directly related to menus of application programs. Objects, attributes, and operations form concept maps corresponding to specific objects. Mastering these concept maps benefits students' understanding of the structure of software, learning of new software, and implementing multimedia material.

## Introduction

Computer software application programs are an essential part of computer technology in the information age. There are many application programs available right now and more will be coming out. It is impossible for anybody to learn all the software applications in his/her discipline. But it is possible to know the basic structure of software and the basics of using software. This is true for pre-service teachers. To meet the technology standards for educators in twenty-first century, pre-service teachers should be proficient in using technologies for learning and teaching. Learning how to use the commonly-used software or application programs in educational settings is an important aspect of using technologies. Just as the object concept is very important for designing software with programming languages like C++, Java, and Perl, the object concept is also very important for pre-service teachers to learn how to use computer software. The following sections will discuss object concept, attributes of an object, operations performed on objects, concept maps related to objects, and benefits of learning the object concept.

## Objects

Educational information can be represented in many forms and delivered with different media. Each form of information can be viewed as a kind of object. There are five basic types of objects that represent the educational information delivered through instruction: text object, graphics object, audio object, video object, and data object (Verduin & Clark, 1991; Heinich, Molenda & Russell, 1993).

A text object can be a letter, a word, a sentence, a paragraph, or paragraphs. The text object has always been the basic and fundamental format of information in education and will continue to be. Because of its long history, it is familiar to students, inexpensive to produce, and portable. But it can give only a vicarious experience of reality and may not be understood very well if students do not have the necessary experience to comprehend a concrete illustration.

A graphic object can be a picture, a drawing, a chart, an animation, or any kind of combination of them. It can illustrate difficult concepts, reflect the creativity of human beings, and depict the realism in different levels.

An audio object can be a recorded natural or artificial sound clip, or a piece of music. It can present stimulating verbal messages more dramatically than text can, reflect natural sound resources, and express various feelings.

A video object is the body that contains time-varying-picture images, possibly with color and coordinated sound. Video provides realistic experiences through showing/documenting places, viewpoints, complex and

dynamic changing processes, slow/fast motion, real world events, and chronological sequence.

A data object can be any number, date, and/or any unit of the above objects.

In addition to the above, another element, table, is heavily used in some application programs such as Word and web development packages. A table is an information container that is composed of various numbers of rows and columns and allows the user to organize information in many nice and neat ways. Because it always comes with other kinds of information together, it can be viewed as an object.

## Attributes of objects

Each kind of object has many attributes. These attributes determine the appearance of the object and the ways that information can be represented and manipulated according to a predetermined design. Different software applications deploy different attributes of an object depending on the purposes of the software. Attributes of an object can be divided into two types: basic and extended.

The basic attributes of an object exist in general purpose software and define the primary aspects of the object. Below is a table showing the basic attributes of some objects.

Table 1. Basic Attributes of Objects

| Object | Attributes |
|---|---|
| Text | Font, size, alignment, color, style, line spacing, borders, and shading |
| Graphics | Size, position, border, layout, brightness, color, file format, and contrast |
| Audio | Volume and loop |
| Video | Position, volume, size, and play control |
| Table | Border and shading, number of rows and columns, and alignment |

Besides the basic attributes, many software application programs add more attributes to the objects depending on the special requirements of the software. In Web development, software packages like Netscape Composer, Dreamweaver, and Frontpage add alt, hyperlink, transparent, rollover, target, and interlaced to graphic objects to fit the new features of the software. In the same way, table object has colspan, rowspan, colored borders, cellspadding, cellspacing, background color, caption, heading, width, and extra HTML attributes besides the basic ones mentioned above. Adobe Photoshop adds more attributes to the graphics, some of which are resolution, effects, image mode, histogram, and layer. Extended attributes of objects give the user more freedom to control and manipulate the objects for special purposes in addition to the basics.

## Operations on objects

In every kind of software, a file is an essential container for the user to work with. A file is composed of one or more objects. For example, pure text can form a Word file; text plus graphics also form a Word file. Therefore, a file can be viewed as an object or objects. In order to make use of various objects while working with a file, various operations on objects are designed. Some of them are almost universal; some are specially designed. Corresponding to the attributes of an object, there are two types of operations: basic and extended.

Basic operations are the operations performed on the basic attributes. File, edit, and format (or menus similar to format) are the three basic menus. All the files can be manipulated through the *File* menu with the commonly used *new*, *open*, *close*, *save*, *save as*, *import*, *print*, and *print preview* operations. *New* creates a brand new file to let users put object or objects on it. *Open* opens an existing file for editing. The products (saved files) created by software can be viewed as objects as well. For example, *Dreamweaver* treats products from *Flash*, *Fireworks*, and shockwaved materials as objects that can be integrated directly into the file. For each kind of object, *undo, copy, cut, paste, select all, find* and *replace* operations can be performed through the *Edit* menu. To change the attribute(s) of an object, the *Format* menu can be used to make the needed change(s). *File*, *Edit*, and *Format* are the three basic menus seen in various software packages.

If a software application program can incorporate more objects into the file, either an *Insert* or *Import* menu is designed to bring them into the file to work with them. For example, *Microsoft Word*, *PowerPoint*, *Excel*, and *Access* have an *Insert* menu. These menus plus the *Help* and *Window* menus are almost the same for every kind of software. With these menus, users can perform general tasks regarding manipulation of objects

(except the table object). Other menus in the software are supportive. In programs that incorporate a table object, there is a *Table* menu or a menu specially designed for table object to perform: insert row (column), delete row (column), split or merge cells, and change attributes of a table.

Extended operations on objects refer to the operations that can be done through special software focusing on a specific kind of object regarding the extended attributes. Adobe Premiere focuses on video object. Microsoft Word and PageMaker mainly focus on text objects. Adobe Photoshop, Image Composer, Photo Editor, and Fireworks focus on graphics. Microsoft Excel and Microsoft Access focus on data object. Take Adobe Photoshop as an example. Operations like *filter*, *adjustment*, *rotate*, *extract*, *add layer mask*, and *add types* are added to the basic operations on graphics.

## Concept maps of objects

A concept map is a graphical representation of concepts and their interconnections. It is believed that concept maps reflect the student's cognitive structure, enabling both teachers and students to determine the level of understanding of material attained before, during, or after instruction (Burke 1998). The purpose of a concept map is to identify key concepts and the relationships in an instructional setting under various levels of abstraction with a visualized diagram. Research has shown that a concept map is very helpful as an instructional tool, a tool to access a student's knowledge structure, a tool to evaluate a student's learning, and a navigational tool in hypermedia (Lee, 1997).

Objects, attributes, and operations can be represented by concept maps of objects: basic concept maps about objects and extended concept maps about objects. The basic concept maps depict the objects, their basic attributes, and basic operations on them. Basic attributes of and operations on objects are universal. Teaching pre-service students the object concept while they learn how to use software like Word, PowerPoint, Excel, and HyperStudio will enable them to develop concept maps of objects. With the concept maps, students can manipulate the objects effectively and efficiently while they learn technologies and perform tasks with technologies. Below is a concept map of a general object.

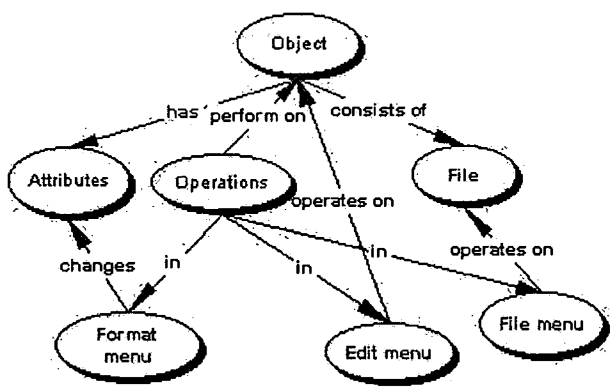


Figure 1. A basic concept map of an object

A concept map not only allows people to connect ideas they already have, but also to connect new ideas to knowledge they already have, and to organize ideas in a logical but not rigid structure that allows future information or viewpoints to be included. Extended concept maps about objects can be formed by adding more attributes and operations to the basic concept maps, which leads to the expanded knowledge structures and to the potential to perform more complex tasks. Below is an extended concept map that can be formed from the graphic object in Adobe Photoshop.

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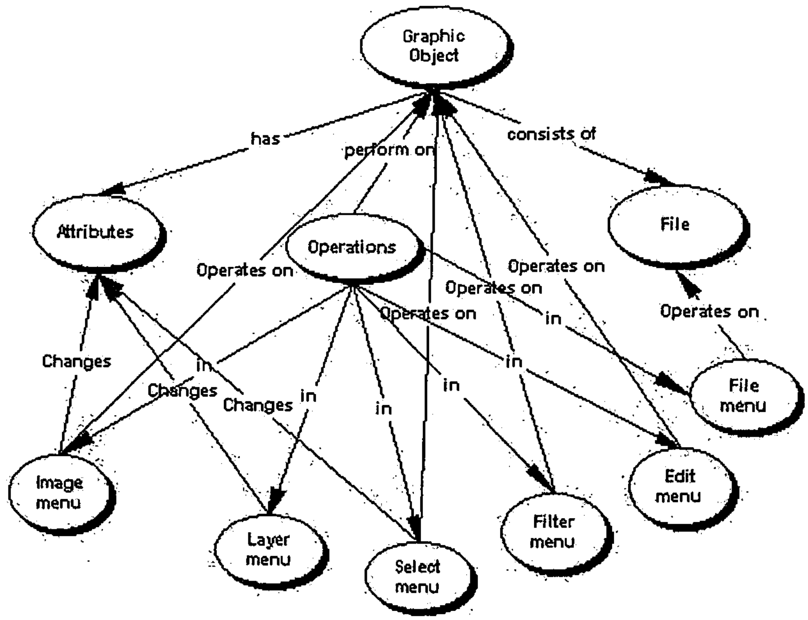


Figure 2. An extended concept map of the graphic object

## Benefits of object concept learning

Mastering the concept maps of objects benefits three aspects of students' learning about technology. Concept maps help students understand the structure of software. Knowing the concept maps of objects, the learners can understand the essential part of the software interface and supportive menus. For example, in Microsoft Word, *File, Edit, Format, Table, Window*, and *Help* are the main parts of the interface. *View, Insert*, and *Tools* are supportive menus. Therefore, learners can understand the structure of software effectively.

Concept maps help students learn how to use new software. In education settings, different software employs different objects. Some use one, some use two, and some even use more. If the object concept and concept maps are stressed from the beginning of using software such as Microsoft Word, this will be very beneficial for students to learn other software like Excel, PowerPoint, and HyperStudio. Microsoft Word usually uses text objects and graphic objects; Excel usually uses graphic objects and data objects; PowerPoint uses text, graphics, audio, and video objects. With more specially designed software, such as Adobe Photoshop, extended concept maps help the learning process.

Concept maps can also help students implement multimedia instructional materials. The object concept is critical to many multimedia application programs such as HyperCard, HyperStudio, Authorware, Dreamweaver, and Frontpage. These multimedia software packages integrate text, graphics, audio, and video information into multimedia learning materials. The process of implementing multimedia instructional materials with these programs is a process of manipulating the text, graphics, audio, and video object to a design. The concept maps greatly benefit the manipulation of objects used in the implementation process.

## Summary

From the above discussion, we can see that object is an important concept for learning technology. Categorizing educational information into different objects helps students learn concept maps, which consist of objects, attributes, and operation while they learn the technology. This object-oriented strategy not only benefits the students' current learning of technology, but also helps their learning of new technologies in the future.

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# Infusing Technology into Pre-Service Teacher Education

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**Abstract:** Ensuring that pre-service teachers are prepared to integrate technology into their teaching is a top priority for teacher education programs today. One way to help achieve this goal is to model the integration of technology throughout the teacher preparation program. This pilot study examines the integration of technology into a language arts methods course and the effects of this integration on pre-service teachers.

## Introduction

The role of technology in society has become an increasingly important issue in the public school. Reports on numbers of computers in public schools show that 98% of all schools now own computers, which puts the current student to computer ratio at about 10 to 1 (Coley, Cradler, & Engel, 1997). It is imperative for educators to help prepare students in the use of technology in everyday tasks. One goal of pre-service teacher education programs is to help prepare these future teachers to become proficient in the integration of technology into the curriculum. Federal and state agencies (US Department of Education, Texas State Board for Educator Certification) as well as educational organizations and society have an expectation for the use of technology in schools. Institutions of higher learning have approached this expectation in a variety of ways. The primary mode in which teacher preparation programs have chosen to meet this need is through a separate course in educational technology course that is part of the pre-service curriculum (Thomas, 1996; Thompson, Schmidt & Hadjiyani, 1995; Zachariades & Roberts, 1996). This separate course tends to present computers and technology as an isolated subject. This tends to model the use of technology as a separate component or 'add-on' rather than the integration that is vital in today's society (Jensen, 1992; Novak & Berger, 1991). Technology use has not been central to the pre-service preparation experience of most colleges of education. Most new teachers graduate with limited knowledge of use of technology integration strategies in their day-to-day teaching (US Congress, 1995; Byrum & Cashman, 1993; Davis, 1994).

It seems unreasonable to expect that pre-service teachers would be able to integrate technology effectively after taking an isolated technology course. Integrating technology into pre-service programs must become the norm if future educators are to use technology effectively in the classroom. One way to help ensure that pre-service teachers get the most from their technology experience in the preparation program is through effective modeling of technology integration throughout courses in the pre-service program (Bias, 1995, Wetzel, 1993, Ehley, 1992). When pre-service teachers participate in a preparation program that models the integration of technology, these students are much more confident in their own technology use as well as gaining ideas for use in their own teaching practices (Stuhlman, 1998).

## The Study

This pilot study proposed the integration of technology into the undergraduate teacher education program by modeling the use of technology in different courses throughout the program. This pilot study focused on technology integration strategies in a language arts methods class. To help with the integration

of technology as part of this methods course, participant's integrated technology into their lesson plans in many ways. This included the use of educational software, desktop publishing, Internet teaching resources, presentation software, HyperStudio© and WebQuest©. Additionally, the instructor modeled each of these applications throughout the course. This modeling demonstrated to participants how technology integration occurs without becoming an add-on to the curriculum.

Participants for this pilot study consisted of undergraduate elementary education students enrolled in the Language Arts methods course in the fall of 2000. All students enrolled in this course also enrolled in Math, Science, and Social Science methods at the same time. There were 72 students enrolled in methods who participated in this study. All participants have taken the basic computer course required by the university. Participants attended the language arts methods class one day a week for three hours in a field based setting at a local elementary school. Participants attended class two days a week and observed and interacted all day in an elementary classroom two other days of the week.

All participants completed a computer use survey focusing on confidence with use of computers. Administration of the survey again at the end of the student teaching semester adds more information for this study.

Before the implementation of this study, the Language Arts methods course contained several varied assignments in order to make sure that students understood language arts concepts and strategies. These course assignments consisted of the following:

- Internet resources- a list of useful resources for teachers of language arts in grades K-8.
- Classroom design – a drawing of the students' ideal classroom including all items, centers, room arrangement, etc... These were hand drawn and labeled.
- Language arts mini unit- consists of five lesson plans written around a theme, a web summary of the unit, and an annotated bibliography of fiction and nonfiction books related to the theme.
- Portfolio- in concert with the other methods courses, a compilation of process, product and performances of competencies related to the Texas teacher certification exam.

For this pilot study, the instructor for the language arts methods course and a member of the instructional technology faculty planned together to make changes to the course assignments. The Internet resources assignment and the portfolio assignment did not change but other assignments did in order to reflect the integration of technology into the projects. The classroom design changed so that students were required to draw their ideal classroom design using the computer rather than drawing it by hand. A paragraph reflecting on this design became a part of this assignment as well.

For the language arts mini unit several changes were made:

- A typed web summary with text boxes replaced the hand written web summary of the unit.
- Participants were required to create a newsletter for parents introducing the unit.
- The annotated bibliography must come directly from web resources.
- Four of the five lesson plans required the integration of technology into the lesson. These included the integration of educational software, use of presentation software, use of Hyperstudio© and the use of a Web Quest©.

Participants in this study did not have experience with any of the technology application tools required for each of these assignments so it was necessary to teach them the skills needed to utilize each of these components. The IT faculty member taught application skills using mini-lessons. These mini-lessons took place in the field-based classroom at the elementary school where the methods class met. The language arts instructor and the IT instructor rotated groups through a small media center with eight computers. This helped to demonstrate to participants how to utilize integration with a limited number of computers.

Since this study examined the use of modeling integration throughout the semester, it was imperative that modeling of technology takes place in the appropriate manner during methods instruction. The faculty member for the language arts methods class did most of the integration modeling. An instructional technology faculty member served as mentor and support for the language arts instructor and modeled technology integration for the students. Examples of modeling technology during instruction included the following tools:

<u>PowerPoint© for presentations</u> Utilization of this tool occurred several times during the semester to present information to the participants on various subjects related to reading and language arts. Participants had handouts of the presentations for use in note taking and to save as a study aid or resource for the future.

<u>KidPix© for demonstrating interactive writing</u> During a presentation on emergent literacy, students role-played as kindergarten students while the instructor modeled interactive writing with this program.

Participants dictated story ideas based on a book read in class. The instructor recorded these ideas using KidPix©. Interactive writing also allows the young emergent reader to come up to the front of the classroom and write in the words they know. Modeling of interactive writing took place as well using the computer and software rather than the traditional chart tablet. Participants were able to see technology integration in an appropriate manner and to understand the process of interactive writing.
Word processing software Use of word processing software occurred many times during the course. On the first day of class, the participants completed a KWL chart listing what they Knew, and Wanted to know about language arts. What they Learned was added to the last column at the end of the semester. The methods faculty created a chart using word processing software and filled it in as participants thought of concepts that fit in each category. Generation of a newsletter as an example also utilized this software. The newsletter described course content and serves as a model for the newsletter participants would create for the introduction to their mini unit.
Internet The methods faculty modeled the use of the Internet as a means to locate teacher resources related to language arts and other areas. Additionally, the faculty members provided examples of WebQuests© for students to use in adapting or developing their own (for the lesson requiring the integration of a WebQuest©.
Educational Software Individual copies of educational software were set up in stations in the classroom so that participants could review them. Participants incorporated educational software into the second lesson plan of the thematic unit.
Hyper Studio© A Hyper Studio© card stack was created by the language arts and instructional technology faculty members to serve as a demonstration of how this tool could be used in classrooms.

## Implications

The changes in course assignments produced several changes in the final products completed by the participants. The computer drawn classroom designs were much neater and more concise than the hand drawn ones turned in during previous semesters. Students had to take more time when deciding where objects should go in the classroom. Although color was not required for this assignment, many participants opted to add color to the design where few did in earlier semesters. Similarly, the unit summary web was much neater when done on the computer than when it was hand drawn in previous semesters. This made both projects easier to read and understand. Students commented that although they would not have used the computer for either of these assignments unless it was required, they thought the results were better. Participants felt that the initial use of the computer to draw the classroom design was more time consuming that if they had drawn it by hand but decided that the next time they had to do it would be easier and faster.

Although the quality of lesson plans did not really change, participants were able to integrate technology into their lesson plans without making the technology the whole lesson. Because of the way the technology components became a part of the class, students were able to do the same with their own lesson plans. Students in previous semesters would not even attempt integrating any of the technology tools into their lesson plans. For the first time, students also included their technology implementations into their final portfolios.

The use of technology in language arts lesson plans also crossed over into the other methods areas of math, science and social sciences. Participants were able to use what they learned to apply in these other courses as well. Participants often wrote lesson plans that integrated language arts and science and turned these in to both instructors. In this way, their use of technology for language arts also influenced lesson planning in other areas. The participants frequently and enthusiastically shared their experiences of integrating technology into lessons developed for the other methods classes, especially with the instructional technology faculty member. One particular example stands out where the participant developed an interactive bulletin board for the social studies methods course on the election. This assignment included activities for using the Internet to search for information on the candidates, as well as participate in an election WebQuest©.

Participants showed an increased use in technology of all kinds. Several participants utilized email to send in lesson plans. This was not the case in previous semesters. Participants were also more willing to use email to ask questions about the course than they had in past semesters.

Since this is an ongoing pilot study, there are changes are being made to the program following the completion of this first semester. One problem with this study was that too much technology

information was crammed into one methods course. It was extremely difficult to include all the regular course content and the technology skill lessons needed to complete the assigned projects. During the next phase of the study, technology skill mini-lessons have been integrated throughout the methods courses in order to make the time spent more equitable between the courses. In addition, some time in the computer lab on the university campus before the courses are field based. This will allow participants to gain some of the skills they need before going out into the field based school where it is harder to find computers to work with.

## Conclusions

This ongoing pilot study has shown that integration of technology into the pre-service teacher program can be beneficial. There was an increase in the quality of student projects after exposure to technology integration than in past semesters. Participants seemed more willing to use technology overall after their exposure to it in class. The increased use of email and the willingness to use technology in lessons for courses that did not require it are examples of this.

It is important to note that participants were able to draw on the technology skills learned early in the semester for projects later in the semester. Participants learned to make text boxes and other shapes for their physical classroom design. When it came time to work on the newsletter, one participant volunteered to show the rest of the class how she used text boxes to make her newsletter. This is a great example of a student using this prior skill to apply it in a new and appropriate way. The class this particular example was in completed their newsletters before the other two sections of the class did.

The changes occurring in the undergraduate teacher preparation program to integrate technology are ongoing and will be cyclical in nature. One participant in this semester's course was teaching a lesson out at her field-based school. The lesson happened to be a lesson that integrated a PowerPoint presentation. The school principal entered the room and was very impressed with the lesson. He then asked this student if she could teach the rest of his faculty how to use PowerPoint. This is one of the reasons that modeling the appropriate use of technology is so important. The university students will show what they are learning and will be able to assist in-service teachers with their technology integration. More of this will occur as the students move from methods to student teaching in the next semester. Participants who completed methods and moved on to student teaching will remain in touch with the faculty during student teaching through email. At the end of the student teaching semester, they will complete the computer use survey again to compare with the results of the first survey. It is anticipated the computer use and confidence will increase by the end of the student teaching semester.

This study will continue as the methods courses change again for the Spring 2001 semester. These changes should bring about positive effects on the use of technology as an everyday tool in the classroom. As the State of Texas puts an increasingly higher emphasis on the use of technology in the classroom, undergraduates in the teacher preparation program need as much technology integration as they can get. Changes in state certification in Texas are forcing universities to cut some courses in order to make room for others and the technology for teachers course is one that is likely to reorganized in the course rotation. Integration of technology into all undergraduate education courses will help with the problem of the loss of this course. Based on the changes in technology use noted for the participants in this study, there will be an even greater change for upcoming students as technology use trickles down to other undergraduate education courses before the methods semester.

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# Breaking Down Barriers: Integrating Technology in Teacher Education and Distributing it to K-12 Schools

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Abstract: Over the last decade Marietta College has integrated technology into its teacher education program. During that time students found it difficult if not impossible to utilize their knowledge and skills of technology in the K-12 arena. In an effort to accommodate students, the college engaged in multiple projects with the local schools to provide sites and experiences that demonstrated "best practices" for integrating technology in the K-12 curriculum. This paper discusses how some of the projects involved students and teachers from local schools, as well as college teacher education students and their faculty. As a result of these projects, Marietta College is making progress toward eradicating the barriers of teacher attitude and lack of willingness to allow teacher education students to try new technology in their classrooms. In addition, these future teachers see first hand how technology can enhance student success, thus insuring technology as an indispensable tool in the classroom.

Integrating technology into the Teacher Education program at Marietta College has been a priority for the last decade. However, while the college worked diligently to secure hardware, software, lab equipment, network services, course requirements, and pedagogical acceptance among faculty to facilitate this integration, our students frequently failed to utilize their knowledge of technology in their K-12 fieldwork. Barriers facing our students were numerous: lack of equipment in the public schools, lack of commitment to and knowledge about technology among local teachers, a mismatch of platform capabilities, and studentsÕ less than enthusiastic belief that technology could be integrated meaningfully into the K-12 curriculum. Because of these obstacles, the Education Department created new strategies, methods, and activities for addressing this Òbroken pipeÓ between higher education and K-12 educational technology.

Students in the Teacher Education program at Marietta College are required to take a course entitled ÒTechnology in the ClassroomÓ during their freshman year or immediately upon transferring into the college. This course acquaints students with research and best practices for integrating technology into their field of education. In addition, students learn software that is utilized for assignments in most of their other education courses. These assignments vary from simple to complex, incorporating such technology as graphics, sound, digitized video, digital photography, multimedia, and web page design.

Over the years, students enthusiastically completed their technology related assignments, but became frustrated when they attempted to utilize them during their field placements. Often the local schoolsÕ computers were outdated or utilized a different platform than the one used by the college students. Sometimes the cooperating teachers saw no value in allowing the students to utilize technology during their field work. The department began developing new methods and strategies to combat these problems.

First, only cross platform software was chosen for use. Second, where computers were in short supply, students were permitted to take department laptops to present lessons planned for field experience classrooms. Third, Zip disks and drives, which could be attached to school computers, were used for large multimedia projects,

and finally, wherever possible the internet was used for accessing instructional material. These strategies solved most of the hardware and compatibility problems.

Addressing the problems of teacher enthusiasm for and willingness to integrate technology into their curriculum proved to be the most difficult obstacle to address. In attempts to change teacher opinion and create a technologically friendly climate, the Education Department began designing projects with local school teachers that incorporate technology into the teaching /learning process in meaningful, creative ways that complemented the K-12 curriculum. These activities, at times, brought K-12 students and teachers to the college to work with education students and faculty. Other activities involved taking education faculty and college students to schools to work with K-12 students. Through these projects, the potential of integrating technology into the K-12 curriculum was witnessed by K-12 students and their parents, teachers, administrators, college students, and college faculty.

One of the first attempts to model effective use of technology in K-12 curriculum involved work with talented and gifted seventh grade language arts students from Marietta Middle School. The education department was approached by the Middle School gifted teachers for ideas about how to adequately challenge these students. This led to the design of a project which linked childrenÕs literature, social studies, and technology using student-created multimedia projects. Led by two education faculty members, teacher education students assisted the seventh graders and their teachers as they learned to create Hyperstudio stacks about historical fiction selections during biweekly language arts periods spent in the college computer lab. Seventh graders were able to search internet sites to learn more about selected aspects of their books, scan photos and artifacts which related to the time periods of their books, create video clips which demonstrated various aspects of the time period, and digitize music to accompany their projects. Student projects were shared at an open house held for parents and school staff. Through this project, parents, teachers, and education students were able to see how multimedia can become a tool for integrating curriculum, encouraging critical and creative thinking, and fostering student enthusiasm for learning. After several projects with middle school talented and gifted students during a period of three years, it became evident that the gifted teacher and the middle school principal recognized the value of technology with this particular group of students. At this point, education faculty saw the need to model how technology can facilitate curriculum goals with heterogeneous groups of students and with students at different grade levels.

In an onsite program at Washington Elementary School, a class of mixed ability fifth graders was selected to work with students from the adolescent literature course to read historical fiction selections and create web pages about the books. Books were selected which could be tied to the fifth grade social studies focus on Native Americans. Students were asked to consider aspects of the cultural and historical contexts of their books which could be represented on their web pages. College students and education faculty worked on site with students in the schoolÕs computer lab as they investigated their books and learned to make web pages with Site Central. In addition to the class of fifth grade students and their teacher, the project attracted the interest of other teachers in the school. Once posted on the web, this project provided the opportunity to share studentsÕ work with parents and other teacher education students.

Additional opportunities to model effective technology integration are afforded through Marietta College Reading Clinic programs. A four week summer program, Summer Reading Camp, provides a practicum experience for undergraduate and graduate students who are seeking reading certification. Graduate students who teach in the summer program are typically practicing K-12 classroom teachers while undergraduate students are senior level teacher education students. Children who attend Reading Camp have been recommended due to poor literacy performance at school. The majority of these children also exhibit negative attitudes toward reading and writing. Teachers are required to address literacy needs using a variety of good childrenÕs literature and through the daily integration of technology. Practicing teachers and teacher education students are able to see the how technology can be used as a tool to enhance instruction and motivate reluctant readers and writers. Teachers use Kid Pix, Hyperstudio, and The Amazing Writing Machine to create lessons which facilitate literacy growth. Frequently, the practicing teachers are able to benefit from the modeling of technology use by undergraduate students who work with them in teaching teams. Projects utilizing pattern writing, language experience, and text for wordless picture books have successfully used technology as a way to encourage student writing.

Hyperstudio is a useful tool for Reading Camp teachers to create templates to encourage student writing. Students are able not only to write responses on stack pages, but can also record themselves reading their text. One example of this successful use of Hyperstudio involves wordless picture books such as David WeisnerÕs *Tuesday* which are scanned and incorporated into Hyperstudio stacks for student response. When first and second grade students are able not only to see the story but to hear ÒfrogsÓ in the background, ideas for writing abound. Children work in small groups to collaborate on their story and take turns adding text to pages with scanned images. This electronic book is printed and taken home by the proud authors who are able to read it to their parents. In other writing projects with Hyperstudio, teachers incorporate digital photos which become writing prompts for the

students. One successful project followed the reading of *Wacky Wednesday* by Theo LeSeig with first grade students. Students and teachers posed for digital photos while reading a book in a Òwacky poseÓ. After the teacher inserted the photos in the Wacky Wednesday Hyperstudio stack, students were able to write and record sentences to describe the pictures. The classÕs version of Wacky Wednesday was a popular attraction during the community open house on the final day of Reading Camp.

Figure 1: A Reading Camp student's contribution to the class's "Wacky Wednesday" HyperStudio stack.

BroderbundÕs Kid Pix and Amazing Writing Machine are additional writing tools which have proven to be effective with reluctant readers and writers. Reading Clinic teachers use digital photos and discussions of classroom experiences and field trips to prompt student ideas for group language experience stories. In other lessons, students may use a predictable picture book as a pattern for their own Amazing Writing Machine or KidPix books. Students are then given the opportunity to illustrate their contributions on the KidPix screen or the Amazing Writing Machine page. The intriguing clip art and paint tools coupled with the child friendly interface of these programs has allowed many of the Clinic students to feel like successful authors when their books are printed and shared with other students and parents. The capacity for Amazing Writing Machine to read the studentÕs words is a popular feature with students and encourages them to double check spelling when the computer doesnÕt read the story properly. KidPix allows the students to record their own voices reading their work. Teachers have noted that this appeals to many children who are otherwise reluctant to read in front of a live audience.

Figure 2: KidPix slides created as part of a Reading Clinic language experience slide show.

The integration of technology into Reading Clinic lessons has been facilitated with the purchase of laptop computers which enable teachers to sit on the floor with collaborative groups of three to four students while the language experience story is discussed and constructed or while students share their creations with peers. The greatest advantage of the laptop computers has been to allow undergraduate Reading Clinic teachers to take computers with them as they conduct one on one tutoring with children at school sites. In this way, the college

students are able to insure that they will have the necessary software need for the lesson and they are able to work in a variety of locations in the school building. Teachers working in the building are able to observe the college student tutors working with technology and have begun to indicate an interest in the applications they are using. Children frequently return to classrooms after tutoring sessions with a desire to share their excitement about working with technology with their teachers.

In a series of small steps, Marietta College is making progress in eradicating the barriers of teacher attitude and lack of willingness to allow teacher education students to try new technology in their classrooms. More importantly, teacher education students are successful participants in the integration of technology into their lesson plans with K-12 students. As future teachers see first hand how technology can enhance student success and engagement in learning, its future as an indispensable tool in the classroom is insured.

# Ridges and Bridges: MentorNet Collaboration Yields a Watershed of Preservice Infusion

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**Abstract:** Mandatory technology requirements for student teachers have put faculty in teacher education programs in the position of being responsible for a learning environment enriched with technology. This paper addresses the processes being used by NC State faculty in the College of Education for infusing technology in all levels of classes (foundations through clinical semester) and across disciplines. MentorNet, a PT3 project, forms bridges between current and future educators by challenging and supporting each other in the creation and critical application of emerging technologies for 21st century classrooms.

## Introduction

The state of North Carolina has a set of Technology Competencies for Teachers which grew out of a report from a statewide Technology Users Task Force in 1995. Aspiring teachers must demonstrate these competencies in order to receive an initial license to teach (NCDPI). The mandatory technology requirements have put faculty in teacher education programs in the position of being responsible for a learning environment enriched with technology. North Carolina's Department of Public Instruction has made meeting the competencies more serious by requiring preservice students to develop technology portfolios. The MentorNet project (http://www2.ncsu.edu:8010/ncsu/cep/mentornet/) addresses this issue by developing collaboration within and among programs to help students develop teaching portfolio artifacts throughout their coursework culminating with clinical practice and portfolio assessment by teacher supervisors and cooperating teachers. A technology thread serves as a bridge across programs including Content Area Reading, middle school interdisciplinary projects, a science education technology methods course, a mathematics education technology methods course, and a high school social studies professional semester.

## WebQuests: Scaffolded Instruction for Content Area Reading on the World Wide Web

An instructional assumption that is regularly made by educators is that the hypertext nature of the WWW and the freedom of choice that it affords will facilitate studentsÕ understanding and use of large amounts of textual information. In some studies of hypertext, however, readers actually found hypertext more difficult to read than linear text (see Gordon, Gustavel, Moore & Hankey 1988; Rouet & Levonen 1996). Related to this issue, Shapiro (1998) found that her hierarchical system of information did not present a reader-advantage over a linearly-ordered one with respect to knowledge retention or quality of written essays. Shapiro concluded that in order to make hypertext advantageous as a learning tool, supportive links must be included to prompt readers to think explicitly about the information relationships they are encountering. A second assumption often made by educators is that students can critically evaluate their web-based resources, a task that has been historically relegated to editors of traditional print publishing companies. Since the flexibility inherent in web-based learning may allow too much freedom for some students to handle, teachers must determine how much freedom

is appropriate and simultaneously teach students strategies for handling their new freedom. Fortunately, a number of recently designed online tools and activities address the potential problem of unlimited freedom.

One particularly promising organizational tool is the WebQuest (Dodge 1995). This web-based set of instructional activities can provide instructional scaffolding as teachers and students take advantage of the WebÕs informational resources in a directed, focused way. WebQuests are inquiry-oriented units of study that propose an open-ended problem for students to solve with the resources put at their disposal in the hypertext environment. A thorough description of WebQuests can be found at http://edweb.sdsu.edu/courses/edtec596/about_webquests.html.

WebQuests are undergirded by key instructional principles that: 1) allow teachers and students to set a purposeful context for reading in which everyone can participate; 2) give readers access to information on a topic at serveral levels of readability/difficulty; 3) provide multimedia (e.g., audio, video) dimensions to enhance the learning/reading process; 4) create opportunities for students to participate in social construciton of meaning and consensus building; 5 create opportunities for students to synthesize ideas across multiple source documents; 6) provide scaffolding for cognitive processing of text (see Spires & Estes, in press).

WebQuests are particularly useful as a technology Òpoint of entryÓ for students in Content Area Reading (see http://www.courses.ncsu.edu/classes/eci541001/index.html), a course that is required across degree programs. By requiring the development of a discipline-based WebQuest within the Content Area Reading course, students may use this web-based instructional product as part of their required technology portfolio as well as an instructional tool in their school-based internship experience. WebQuests are particularly appropriate in that they can be created as high-tech or low-tech projects, commensurate with a student's comfort level with technology. Since a primary aim of the Content Area Reading class is to help students explore theoretical and practical challenges of web-based reading and learning, a WebQuest is an appropriate instructional tool to help achieve this goal.

## The Wetlands Preservation Project

The Wetlands Preservation Project brought preservice teachers in all core disciplines together with 100 middle school students and their teachers who sought a capstone eighth grade service learning experience (Arnold & Beal 95). Working with churches (Partners for Environmental Justice), state and city government, neighborhoods and North Carolina State University, the eighth graders conducted action research to become fully informed about wetlands, law and politics, city history (Beal 92) and environmental justice.

With the help of classroom and preservice teachers, the middle school students used web research, GIS technology, Excel and Power Point, topography maps, neighborhood interviews and conversations with city officials. Teachers guided and learned along side their students as they incorporated all forms of learning into this theme-based unit. They used math to draw and plot maps of the area, made flow charts of the problem cycle, prepared cost analyses and developed spread sheets that indicated the use and abuse of the wetland area. Their personal writings - essays, poems and songs - reflected a new found appreciation for the beauty and solitude of the wetland. In social studies they addressed the issue of environmental justice, examining the wetland area in light of land use and city services affecting residents of the area. GIS enabled them to study area demographics and determine that the area has long lacked for amenities that other parts of the capital city enjoyed. Letters to the members of city council and the mayor helped alert city officials to the need to carefully study city plans for the wetlands. Initially, science drove the unit, as students increased their knowledge base about wetland form and function. They studied the land and the hydrosphere, change over time, population dynamics, river systems and erosion.

As students took wetland theory to practice and examined their own cityÕs wetland, they discovered that being knowledgeable is not as simple as textbook learning in one core subject, but that, like life, learning must be integrative. The wetland project enabled them to use and acquire life skills by becoming involved and active in a community issue. Together with preservice teachers, students prepared a technology enhanced presentation about their wetland research for a university-wide Spell of the Land symposium. They presented their findings about the wetland issue in the form of poems, songs, reflections, a ten foot mural and a digital slide stream presentation with voice over reflection and music. Because preservice teachers were involved from the projectÕs inception, they experienced all aspects of teaching - brainstorming, planning, teaching technology skills in the context of the project, managing numerous groups with many different assignments,

and, finally, helping students prepare and use technology in their presentation. All members of the Wetlands Preservation

Project team felt that this was just the beginning. Through the use of technology, they can stay current with this issue and perhaps discover more issues that need eighth grade champions.

## OutVentures Incorporate Technology and Science

One of the education courses in the Science Education program has been restructured to focus on student practice of instructional technology and on student development of digital products for instruction (http://www.ncsu.edu/sciencejunction/route/usetech/index.html). One venue that allows students to practice the technology they are learning to use in the classroom and the lab are "OutVentures" (Outdoor Adventures). Activites are scheduled on a monthly basis to engage the Juniors taking the course to use the technology outside of the classroom and to develop instructional materials around the data they collected. Students who have already taken the course are also invited to the OutVentures. One such OutVenture was capturing the images of the January 1999 lunar eclipse. Web pages were developed from the images to promote earth-moon-sun motion inquiry activities, and provide service to the larger community by making these projects available to teachers.

## Developing Teachers' Techno-Mathematical Knowledge

According to the National Council of Teachers of Mathematics, "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (NCTM 2000, p.11). The use of the word essential in this statement has many implications for school mathematics, as well as mathematics teacher education. Not only are teachers charged with a vision of transforming their teaching and students' learning of mathematics, but teacher educators are challenged to prepare teachers who can utilize technology as an essential tool in developing a deep understanding of mathematics, for themselves and their students. Thus, teachers must develop techno-mathematical knowledge, which consists of several elements:

1. Solving mathematics problems and constructing mathematical ideas utilizing technological tools
2. Using technological tools to justify mathematical ideas and engage others in meaningful mathematics
3. Designing experiences with technology that will allow others to develop techno-mathematical knowledge. This includes designing lessons with appropriate tasks and questions, as well as interactive technology templates using dynamic geometry tools, spreadsheets, or web-based technologies (e.g., java, Shockwave).

A traditional approach to mathematics teacher education assumes that the skills needed in mathematics, pedagogy, and technology are distinct entities. In many mathematics teacher education programs, preservice teachers learn their mathematics content separate from their pedagogy content and separate from basic technological skills. These preservice teachers are then expected to make use of these separate skills in a classroom as a mathematics teacher. Some teacher education programs do combine content with pedagogy courses, but still have separate technology courses that are often taken jointly by preservice teachers from a variety of disciplines and grade level concentrations. The message behind this type of teacher preparation is that technology is an add-on "subject" rather than a subject-specific learning tool. Garofalo, Drier, Harper, Timmerman, and Shockey (2000) set forth guidelines advocating for an integrated and appropriate use of technology in mathematics teacher preparation.

Teaching and learning mathematics effectively in a technological classroom requires multifaceted knowledge that extends beyond what is typically learned in mathematics methods courses. The work of Garofalo et al (2000) can help teacher educators weave appropriate technology experiences into existing mathematics methods courses. As part of the sequence of courses required in the secondary mathematics education major, students take a course on teaching and learning mathematics with technology. The goals of the course are to have students revisit their own learning of school mathematics topics using technology. The preservice teachers gain a deepened and broadened understanding of school mathematics, learn how to use

powerful interactive technology tools, and develop techno-mathematical knowledge needed for engaging their students in learning powerful mathematical ideas with technological tools.

## Developing Critical Perspectives and Ethical Practices in Technology Applications in Social Studies

The North Carolina technology portfolio requirement for initial-license teaching candidates has impacted all subject area methods classes. To Social Studies Methods classes, this component adds another dimension to the methods through which the multidiscipline of Social Studies will be taught and learned. Because of the portfolio requirement's recent development, there is little in the way of research on Technology Portfolios in Social Studies teacher education.

For the Methods instructor, this poses certain challenges in an already "loaded" course. In the first year, the response was to add two technology sessions, training students in Power Point and requiring that they construct a (minimum) 6-slide presentation that imported resources from the Web with relevant citations. In the second year, a computer lab each week was added across the 8-week pre-practicum intensified Methods schedule. By the third year, fortunately, courses that appear earlier in our program had also been adapted. The students' previous experience was built upon with designing WebQuests housed on remote sites such as "Filamentality" (http://www.kn.pacbell.com/wired/fil/). Students designed websites that coordinated with their unit design specifically for the course they would first teach in the practicum. North Carolina also requires a Beginning Teacher Portfolio that includes a unit plan of 5 consecutive lesson plans. Students design a unit of 10 days duration that must include the eight intelligences (Gardner 1983) plus a technology component. As one might imagine, these units are densely packed. The methods classroom experience indicates that students, lacking other models, simply adopt this model as their unit planning model and take seriously the importance of engaging the multiple intelligences as well as technology inclusion.

In requiring the website, students are asked to compose in Netscape Composer since that would be available in the greatest number of schools, no matter what their technology resources. This proved very useful to students. At the same time a website was built for the Methods class which links each of the students' sites as well. Students worked collaboratively, sharing links and Internet treasures. An important first step in this was a discussion of Boolean searches that would include certain key phrases such as "lesson plan," "simulation," "learning activity," "jigsaw," or whatever was desired. The purpose was to instill a reaction/response that would make the Internet the first source of instructional resources. Work on search strings, it turned out, was essential before the Netscape Composer lessons.

There were 2 Netscape Composer lessons, with 3 weeks in between. Each lesson was approximately an hour long with an hour practice or execution. In the first, we learned how to link internally and externally to pages of our own and on the Internet. In the second lesson,we learned how to post these onto the university webspaces set aside for student use. Each of the sessions was led by an undergraduate with technology work/study experience. One of the most important lessons in technology infusion is to let student teach one another. People learn and apply these new technologies on an as-needed basis; therefore in any group there is "distributed cognition" that the instructor must initially facilitate. Once a collaborative norm has been established, the resource sharing and co-teaching and learning become routine. I have written in the past about "modeling learning" (Alibrandi, 1997). In this case, the undergraduate was teaching all of us; myself included. I believe that if instructors model learnng to students, that there will be a more fluid approach to learning and teaching that will influence novices to be more open to distributive and other types of collaborative learning in their own classrooms. We have been very pleased with the (what I call) "uptake" by cooperating teachers who have responded positively to having a ready-made customized website.

We point to websites that may be helpful and describe the evolving adaptations that have been made in Social Studies Methods classes to accommodate the changes. Even as this process has become more "seamlessly" integrated, several questions remain that have implications for the teaching of Social Studies Methods. These are: Will there be adequate time to address the increasing methods of technology integration within existing course structures? Do Methods students learn as much, more or less about teaching Social Studies as they construct technology portfolio products? Will the portfolio products be useful in currently-equipped classrooms? How and when will it be appropriate to research Social Studies students' learning with technology? Finally, as we integrate technology into Methods classes, how do we exemplify the reflective nature of the NCSS theme of Science, Technology & Society by developing critical perspectives and ethical practices in technology applications?

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# Infusing Technology into the Teacher Education Program

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**Abstract**: Success in the elementary classroom demands that teachers understand and have a working knowledge of educational technology. In 1999 the Education Department at Rollins College set the goal that all education students would graduate with the skills needed to effectively use technology in the K-12 classroom. Using the competencies as a guide, a new educational technology course was designed and implemented in Fall 2000. This paperless, self-paced course uses e-mail messages to guide the students through the basics of a specific software program such as Word, Internet and databases searches, Excel, PowerPoint, and Netscape Composer. The exercises develop the technological skills necessary for other education courses. Pre and post surveys showed a positive change in computer skills and confidence in using technology. The dynamic course design incorporates the latest technology and provides the foundation necessary for teachers to adapt their knowledge to new technology as it develops.

To be successful in today's classroom teachers must understand and have a working knowledge of educational technology. With each passing day computers become a more integral part of the elementary curriculum, for instruction in and out of classroom, student assessment, and communication with parents and the community. Technological literacy is essential to be an effective teacher. This need is reflected in Florida Department of Education (FDOE) mandates (DeTure 99). Use of computers is specified as one of the twelve Accomplished Practices required of all pre-professional and professional teachers and is inherent for Florida state approved teacher education programs. Yet, the explosion of technological knowledge challenges even the most willing pre-service teacher.

The Education Department at Rollins College investigated a variety of options for helping pre-service teachers become technologically literate. Beginning with the 2000-01 Academic Year the Department instituted a systematic approach for elementary education students to develop their technology skills. Prior to this time, although students were exposed to some elements of educational technology in their course work, a technology course was not part of the teacher education curriculum. While pre-service teachers were advised to take short courses offered by the Information Technology Department, these courses were not designed to address the specific needs of teachers. The most successful approach for infusing technology into the educational curriculum was its integration into a biological science content course specifically designed by the authors for pre-service teachers (DeTure, et al. 90). The technology components were utilized by students concurrently enrolled in the science content course and the science methods course. Two problems emerged with this approach. One was the proliferation of the uses of technology, and the limited amount of course time to teach this material in a science content class. The second was that the science content course was not required of all majors, so many graduates did not have even this limited exposure to technology. Students not enrolled in the biological science content course were left to their own devises for developing their technology skills beyond the basic Internet searches used for activities and research in their education courses.

In the Fall of 1999 the Education Department, as part of the program evaluation plan, set the goal that all education students would graduate with the skills needed to effectively use technology in the K-12 classroom. The ensuing discussions, in conjunction with the review of state standards and FDOE mandates, led to the establishment of a set of computer competencies for elementary teachers. The Education Department concluded that the most practical approach to ensure that all students would met the goal was to develop a required course to provide the foundation for the technological skills needed throughout the curriculum. During Spring 2000, the

Education Director approached the instructor of the biological science content course to explore the possibility of deleting the technology components from the biology class and expanding this material into a new technology course. Using the competencies as a guide the education faculty and the biology instructor jointly designed the specific content and order of coverage for the course. This ensured that the needs of the students would be met and that students concurrently enrolled in other education courses would have the computer skills required for success in those classes. The design of this course was intended to be dynamic in order to incorporate the latest technological advances as they occur.

The new technology course was first offered as a pilot course and co-requisite for the science methods course in Fall 2000. All class sessions were attended by the science methods instructor in order to facilitate integration of the technology into the elementary science curriculum. This paperless, self-paced course met once each week for 75 minutes. Before each class session students were e-mailed instructions to guide them through the basics of a specific software program. Over the course of the term the students were introduced to e-mail, word processing, Internet and databases searches, Excel, PowerPoint, and Netscape Composer. The exercises were designed to develop the skills necessary to apply this technology in their other education courses. For example, students in the educational statistics course used Excel to solve problems and to graphically illustrate data, and science methods students used PowerPoint for their science curriculum presentations.

At the end of each class students were assigned a homework problem requiring them to apply what they learned in the session. Students worked individually but were encouraged to use the instructor and classmates as resources. In addition to the practice element and to further insure mastery of the material, each student constructed a technology portfolio demonstrating their ability to use each software application and its relevancy to the elementary classroom. This web-based portfolio also serves as the initial model for the student's electronic performance portfolio required by the Education Department for graduation. Uses of electronic portfolios is further developed in upper level curriculum courses. The instructor of the educational technology class acts as a consultant for the computer segments in the education courses that apply this technology.

All assessment was and will continue to be performance based inherently containing a mastery component. Homework assignments were submitted early, reviewed and commented on by the instructor prior to the due date giving the students the opportunity to revise and resubmit their work. All portfolio entries were reviewed through peer evaluation; entries could be altered through out the term and were only graded at the end of the course through an oral presentation for a mock interview with a school principal.

The need for an education oriented technology course at Rollins was documented in part by a technology literacy survey completed by all students in the biological science content course. Students enrolled in the new technology course completed a similar survey as pre and a post test to measure student perception of changes in their computer skills and their confidence in using technology. Survey results showed an increase in confidence in the use and application of computer technologies. Students reported a marked improvement in their ability to use the specific software introduced in the course. Anecdotal observations also indicated that these students served as technology mentors in their other education classes. Long-term assessment of the course will involve evaluation of the students throughout their academic program and in post-graduation follow-up studies conducted annually by the Education Department. The amount and effectiveness of computer usage by the students who have completed this course will be measured and compared to other new in-service teachers who have had not completed a similar course in educational technology.

While the initial indications regarding this approach to improving the technological skills of pre-service teachers are positive, it is understood that no single course can address all the technological needs of the students. This course at least addresses their initial basic needs and provides pre-service teachers with the foundation necessary to adapt their knowledge to new technology as it develops.

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**Teacher Education Changes, Transitions, and Substitutions: Technology to the Rescue!**

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When, a new updated Early Childhood teacher education program with an entirely different set of courses had to be created to meet a new set of state competencies, a a flexible course - Early Childhood Practicum was crafted to ease the transition and provide coursework for twenty-three students who needed a total of seven different courses in to graduate. The course individualized the learning so each student could complete the required competencies.

Technology came to the rescue as means for me to use email to keep track of pairs of students who worked with teachers in several schools on inquiry projects to improve teaching and learning for young children. The course design also included five face to face college class meetings and creation of a video tape. Successes of this learning experiences were win-win for teachers in the field and students. Since so much of the responsibility for creating and implementing the inquiry project was a collaboration of teacher and college student, the motivation levels were high and most results highly successful. As the professor, my job was made easier when the excitement levels reduced the need for an intensive mentoring on my part.

# Graphic Representations for Learning: Developing a Learner's Conceptual Framework

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**Abstract**: The emphasis on knowledge attainment, higher order thinking skills and real-world learning opportunities within teacher education offers numerous opportunities for preservice teachers to develop a conceptual framework through which their future educational profession is viewed. The introduction of instructional technology into the educational environment offers the opportunity to represent such knowledge and understanding within a graphic format.

## Introduction

The emphasis on knowledge attainment, higher order thinking skills and real-world learning opportunities within teacher education offers numerous opportunities for preservice teachers to develop a conceptual framework through which their future educational profession is viewed. The introduction of instructional technology into the educational environment offers the opportunity to represent such knowledge and understanding within a graphic format.

## Graphic Representation of Information

Not only does the graphic representation of information through out the learning experience develop a visual framework for the preservice educator's understanding of the theories and concepts being presented, but the opportunity for preservice educators to graphically represent their own developing conceptual framework of understanding further encompasses a rich opportunity for reflection, discussion and possible revision of the graphic representation towards a fuller understanding of the personal, developing conceptual framework. Further, the preservice educators is developing an understanding of graphic representations within a learning environment, as well as offered the opportunity to view an instructional model that will be emulated within the PreK-12 instructional environment.

As an example of information developed into a graphic representation, the Instructional Technology specialization area of the University of Houston – Clear Lake's School of Education offers a philosophical orientation to all learners, so as to delineate the theoretical underpinnings of the specialization area. While a textual explanation is necessary, graphic representations of the textual information aid in the conceptual understanding and begin to develop a graphic realization and understanding of the reader's conceptual framework associated with the Instructional Technology specialization area. For example, following is a graphic representation of the Instructional Technology's philosophical orientation:

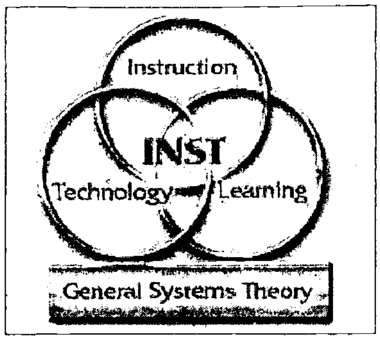


Figure 1: Instructional Technology Philosophical Orientation

Although this is an attractive graphic representation, which aids the user in realizing the main aspects of the information and how it fits together, the simplicity of the design respects the integrity of the information and the creation of a visual understanding; this understanding offers the user a conceptual framework through which to further integrate the philosophical orientation of the Instructional Technology specialization area.

Further, a second graphic that presents the Instructional Technology specialization area's philosophical orientation towards a student-centered model of instruction displays two representational models for the user's understanding: teacher-centered model of instruction, student-centered model of instruction. Through the representational modeling of the theoretical models of instruction, the user can create a thorough understanding of the Instructional Technology specialization area's focus upon the student-centered model of instruction that is apparent and modeled within the Instructional Technology courses offered.

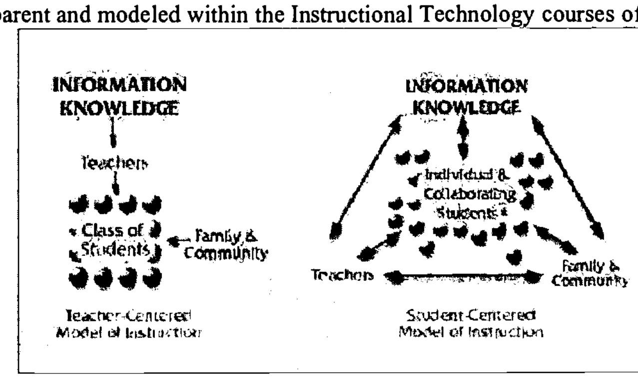


Figure 2: Teacher-Centered Versus Student-Centered Models of Instruction

The graphic representation of advanced theoretical viewpoints that are deemed important by faculty within the Instructional Technology specialization area aids the user in the creation of a conceptual framework of understanding through which the textual information can further delineate the knowledge obtained.

## Conclusions

The opportunity to model the art of graphic representations of information within a learning environment aids the preservice teacher in the developmental process associated with realizing their own developing conceptual framework. Also, the preservice teacher observes the modeling of such a task, as well as the higher order thinking skills associated with this activity. The preservice teacher's understanding of their developing conceptual framework is imperative towards the professionalism associated with the field of education; through the graphic representation of such information, the preservice teacher will integrate the technological aspects of their training within an instructional environment. The simplistic representation of integrated knowledge and understanding is both difficult and imperative towards the development of the preservice teacher's higher order thinking skills and professional future. Graphic representation of a learner's conceptual framework may appear simplistic, yet this powerful activity emphasizes the preservice teacher's understanding of the profession, as well as areas of strength and possible areas of further growth.

# Computer use in pre-service and in-service teachers

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**Abstract:** This study examines survey data from pre- and in-service teachers and makes observations from that data regarding computer use. The three main observations include; broad and common use of simple elements such as email was found; minor differences were found between men and women in technology use; and participants increased their use of the internet for purchases and class registration during the study period. The teachers appeared to parallel computer acceptance in general society. As society embraces technology, so too will our newer teachers.

## Introduction

The major portion of the impact of instructional technology will come through improved and continued education of in- and pre- service. The teachers existing knowledge, their use of computers, and their technology oriented activities all affect their learning in such courses, and their preparation as teachers.

This study uses data collected in a course entitled "Teaching via the Internet". The course was offered at the University of Minnesota's College of Education. A survey was conducted of each section by the instructor and was designed to support course instruction and not as part of a designed study. The questions dealt with computer use instead of investigating domain specific topics such as pedagogy, curriculum, or psychology. Data was collected over three academic years from five sections of the course. Each student was asked for their name, email address, and eleven multiple choice questions.

All data was examined *post hoc,* and was an examination of existing materials. The study has focused on a number of research questions. Each is examined in detail below. How computer use by teachers changed over the past three years, how that changed paralleled society as whole, and how gender differences in computer use are evident in teachers.

Use of the internet and computers has changed markedly over the period of the study and the results of this study illustrate that change. Over the past few years, we have witnessed exceptional growth in the use of the internet for commercial and educational activities. One would expect teachers, as learned professionals to act as early adaptors of technological innovation. Their use and involvement with computers and the internet should at least reflect, and to some extent precede computer use in the general population.

A final concern examined in the study dealt with gender differences in computer use. While the issue of gender and computer use is a substantial topic and one worthy of further study, this study only briefly examines differences by gender.

## Results

***Demographics:*** A total of 86 students completed the survey; 54 were female, and 32 were male. Respondents by year totaled 34, 32, and 19 students. The male-female ratio varied over the three years, but remained majority female in each year.

**Chonological Differences:** The number of computer owners remained relatively constant at about 82%. In comparison, the rate of use found by the NPR/Kaiser/Kennedy study was 69% for all adults under age 60. Participants in these classes said they use computers at a higher rate than the national average.

Almost all of the students reported 'surfing the net' in the final two years of the study. Buying something over the Internet, however, rose from a relatively rare phenomenon to a fairly common, well adapted one over the two years of the study. In the final sampling, over two thirds of all students had purchased something via the internet, and almost half had made multiple purchases; about a five fold increase in both measures. This change was statistically significant between the first and second years, the first and third years, but not between the second and third years of the study.

Similarly, registration procedures for the course reflected this evolution. About half of the students in the first year of the survey (1998) used the internet to register; in the final application of the survey (2000), about eighty percent registered via the net. Most of the change occurred at the "expense" of in person registration.

**Gender Differences:** Data from each of the sections of the course was combined and examined for gender related differences. Ownership of personal computers was about the same for men and women (84% v 81%). A significant difference was, however, found between genders and their purchases over the internet (t = 3.0%). 31% of women reported one or more purchases via the Internet, whereas 47% of men reported making a purchase. The significance was driven by the larger number of men reporting multiple purchases over the internet. (15% v. 41%).

A significant difference was also found in the means students used to register for the class (t= 2.9%). Women used the internet less (57% v 65%) and the fax more (23% v. 3%) than men. Men registered in person in greater numbers (32% v. 21%). There were not significant differences between the individual methods of registration by gender.

## Observations/Conclusions

There is a base line of technological understanding that is fairly broad among pre-service and in-service teachers; most will have and use computers, access the internet, and evolve in their use of the technology with the rest of society. As computer use expands and develops in society, it appears that new and experienced teachers will continue to develop their computer/internet use and expertise, paralleling the general population. Men may adapt the new technologies sooner than women.

It is clear that while this limited study provides an insight into the a small portion of the newer teachers of this country; additional questions and observations must be made about teachers and computer use. Computer use will continue to develop and change; the educational impact will follow closely behind.

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# Black Bear, Black Bear. What Do You See? We See Teacher Educators Integrating Technology

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**Abstract:** This paper describes a staff development process used to support technology development of both faculty and preservice teachers at a large state university. The authors explain the progressive and innovative slant of the integration model, the three-day training and writing workshop for faculty, and the description of a pilot project using a technology-rich, integrated curriculum on Florida Black Bears to train preservice teachers.

## Introduction

In 1990, a critic of the teacher preparation process proposed an interesting idea to the education community. The critic suggested that if one hundred years ago, a teacher had been cryogenically frozen and brought back to life in 1990, the teacher could just pick up their piece of chalk and without missing a beat, continue teaching. In the tradition of Eric Carle's (1993) Brown Bear, Brown Bear, What Do You See? a group of teacher educators involved in faculty development and a writing technology team in the year 2000

asked ourselves a similar question about what do we see in terms of technology and teacher education, do we see any changes, would we see any changes if we came back after one hundred years, and what do we want to see in the year 2000-2001? Using the content areas surrounding the Black Bear, we (as teacher educators) participated in a three-day training and writing workshop as part of **PT3** (Preparing Tomorrow's Teachers for Technology) funding. The outcome of which was to create a technology-rich, fully integrated curriculum piece to model for our preservice teachers. This paper tells the story of the process of creating "Black Bear, Black Bear" and how we plan for integrating technology.

## What have we seen? How technology has been integrated in the past

In a recent issue of the Journal of Technology and Teacher Education, Hruskocy, Cennamo, and Ertmer (2000) reported that "although computers have been in the schools for nearly two decades, the Office of Technology Assessment (OTA, 1995) reported that relatively few of the nation's 2.8 million teachers use technology in their teaching" (p. 69). For the most part, the technology is becoming available, but the problem seems to be that teachers don't know how to integrate technology into their instruction. Not surprising, since the faculty who trained the teachers during these last twenty years were trained themselves before computers were even a consideration.

Throughout the research literature, teacher educators have reported many ways to use technology to enhance the content areas and to assure the preparedness of our preservice teachers. Like Hruskocy, et al. (2000), Stuhlmann (1998) describes a model developed at Louisiana State University for preservice teachers that trains elementary students to work with teachers and teacher educators. Others have given accounts of mentoring programs using graduate students and education faculty to infuse technology into methods courses (Sprague, Kopfman, & Dorsey, 1998; Zachariades & Roberts, 1995). Falba, Strudler, Bean, Dixon, Markos, McKinney, & Zehm (1999) formulated a team of teacher educators to use new technology across individual content areas in order to choreograph change in teacher education programs. They reported minimal effects in specific courses, but found positive overall effects. Thorson (1999) reports successful integration of technology within science and math courses. Cooper & Bull (1997) offer guidelines for integrating technology in teacher education programs by looking at past practice. They recommend taking the direction of working to integrate technology through the teacher education faculty. Their paper notes that teacher educators who are comfortable with technology tend to create technological leaders as their product. As evidenced by most of these published reports, movement toward integrating technology seems to be effectively applied to separate methods courses and to be routed through the individual teacher educators.

## What do we want to see? Moving in a new direction with a PT3 grant

Responding to the need for integrating technology in a meaningful way, our technology team submitted and received **PT3** (Preparing Tomorrow's Teachers for Technology) funding. The purpose of this grant initiative is to provide a systematic program and process of instruction with increasing levels of technology integration. The levels culminate with an intensive "TechIMPACT" experience for preservice teachers during their final internship. These interns are to be placed in technology-rich schools in diverse teaching settings with technology-proficient teachers. This total process will ensure that preservice teachers who graduate from the teacher preparation program are truly technology-proficient and ready to teach in the new millennium.

The levels of technology integration include foundations courses, methods coursework, Internship I, and Internship II. Like many of the successful programs reviewed in the research literature, individual coursework throughout their program will infuse technology in the following incremental ways. Foundations courses provide basic theory and use of technology. Methods courses provide specific practice in using technology to teach content areas. Internship I provides preliminary practice for teaching technology-based connected lessons, and Internship II provides support during the integration of technology throughout the subjects and throughout the elementary day with themed-use being a goal. Seamon (1999) explores a similar multi-level, interdisciplinary approach. She proposes problem solving as a conceptual framework to create scope and sequences for integrating technology into the elementary

curriculum. This multi-tiered and integrated approach is to be followed throughout our preservice teachers' curriculum and then modeled in a way that they, too, will use technology in content-rich ways to learn in authentic ways and to solve real world problems. To obtain such growth in our preservice teachers throughout their coursework, the process must be systematic and involve all teacher education faculty in the program. The **PT3** grant (Lynch & Mitchell, 2000) has afforded our institution the opportunity to find ways to integrate technology in meaningful and seamless ways.

While four objectives clarify the vision of this grant, this paper focuses on the fruition of the first two of these objectives. All four objectives aim to:

(a) develop learning communities to provide specific technology integration training and support for faculty connecting the College of Education and the College of Arts & Sciences,
(b) develop learning communities to provide systematic training and support for preservice teachers to integrate technology into their curriculum,
(c) develop learning communities to provide internships in technology rich schools in diverse settings, and
(d) develop learning communities to facilitate change providing a structure to transform education that will sustain technology integration including methods to evaluate, share internally, and disseminate information nationally.

First, students are enrolled in a Technology for Educators course, usually taken in the sophomore year. This course provides preliminary study, which develops the foundational understanding of how technology should and could be used, and is the course upon which future levels build. Since this course may be taken at the community college level, university and community college faculty have begun to dialogue to maintain and increase consistency for students.

The next portion of the **PT3** grant requires that students have technology integration modeled in their methods courses followed by intensive "TechIMPACT" modules for Internships I and II. The teacher education faculty that attended the first three-day workshop created these modules. The Internship II module for elementary preservice teachers revolves around the "Black Bear, Black Bear" curriculum that evolved from our writing team. We wanted to extend the ideas gained in the level, which included their methods, courses to show how technology can be seamlessly integrated into all curricular areas using a theme rather than only into a particular curricular area.

## What do we see? We see technology integration starting with me: Faculty development training

To have technology modeled by faculty for preservice teachers requires that faculty are comfortable using technology (Cooper & Bull, 1997). The initial series of training days was established to share a common understanding of how technology integration can be successful using specific approaches and a theme. This faculty development plan was based on National Council for Accreditation in Teacher Education (NCATE) and International Society for Technology in Education (ISTE) Standards (Thomas, 2000). During the initial **PT3** training for our institution, twenty participants from the Colleges of Education and Arts and Sciences formed the first learning community. Systematically and closely following the InTech model developed in Georgia, faculty were immersed in a technology-integrated, constructivist workshop developed around the theme of the environment. Most faculty arrived at the staff development expecting standard technology workshop sessions highlighting a particular software application without much content upon which to apply the technology.

Instead of technology instruction only, participants were required to use technology as a tool for learning about the environment. The workshop facilitators modeled technology infusion across authentic learning problems and all curricular areas, showing us how it all related to the theme of the environment. For many of the participants, this completely different approach allowed them to see an entirely new role that technology could play. Technology was the tool for learning about the environment and for solving problems in science, math, social studies, music, movement, and language arts, rather than technology being *the* focus. The excitement of learning about technology in this way led many teacher educators to race home and revise syllabi for the semester that was starting in five days.

The goals for the three-day experience included: (a) creating curriculum-focused, theme-based technology integration modules for Internship II students; (b) determining how to include all college of education faculty in the discussion of developing a program-wide look at technology, so that each

preservice teacher has similar experiences; and (c) developing a learning community of faculty through which ideas are shared and instruction is enriched by collaboration and dialogue.

## What do we see? We see interdisciplinary teams completing the scene

At the end of a three-day period, teacher education faculty formed interdisciplinary writing teams to take what we had experienced and create a series of integrated lessons for Internship II students incorporating International Society for Technology in Education (ISTE) Standards. Our writing team narrowed the theme of the environment to write the module entitled "Black Bear, Black Bear" related to the Florida Black Bear. These connected lessons (modules) were designed to re-create for the interns an experience similar to what we, the teacher education faculty, had experienced with the technology being integrated as a teaching and learning tool.

The writing teams were formed based on grade levels of interest. Our elementary writing team was truly interdisciplinary, consisting of special education, language arts, math, music and foundations faculty members. The team selected the Florida Black Bear as the content focus for its module. The Florida Black Bear had been the focus of materials published by the Florida Fish and Wildlife Conservation Commission and the Defenders of Wildlife. With the expert guidance of Linda Cronin-Jones (1999), these agencies have created an exemplary resource for elementary teachers in Florida to teach an integrated unit on the Florida Black Bear. The writing team's efforts were to overlay and enhance the already superior resources created for use in Florida schools with applications of technology. The hope of the writing team was to show that technology could be integrated in a seamless fashion that highlights the curriculum and enhances student learning, not necessarily to spotlight technology. After being exposed to the various uses of Inspiration, digital cameras and iMovie, the resources of the Internet, Webpage development, database spreadsheets, HyperStudio and PowerPoint formats, Microsoft Publishing, TrackStar and WebQuest templates, and Timeliner over the course of several days, the team immediately began to see a continuum of technological aids that could be integrated into the unit on the Black Bear to enhance the overall results.

Certainly, elementary school students could have learned about the Black Bear without these technological aids, but when technology can be an overlay, the students benefit and are better prepared for the seamless role technology will play in their world as adult learners and workers. After an intense brainstorming session, each member took a daily lesson plan to be retooled and rewritten through technology. ISTE standards as well as the Florida Sunshine Standards were correlated and included in the lesson plan as well. The writing team pictured our preservice teachers in Internship II experiencing technology integrated into the Black Bear unit throughout five model lesson plans. Following these five lessons, the interns themselves would be asked to find their own paths to technological integration by retooling one lesson plan themselves. In this way, the writing team will be able to assess not only their awareness of technology integration, but to assess the application or implementation level as well. This way of thinking somewhat mirrors the three levels of the original **PT3** grant: capacity, implementation, and catalyst levels (U. S. Department of Education, 1999) as well as the focus and intent of the ISTE Standards.

## Implementing the pilot study: We see TechnoloGEE!

Preservice teachers have taken a Technology for Educators, but the focus of the course was not on integrating technology within lesson design for instruction. Lesson design and implementation is specifically taught in separate methods courses at the university. Often, preservice teachers will not and do not make the technology connections with instruction. Technology implementation most often occurs to complete research using Internet services and to create presentations (PowerPoint). Although technology is listed as a component for lesson design, data collected from other preservice teachers enrolled in methods courses would not usually include technology. Most preservice teachers indicated "not applicable" in their lesson design planning forms when considering technology within their lessons.

To pilot the Black Bear modules in the fall 2000, the target course to teach the Black Bear, Black Bear modules was a methods course, where initial lesson design was taught. The preservice teachers were taught how to write lessons plans. Copies of these initial lesson plans were collected. Upon analysis, these lesson plans were very similar to previous years as to the use, or lack, of technology. Subsequently, these

same preservice teachers then participated in the technology integration modules as designed. Within the methods class, the preservice teachers experienced the various types of technology that had been infused into the environment curriculum. Over a period of several weeks, the preservice teachers experienced technology *within* the professor's instructional process. After each lesson, the participants were asked to reflect upon their learning and the use of the technology. Specific ideas were generated after each session and posted for the members of the class. In addition, written feedback was requested.

At the end of the semester, the preservice teachers in this course will be asked to revise their original lesson plans to include technology. Results of the Black Bear pilot program using the technology-rich, integrated curriculum to train preservice teachers will be evaluated and used to refine this experience before it is implemented with all preservice teachers during the spring semester.

## What have we seen? Concluding remarks

Exposing teacher education faculty and preservice teachers to technology is not enough. Both entities must understand how to integrate technology in a pedagogically sound way so that the curriculum itself is highlighted and the technology is a means to an educational end. By instructing teacher education faculty in the integration process and aligning the learning process around the theme of the environment, teacher educators could easily see the power of *what* we learn as well as *how* we learned it. Technology plays a vital part as a tool for learning. By asking faculty participants in the writing team to create modules integrating technology around a similar environmental theme, faculty will now be better equipped to model for preservice teachers how technology can enhance a particular content area as well as to intensify the total learning process around a theme. In this way, preservice teachers can use the technological and content knowledge experienced during their Internships and gained from modules like our "Black Bear, Black Bear" to reform their own teaching. Truly, "Black Bear, Black Bear" will be seeing teacher educators and consequently preservice teachers using technology effectively.

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# VisionQuest©: Creating Visions and Strategies for Technology Integration

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**Abstract**: As the need for meaningful technology integration has increased, various programs have been developed to support and help pre-service teachers accomplish this complex task. Decisions-makers for teacher-education programs could benefit from instructional information that highlights the strengths of these various development programs. This paper describes VisionQuest©, a CD-ROM teacher development tool, designed specifically to help teachers gain the critical skills needed to effectively use technology in classroom learning environments. VisionQuest© uses an instructional method that focuses on creating a vision and developing a personalized implementation strategy to achieve sound technology integration. This tool helps users reflect on exemplary cases, thereby engendering thoughtful consideration of the visions and strategies that enable exemplary use.

## Introduction

According to the most recent report of the National Center for Education Statistics (NCES, 2000), 99 percent of all public school teachers now have access to computers or the Internet in their schools. However, nearly 70 percent of teachers still report not feeling well prepared to use computers and the Internet in their teaching (NCES). According to the 1998 Technology in Education Report (Market Data Retrieval), only 7 percent of schools, nationwide, boast a majority of teachers at an advanced skill level (i.e., able to integrate technology into the curriculum). Even among our newest teachers, instructional use is not as high as might be expected. Although beginning teachers report wanting to use computers, they often find it difficult to do so when so much of their time is consumed by routine classroom tasks related to organizing and managing instruction (Hruskocy, 1999; Novak & Knowles, 1991). Furthermore, teachers report finding "little incentive to tackle the technical and scheduling problems associated with technology unless they have a clear vision of how the technology can improve teaching and learning" (Office of Educational Research and Improvement, 1993, p. 83).

Thus, the barriers that teachers encounter when trying to integrate technology appear to be less related to a lack of resources and more related to teachers' pedagogical visions and beliefs. Based on recent survey results, NCES (2000) advocates a renewed emphasis on relevant technology educational experiences:

- Teachers with more hours of professional development reported feeling better prepared to use computers and the Internet for classroom instruction. Teachers with fewer hours of professional development reported feeling unprepared to use computers and the Internet.
- Teachers with more hours of professional development tended to use computers for constructivist activities like problem solving or graphical presentations. Teachers with fewer hours tended to use the computers for activities like drill and practice.

Traditionally, technology courses for pre-service teachers have focused on increasing their technical skills and competencies for using specific software applications with little time spent promoting educational best practices related to technology integration. As a result, even though most pre-service teachers recognize the importance of technology integration, visions for integrated practice remain narrow and unimaginative. Although pockets of exemplary technology practice exist, few pre-service teachers have opportunities to observe integrated technology practice in local schools or to examine the beliefs and visions that support exemplary use.

University and college faculty who are responsible for creating programs and/or courses that prepare future teachers to integrate technology in meaningful ways need to be aware of the various programmatic efforts that address these technology development concerns. To facilitate the decision-making process, several key elements need to be considered when selecting an appropriate development tool. An effective tool (Becker & Riel, 1999) will present pre-service teachers with the following set of learning activities:

- Discuss pedagogical beliefs supporting classroom practices of technology-using teachers
- Identify critical similarities and differences among teachers' beliefs and practices
- Outline strategies for increasing technology use among teachers who currently operate at different levels of use

## Solution

To help pre-service teachers develop the complex skills associated with effective technology integration, the VisionQuest© CD-ROM was designed to address the previously identified concerns. Specifically, this tool uses electronic models as a means for pre-service teachers to create visions and develop strategies for sound technology integration. Exemplary models comprise a powerful means for helping pre-service teachers develop robust visions of, and effective strategies for, technology integration. Our intent is to encourage future teachers not just to use technology but to use it in ways that align with educational best practices.

VisionQuest© affords users the opportunity to examine different uses of technology through classroom video examples of exemplary technology-using teachers. The digitized video examples transport users into the classrooms of exemplary teachers so they can examine the instructional practices, classroom organization, and curricular emphases of exceptional users of technology. They can see for themselves the roles played by the students, the teacher, and technology in a classroom where technology is integrated. Users can examine how teachers' visions guide their uses of technology and how visions are translated into classroom practice.

To promote pre-service teachers' development as exemplary technology-using teachers, VisionQuest© provides opportunities to compare one's existing beliefs and approaches with those of the teachers observed. As pre-service teachers consider different ideas and teaching approaches (exemplified on the CD-ROM), changes in beliefs and subsequent practice are fostered.

## Description

VisionQuest© uses the metaphor of a journey as its underlying organizational structure, incorporating and building on three main components of a journey: road map, path, and destination. Embedded within this metaphor is the powerful image of a vision that serves as both the beginning and ending point of a journey, as well as a guidepost along the way.

Users explore the three major components: 1) how teachers planned for integration (their visions and beliefs), 2) how teachers implemented technology within their classrooms, and 3) how teachers assessed the impact of their efforts. Within each component, the users can investigate the following list of topics.

Teachers' Road Map: Planning for Technology Integration

- Forming a Vision for Technology Integration
- Getting Started with Technology Integration
- Identifying Incentives and Overcoming Barriers to Technology Integration

Teachers' Path: Implementing Technology Integration

- Classroom Roles within an Integrated Classroom
- Classroom Organization within an Integrated Classroom
- Curricular Emphases within an Integrated Classroom

Teachers' Destination: Assessing Technology Integration

- Teacher Assessment within an Integrated Classroom
- Student Assessment within an Integrated Classroom
- Sample Assessment Tools used within an Integrated Classroom

Within each topic area, users explore the paths that three sets of teachers (high school, middle school, and elementary) have taken to achieve their current levels of technology use. Each case contains a variety of elements that illustrate how teachers' visions for technology use are translated into practice. In the Road Map component, users examine how teachers' pedagogical visions of classroom practice have shaped their journeys including how they got started, the roadblocks and challenges they faced, as well as the incentives that propelled them forward. To support each component, several classroom video examples comprise the center of each case. Specific videos include teachers' interview comments, reflections on lesson effectiveness, descriptions of how lessons evolved, and discussion of supporting pedagogy.

As pre-service teachers work with this tool, they begin the process of creating visions and developing strategies to prepare them to integrate technology in meaningful ways.

## Instructional Strategy

A key to the success of an instructional program is the strategy used to design and implement the instruction. In designing the VisionQuest© CD-ROM, we not only considered the design of the media, but also a sound strategy for implementation. The VisionQuest© teacher development model (Fig. 1) (adapted from NCREL, 1997) serves as the underlying framework for the implementation of the CD-ROM. The main goal is to facilitate the growth of pre-service teachers' visions for teaching and learning with technology by engaging them in reflective and collaborative activities that nurture and sustain their development.

The six-step model facilitates reflection on, and the transformation of, classroom practice. Teachers are challenged to reflect on their current knowledge and classroom practices, relative to technology integration, and then, after observing exemplary models included on VisionQuest©, develop and pilot personal solutions to relevant classroom issues. Through a collaborative and reflective process, teachers gradually develop their own understandings about how to integrate technology in ways that address relevant curricular and pedagogical issues within their classrooms.

Following the model, pre-service teachers are asked to reveal their current ideas and beliefs about a specific component of technology integration (e.g., classroom organization, assessment). Next, they explore the beliefs and practices, relevant to this particular theme, illustrated by the featured teachers. In conversation with peers, pre-service teachers then consider the critical similarities and differences across cases, as well as make comparisons to their own beliefs and practices, revealed earlier. Recognizing that even exemplary technology integration is ever-changing, users will be challenged to articulate testable

suggestions that refine observed practices. In a continually "evolving expert" process, pre-service teachers will be encouraged to pilot their ideas and refine their own practices as they continue along their unique integration journeys.

**Figure 1: VisionQuest© Teacher Development Model**

## Project Significance

Although most teachers today recognize the importance of using technology in their classrooms, Roblyer (1993) lamented that educators lack a clear vision as to how technology can be used to achieve new goals or implement new teaching practices. Given that most technology training (educational computing courses, in-service workshops) emphasizes learning *about* computers rather than teaching/learning *with* computers, it is not surprising that few teachers can envision, let alone achieve, integrated technology use. Researchers for the Apple Classrooms of Tomorrow (e.g., Fisher, Dwyer, & Yocam, 1996) have suggested that novice technology users may benefit from reflecting on the beliefs and practices of others who have already achieved integrated practice.

VisionQuest© is designed to support the professional development of both pre- and in-service teachers by providing electronic access to models of technology-using teachers. First and foremost, VisionQuest© facilitates the growth of pre-service teachers' visions for teaching and learning with technology. As such, this technology development tool helps these teachers achieve those visions by engaging them in reflective activities that nurture and sustain the change process. By illustrating the best practices of exemplary teachers, this visioning and strategic tool has the potential to inspire reluctant pre-service teachers to initiate their own technology integration journeys. Finally, by increasing the number of technology-using teachers who enter the workforce, we also increase our potential to effect meaningful student learning.

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# Mentoring and Assessment: A Case Study of Initial Teacher Education and In-Service Development.

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**Abstract:** This paper concentrates on the issues pertaining to the determination and accreditation for Qualified Teacher Status in Information Technology in England and Wales, and the role that School Based Tutors have in this process. The major problem faced in initial teacher preparation is that while there is broad agreement that high levels of practicum are important, the lack of suitably qualified teacher mentors in Information Technology is hampering the effective preparation of newly qualified teachers. This paper looks at one model for effective mentor support.

## Description

The role of assessment in the professional year at the University of Sunderland, School of Education is complex in that the assessment provides both formative and summative data, which informs and validates the requirements of a number of external and internal forces. The assessment of secondary student teachers following the professional year falls into a number of different categories and is monitored by a range of mentors as it happens, and also at specified end-points. Broadly speaking the work undertaken by the student teachers can be broken down thus:

| External Professional Requirements | Required by: | Monitored by: | Internal Academic Requirements | Supported by: | Moderated by: | Type of Assessment | Contribution to award |
|---|---|---|---|---|---|---|---|
| Teaching Standards | DfEE/TTA | UST<br>USLT<br>GSBT<br>SSBT | | | | Competency Based - Portfolio Evidence | Pass/Fail |
| | | | EDS291 - Generic Education Module 1 | UST<br>UET<br>GSBT<br>SSBT | UST | Written Assessments - Marked against academic criteria - provides some evidence for Teaching Standards | Marks according to University Grading Criteria (0 - 16) |
| | | | EDS293 - Teaching Practice 1 | UST<br>USLT<br>GSBT<br>SSBT | UST | Competency Based - Portfolio Evidence. Assessment based on student developed portfolio and on observation and response to feedback | Pass/Fail |
| | | | EDS391 - Generic Education Module 2 | UST<br>UET<br>GSBT<br>SSBT | UST | Written Assessments - Marked against academic criteria - provides some evidence for Teaching Standards | Marks according to University Grading Criteria (0 - 16) |
| | | | EDS393 - Teaching Practice 2 | UST<br>USLT<br>GSBT<br>SSBT | UST | Competency Based - Portfolio Evidence Assessment based on student developed portfolio and on observation and response to feedback | Pass/Fail |
| | | | EDExxx - Generic Option Module | UET | UET | Written Assessments - Marked against academic criteria - provides some evidence for Teaching Standards | Marks according to University Grading Criteria (0 - 16) |
| Subject Standards | OFSTED | UST | | | | Portfolio of evidence of prior learning and learning contracts | Pass/Fail |
| | | | EDE207 - Subject Studies 1 | UST<br>SSBT | UST | Written Assessments - Marked against academic criteria - provides some evidence for Teaching Standards | Pass/Fail |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | EDE307 - Subject Studies 2 | UST SSBT | UST | Written Assessments - Marked against academic criteria - provides some evidence for Teaching Standards | Pass/Fail |
| | | | EDT343 - Subject Studies 3 | UST | UST | Development of web site and written evaluation - Marked against academic criteria - provides some evidence for Teaching Standards | Marks according to University Grading Criteria (0 - 16) |
| ICT Standards | DfEE/TTA | UST SSBT | | | | Portfolio of evidence of prior learning and learning contracts | Pass/Fail |
| | | | EDE237 - ICT Module | UST SSBT | UST UICTC | Written lesson plans, evaluations and analysis of ICT in subject teaching. | Pass/Fail |
| Numeracy Test | DfEE/TTA | DfEE/TTA | | | | Examination | Pass/Fail |

Key: **UST** - University Subject Tutor, **USLT** - University School Liaison Tutor, **UET** - University Education Tutor, **GSBT** - Generic School Based Tutor, **SSBT** - Subject School Based Tutor, **UICTC** - University ICT Co-ordinator.

Table 1 - **Assessment Matrix - University of Sunderland, School of Education - Professional Year**

The range of assessment requirements within the professional year as detailed in Table 1 indicates the centrality of the role that assessment plays in the overall management and co-ordination of the programme. The assessment framework balances the requirements of both internal and external mechanisms and quality indicators. It is comprised of assessments of knowledge based outcomes and of the 'standards' which form, in essence, a competency model - evidence for which is derived from a number of sources and validated by a number of partners in the training process. The role of the validating and contributory partners within the assessment framework is vital. While the burden of reporting and moderating falls on the UST (this being part and parcel of the quality management of the programme) the role of the GSBT and the SSBT is such that they contribute to both knowledge development and the progression towards competency. GSBTs and USBTs offer seminars and directed study during school placement for the education modules (EDS291 and EDS391) while the students are working through their directed study manuals to meet the assessment requirements of these two modules of study. The SSBTs also follow a University programme of tasks and activities aimed at providing opportunities for the development and auditing of subject knowledge and applying subject pedagogy towards the collection of portfolio evidence for the teaching and ICT standards.

As the UST responsible for IT Teacher Education I have ultimate responsibility for the management and co-ordination of the assessment requirements within the programme. All written assignments and standards portfolios are marked and validated by me at key points during the academic year. I liaise regularly with the subject mentors (SSBTs) to check that students are working effectively towards the standards and that enough support is being offered within the school in order to generate sufficient evidence for each of the teaching standards. Since the major conduit for assessment is through the UST, and since much of the work has been developed and supported outside of the University, a number of quality assurance mechanisms are in place to ensure fair play across all the secondary programmes within the School of Education. All academic assignments are internally moderated - a sample is second marked (preferably by a subject specialist) - and another sample is moderated by the Secondary Programmes Area Manager. All work is subject to external examination also.

The assessment of teaching standards is carried out by the GSBTs and the SSBTs, and moderated by both USLTs and USTs. A sample of student portfolios is collected at the end of the academic year and reviewed by an external examiner during review week. I see each student individually to moderate his or her portfolios before agreeing completion. What is interesting to me as a teacher educator is the whole question of competency as a measure of teacher performance. Questions we should be asking, especially in ICT where the question of school teacher competency is reported on year on year in the CHMI's annual report, include the question of when is competent simply not enough? Do we require teachers who are more than competent? Are there facets of 'being a teacher' which cannot be assessed either through knowledge based assessments or through a competency model?

## Critical Evaluation

As can be seen in Table 1 the university subject tutor in the model employed for secondary teacher education at the University of Sunderland is a major player within the mentoring and assessment process: almost all the assessment is monitored and validated by the UST. This said, the relationship between student teacher, subject school based tutor and university subject tutor is very important in the collection and validation of evidence for the monitoring and validation of the teaching standards. At the heart of the whole process are the teaching standards as defined in Circular 4/98 (DfEE, 1998). All assessment throughout the programme leads to the development and provision of evidence for the students' knowledge, skills and understanding (KSU) in relation to the teaching standards. While the specific set of teaching standards remains firmly at the core of the system, the ICT standards and the subject have been further developed to provide the student teachers (and SSBTs in their moderation role) with more areas of KSU to evidence for their portfolios.

Although there is broad agreement among the student teachers and the SSBTs with whom I work about the benefits and drawbacks of the teaching standards, there are difficulties beyond those raised by Whitty and Willmott (1995 p217). Student teachers and their SSBTs often need support in their understanding of what the standards actually mean in the context in which they find themselves. The interaction of the UST is crucial here in enabling contextualisation, interpretation and progression to take place. The problem of reductionism, of a 'surface approach' to

the learning taking place, is certainly apparent; but beyond the simple 'what do I need to do, specifically, to achieve this standard?' many student teachers are keen to search for the meaning inherent within the standards. This could be seen as student teachers and their SSBTs beginning to think in terms of the standards as elements in the process of reflective practitioner development (Schön, 1996, Boud, Keogh and Walker, 1996 p52). More often than not however this search for meaning veers towards the pragmatic: what counts as evidence, how much evidence do I need before I can be considered to have met the standard?

The answer is, naturally, not straightforward, and for many students the problem of evidence collection becomes their focus as they progress through teaching practice. Rather than being part and parcel of a reflective and reflexive response to the experiences they have on teaching practice the view that the portfolio is very important leads to the generation of masses of data and a mechanistic approach to the process.

Where the evidence is generated as a result of observations of teaching, reference is made against the narrative to the relevant teaching standard (see Fig. 1). The danger here is that when a student teacher sees the reference to A3 then the assumption is that A3 can be claimed and referenced within the portfolio. The question of whether or not the student understands why A3 can be claimed might not even enter the frame. The fact is - it is referenced and can therefore be ticked off.

**Observation Record**

| | | | | | | |
|---|---|---|---|---|---|---|
| Student Name | A Student Teacher | Date | 28/03/00 | Observer | Chris Jones | |
| Class Observed | GNVQ - I - Unit 7 | Time | 0900-1100 | SSBT | | |
| Placement | A North East College | | | | | |
| Teaching Standards | Commentary | | | | | |
| B1 B3 | You introduced the session well - your exposition of the learning outcomes clearly identified to the students the structure and approach that they would experience during the learning session today. You bad planned some leeway into the session to allow for student drift owing to the change of venue, which was necessary, since you had invited in a visiting speaker. | | | | | |
| A3 | The students obviously had the background knowledge available to them in order to answer the questions that Steve threw at them. They appeared confident and able. Your brief to Steve had been clear in that he was able to pitch his delivery appropriately to meet the learning needs of the students. | | | | | |

Figure 1 Example of Feedback Sheet for Student Teacher

The danger of following such a 'narrowly mechanistic approach' (Furlong, 1995, p230) is that while it enables student teachers to see what it is they have to do in order to meet the requirements, it removes elements of creativity and values from the teaching process. It reduces the concept of the 'teacher as professional' to that of the 'teacher as technician'. Furlong (op. cit.) would have it that such a consequence would be self-inflicted. I agree that the standards do establish a minimum entitlement for all student teachers, that there is a rigour in terms of systematic training and that they help to focus and structure our judgements of student teacher performance. The notion of the self-inflicted wound is not, in my view appropriate. It is the assessment of the assessors that drives 'the standards, the whole standards and nothing but the standards' as the tenet for initial teacher education.

The OFSTED criteria for the inspection of providers of initial teacher training make it clear that students must "when assessed, demonstrate that they meet the standards set out in circular 4/98, ... and for the use of ICT in subject teaching." (OFSTED/TTA, 1998, p 7) The evidence then for assessing the providers of initial teacher education is to be derived from observations of how the students are meeting the standards - all the standards. Beyond the teaching standards, there are the ICT standards, and for those subjects for which a national curriculum for ITT is not defined, the institutionally developed subject standards which demonstrate that a student is educated to degree level in the subject, and can apply that knowledge effectively within GCSE and A Level teaching.

What this means is evidence - portfolio evidence. The concept of student teacher as burgeoning reflective practitioner disappears under a mountain of paper. Referring back to Table 1 it is clear that the student teachers at the University of Sunderland have to undergo a lot of assessment in their thirty-six weeks of study. This pattern is repeated all over the country - and not just in England and Wales; Scotland too has a perceived problem of 'competence overkill':

> The SOEID guidelines for initial course list some 48 competences. The ICT consultation document takes just two of these and elaborates them to suggest another 46 competences relating to them. If the same elaboration were appropriate for all 48, we would have a total of 1104 competences in total ... It is not my intention here to ... tackle the more fundamental argument relating to the notion of competence based approaches in general, rather I wish to use this example to suggest that initial courses are in danger of being overwhelmed by this process of accretion. (Ward, 1999)

The danger of the competency model of teacher training, while demystifying the process of change from student through to student teacher and onto proto-professional (Whitty, 1995, p202, Whitty and Willmott, 1995, p217), is that it breaks the whole process down into a set of individually achievable targets which can, as separate entities, be recorded and evidenced. This may not, in terms of the NVQ 'can do' approach to vocational training, be a bad thing, and the discourse between Whitty and Pring (Moon and Shelton-Mayes, 1995, p235) highlights the dilemmas that both university and school-based teacher educators have to face. The whole question of when is a teacher more than the sum of the parts is very important in the process of making and recording our judgements of student teachers and their performances, both as academic students and as developing teachers. Moon and Shelton-Mayes (op. cit.) describe how the OU model has gone some way towards mitigating the attempts 'by assessors to *tick-off* competences in a discrete and isolated way' (p237). The inclusion of a values element which requires student teachers to demonstrate how their achieved competency relates to the professional qualities of the practising teacher is one which in some respects acknowledges the fact that being competent requires more than just the ability to meet a series of separate targets. What is implicit within the

model they describe is the notion of progression (from novice to expert - Berliner, 1994) within the individual standards and also recognition that the standards should be seen not as separate entities but rather as contributory elements which describe the whole teacher.

There is, however, within this, a certain dichotomy that can obfuscate the training process and begin to re-mystify it. As Pring (1995) would have it, you either are, or are not competent. The definition and application of a set of standards appears clear and uncomplicated. The pattern is set out and there are, seemingly, definite pointers which delineate both the process to follow and the evidence indicators necessary for successful completion. The contradiction, or indeed the difficulty, for some comes from the demand for quality: the requirement for the student teacher to understand and apply the principles that underpin the standards.

This was a tangible dilemma for the ICT partnership in Sunderland. How were we to clarify the 'conceptual mess' (BERA, 1992) that the standards presented to us? Our partnership meetings allowed us opportunities to discuss and challenge the notion that the standards, if achieved, presented us, absolutely, with a passing student. Taking the Berliner scale (op. cit.) as our starting point, we looked at what it was that separated the novice student teacher from the competent one. We also looked at what is was that indicated a student teacher who was likely to progress during the induction year, and beyond, to expert status.

The importance of this discussion became clearer for the SSBTs as we began to tease out some of the distinctions. The student teacher beginning a first placement has more to deal with than the standards - there are at least two stages to go through (Maynard and Furlong, 1995) before assessment plays a part. And the SSBTs had different role to play in this also. The difficulty of balancing the nurturing role (Anderson and Lucasse-Shannon, 1995) with that of assessor and judge had to be recognised: and in doing so the SSBTs began themselves to see that the competency model was not sufficient in itself as the modus-operandi for teacher training. The recognition that they too played a part in professional growth and could begin to vocalise the associative benefits of the reflective practitioner model of teacher education (Elliot and Calderhead, 1995, Maynard and Furlong op. cit.) allowed us to begin to analyse the standards and to look at them as the basis for a more developmental and reflective model of student teacher assessment (Berrill, 1992).

The explicit inclusion of reflection and consolidation on the part of the SSBT into the mentoring and assessment process acknowledges that:

> The teaching profession is complex and heterogeneous, and the development of competency standards needs to take account of both the similarities and differences between various categories of teacher (e.g. beginning teacher, *master* teacher, primary teacher, secondary teacher, teacher of adults) and the variety of different specialities within these categories. (Hager and Gonczi, 1996).

There was a pragmatic element too in all this. The course was being re-inspected by HMI this academic year, and while all aspects of the programme were under review, the whole area of how the partnership was addressing the 'accuracy and consistency of the assessment of trainees against the standards for QTS' (DfEE/TTA, 1998, p7), was an area for specific examination.

This being so, the team began to distil our understanding of the Berrill scale we had reviewed and to begin to incorporate these within the teaching standards and OFSTED's criteria for the grading of cells within the framework. This meant identifying a four-point scale in line with the expectations set down in the framework:

| | | |
|---|---|---|
| 1 | Provision is consistently of very good quality with several outstanding features; | Very Good |
| 2 | Provision is of consistently of good quality with no significant weaknesses; | Good |
| 3 | Provision complies with the Secretary of State's criteria, but requires significant improvement to ensure that the trainees are enabled to reach a good standard of teaching; | Fair |
| 4 | Provision does not comply with the Secretary of State's criteria. | Poor |

(DfEE/TTA, op. cit., p8)

We arrived at a series of statements which exemplified the nature of the performance which underpinned the achievement of the teaching standard whereby a student teacher could be deemed to have provided evidence for the standard - or not as the case may be. While the students themselves were not specifically made aware that they were being assessed in relation to the exemplification, the exemplification grid was seen as central to their professional development and set an expectation that, for each standard, they would be working towards achievement in the cells at the left hand side of the page.

This, as in the Open University model, enabled students to demonstrate clearly that as they were developing and collecting evidence for their teaching standards portfolio they were developing also 'a foundation of evidence for their capability in relation to their professional qualities' (Moon and Shelton-Mayes, op. cit., p 237). They were also working against clear criteria that enabled both themselves and their assessors to make summative judgements about their level of performance.

What it has also done is to focus the SSBTs in on the meaning and application of the standards. Rather than seeing them as a mechanistic tick list, the exemplification document encouraged discussion about the standards in a way that encouraged reflection at all levels. SSBTs were more focused in their feedback to the students and were in many respects more able to be objective in their judgements and commentaries. The students too commented favourably on the system in their feedback about the programme at the end of the year:

> My mentor was able to give me specific feedback about how I might improve in my approach to classroom management. This had happened during my first teaching practice - but the reference to the matrix seemed to make it much more focused.
>
> I was able to use the exemplification of the standards to help me to set my own agenda. It made me realise how important it was for students to action plan and to set realistic targets for development: it improved my understanding of the teaching of GNVQ Advanced IT no end.

What clearly happened for some students, I dare not claim that it happened for all, was that the pragmatism of the matrix helped them to become more reflective about the nature of the programme, and about teaching itself. The HMI inspection became, in many respects, incidental: the change to our approach which had been fostered by our previously poor inspection results took on a life of its own and enabled both SSBTs and student teachers to be much more confident in their analysis of their strengths and weaknesses.

There were students and SSBTs who simply saw the exemplification sheet as 'yet another document' to deal with. It was seen as part of the bureaucracy which for some simply slotted into to the notion of the 'professional community that is increasingly coming under the dictates of central government' (Hoyle and John, 1995, p160). While these participants presented a minority opinion - that opinion is valid in that the professional year has generated a number of booklets and help sheets that define and illuminate the structure and process of the programme. Consolidation is necessary in order to continue the process of demystification and to continue to encourage a reflective and reflexive approach to the teaching standards.

**Summary and Recommendations**

The progress made towards reflective practitioner status, by both student teachers and SSBTs, as a consequence of the assessment of student teacher competency owes something to the application of elements of total quality management within initial teacher education (Bank, 1992, Latta and Downey, 1994). The focusing in on strategies for improving the data collection for assessment and review processes, for both internal and external audiences, has provided opportunities for changing practices and raising the performance threshold (for individuals and for the partnership as a whole). Hoyle and John (op. cit.) in their review of government policy and its impact on teacher formation, while expressing some concern about impending de-professionalisation, offer a view which reflects appropriately the effects of the work on the measurement of student teacher performance against the standards, and which indicates that many teachers "have been enhanced professionally by the greater contact and involvement with teacher educators." (p161)

Working together to come to a common and agreed format for the exemplification of the teaching standards has enabled the training of teachers of ICT to begin to focus in on what it is that establishes the foundation for successful subject teaching within a professional and accountable context. The distinction between the teaching standards and the notion of simple competency has been an important one for us to make. The acceptance that being competent is but part way towards being a teacher and also that the notion of levelness can be applied to the standards in order to begin the process of personal and professional action planning is important also. What is interesting in the current climate is that the language of the teaching standards, the application of portfolio development and the notion of performance assessment are part and parcel of the threshold standards recently applied to teachers at the top of the pay scale.

This paper has concentrated mainly on the way the partnership between the UST and the SSBTs has contributed to the assessment of the teaching standards. The integration of a competence model with that of reflective practitioner has been worthwhile in terms of student confidence in their preparedness for teaching as measured at the end of their programme of study. There are other areas for development within the programme where the partnership can usefully work together to improve the quality of the experience for the student teacher. Table 1 demonstrates clearly that the professional year is over assessed and presents a burden on the students which can be lessened without undermining steps to ensure that they have met all the standards (both explicit and implicit) defined by the programme. This has to be a clear target for the next academic year: the addition of national tests for literacy and ICT on top of that for numeracy is one driver for a review of assessment. We have to question again the type and quality of evidence that exemplifies a standard and establishes the competence embedded within it. This will certainly provide a focal point for at least one of the partnership development meetings during the next academic year.

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# THREE COMPUTERS IN THE BACK OF THE CLASSROOM: PRESERVICE TEACHERS' CONCEPTIONS OF TECHNOLOGY INTEGRATION

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**ABSTRACT:** Faced with a new generation of pre-service teachers, teacher educators may easily assume that these young men and women are technology savvy and have mastered the skills required to word process, create presentations, surf the web, email professors and friends, and conduct their research online. Nevertheless, these same pre-service teachers may express anxiety and doubt about their ability to incorporate technology into their future classrooms. Our study, based on interviews with pre-service teachers, looks at this disconnect between using technology with confidence for personal use and using technology as an educator. We consider possible sources for this disconnect, and offer an alternative conception of technology in education we call "technological pedagogical content knowledge" (TPCK) which extends beyond computer proficiency to understanding the effect technology may have on student's conceptions of subject matter, the inevitable challenges that accompany technology, and the judicious use of technology when new forms of representation are most appropriate.

## Introduction

In an age of technology related standards for students (ISTE, 2000) and teacher education programs (NCATE, 1997, CEO Forum, 2000) pre-service teachers feel the weight of knowing that the schools in which they will eventually teach require them not only to be personally proficient with computers, but also translate that proficiency into an effective use of technology in their classrooms. Schools of education and schools as potential employers often assume that these young teachers, many in their early twenties, have been inculcated into the use of technology from a young age. We imagine that this up and coming "generation" of teachers is technology-savvy, having grown up word processing their assignments, taking weekly trips to the computer lab, and mastering Nintendo. And our assumptions may not be far off. Pre-service teachers have had more exposure to technology, and as a result are quite comfortable surfing the web, emailing professors and friends, and conducting research online (Brown, 2000; Tapscott, 1997). But how does this measure of comfort translate to the classroom? Not well, according to our research with pre-service teachers. We found that pre-service teachers who feel comfortable with technology in their daily lives express reservations about using technology in their future classrooms. The source of this disconnect we have defined as a lack of "Technological Pedagogical Content Knowledge."

## Question

Shulman (1986) defines pedagogical content knowledge as that form of pedagogical knowledge that "goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching...the particular form of content knowledge that embodies the aspects of content most germane to its teachability." For Shulman, pedagogical content knowledge involves ways of representing subject

matter so that it is comprehensible for students, and understanding the kinds of preconceptions and misconceptions students may have as they embark upon learning the new subject. Likewise technological pedagogical content knowledge (or TPCK) extends beyond proficiency with technology for personal use to an understanding of how technology can be integrated with subject matter in ways that open new avenues for student understanding of the subject matter *and* the technology itself (Jonassen, Peck & Wilson, 1999; Barab &Duffy, 2000). In our conception of a teacher's TPCK, the teacher has the ability to use technology judiciously, when new, technologically enabled forms of representing subject matter knowledge are most appropriate. He or she understands the effect technology may have on her student's conceptions of the subject, the extent to which student's use of technology may actually impede understanding of a subject, and the inevitable challenges that accompany any new technology.

In this study, we sought to determine the level of preparedness and comfort teachers exhibit as they begin to integrate technology into their practice in order to better help them understand how technology can potentially transform their teaching. We also wanted to get a sense of how teaching with technology fits into our student teachers' evolving pedagogical content knowledge.

**Methodology**

Using a grounded theory methodology (Strauss & Corbin, 1990), we eschewed coming to this study with any one specific theory to prove or disprove; rather we focused on collecting and studying our data to see what theories, if any, could be generated. Eleven pre-service teachers at a mid-sized New England private university, all of whom were students in a course entitled Transforming Classrooms with Technology, agreed take a survey and participate in interviews. The semi-structured interviews lasted approximately 20 minutes, were audio taped and later transcribed (See Appendix A for a list of the interview questions.)

Our initial review of the data revealed three areas related to teacher education that seemed to contribute to the pre-service teachers' lack of confidence in their ability to incorporate technology into future classrooms. Once identified we then used these areas to code the interviews, altering and refining our codes as needed. Ultimately, these areas were defined as Modeling, Usage, and Pedagogical Fit.

The first area we call modeling, which, for the purpose of this study, encompasses the kinds of modeling pre-service teachers encounter in their K-12 experiences and in their pre-service years. Our idea of modeling here has strong ties the to notion of "hidden curriculum" or the "content of the messages 'that are transmitted to students through the underlying structure of meaning in both the formal content as well as the social relations' in teacher education programs beyond that conveyed by the stated curriculum" (Ginsburg & Clift, 1990). We have altered this definition to include the messages conveyed by the formal content and social relations in teacher education programs and in the schools our pre-service teachers attend as both students (K-12) and as future educators. Thus, modeling is defined as those messages received by students through formal, stated curriculum; the actions of their teachers, professors, and cooperative teachers; and the underlying social relations they perceive in the use of technology in education (see also Carlson and Gooden, 1999). We also consider how these aspects of modeling have engendered certain preconceptions about teaching with technology.

The second area of concern we have defined simply as "usage." How have our pre-service teachers used technology in the past? How do they currently use technology in school, at home, and in their practica? By asking these questions we gain insight into our students' level of comfort with technology and the extent to which they mesh with current assumptions about young people and their technological prowess.

The final area we have defined as "pedagogical fit." We encouraged students to design their ideal classroom and discuss how technology relates to their philosophies of teaching, student learning and curriculum building. Our students' visions of themselves as future teachers who use technology are a revealing look at how, even at this stage, they have fixed certain limitations and potentialities into their conceptions of teaching with technology.

## Results

### Modeling

As we described earlier, our concept of modeling includes both the stated, formal curriculum, the actions of their teachers, and the social relations they perceive in the use of technology in education. In terms of a formal curriculum, our School of Education has incorporated two classes, Computer Applications for Educators and Transforming the Classroom with Technology. Our students noted, however, that these

courses were not required either as a graduate or an undergraduate. "I'm not very familiar with computers...its not like a requirement in education or anything...and then my senior year my dad was like (because he's really into computers) you should look into it for an elective."

Our students also came away from their methods courses with both positive and negative attitudes towards various forms of technology, depending on how successfully it was modeled in class:

"I think it's important to have an overhead. The more and more methods classes you get into now that's what they stress...Well, I guess I'm biased because I spent four semesters with the same teacher for my math and she is always using overheads...so she's gotten me in the mind set of thinking."

"A couple of years ago in one of my Ed classes I was supposed to create a web site and I got through the whole thing and we had trouble I guess finishing it or getting it on the computer, it never ended up working so from then on I haven't tried to make any more web sites--it was a tad bit frustrating. I'm not sure what happened, a lot of people had trouble with it, and the professor ended up not counting that project."

In their practicum experiences, students who observed their cooperating teachers using technology came away with strong notions of the possibilities and limitations presented by technology. Most students said seeing their cooperating teachers use computers was important for their understanding of how technology works in the classroom:

"I still would love to see teachers that are using it now before I go out [to the practicum]. I can take out a program and try it but I won't know how it works until I really see kids with it, so any time I get an opportunity to see teachers using it I think its great and I' m excited. As much as I feel comfortable using it I'm always looking in my pre-pracs to see it out there..."

In addition, students expressed concern over the deep divide in funding between school systems in various parts of the area and recounted some of the frustration that accompanied poor quality hardware in districts that could not afford better resources:

"When I did my full practicum the computers in the class were down the entire semester I was there, it was awful. A couple of the other classrooms were working, there were like 3 computers in each class. The program...was a bunch of English and science and social studies activities the kids can use, but you can't do much else on it besides that. It was part of a...technology grant but I couldn't do any work on the computers... so that was a little frustrating."

Students also worked closely with the cooperating teacher to develop lessons and units. The cooperating teacher counted on the pre-service teacher's knowledge of computers and ability to research effective software programs.

"She [the cooperating teacher] loves the fact that I can't wait to bring in different things... like we were doing a unit on money and I brought in this money program but I never got to see anyone use it and she was just getting into it. She needed someone like me...the two of us worked out great together."

Another student, however, felt the pressure of having to impart her knowledge to other teachers:

"[When] they found out I was a math computer science major, it was like bombardment of 'show me how to do this, show me how to do this.' I did Kid Pix and all of a sudden I was presenting to the whole faculty how to use Kid Pix. It was good to see that they want to know and they were interested in using it. But some people didn't know how to print --they didn't know where the print function was." In fact, a number of our students expressed apprehension with being expected to assume a leadership role in modeling the use of technology in their courses and for their colleagues as a first year teacher.

### Usage

Without exception, our pre-service teachers said they had grown up with computers in their home and in their schools. They each felt comfortable word processing, emailing, and searching the Internet. Some even had programming experience using LOGO or Hyperstudio in elementary school and high school. Despite similar backgrounds, however, students varied widely in their descriptions of themselves as computer users. Some students saw themselves as a "computer person," confident in their ability to translate their skills into a variety of settings. For these students, using technology in teaching was simply an extension of their identity. One student said, "I'm not typically a Barbie person--I used to love to play with Legos...we'd spend hours putting them together and I loved trying to figure...like even now my dad will call me and ask how I do this on the computer." Conversely, other students focused on what seemed to be a rather ill-defined set of technology skills that had escaped them but which they felt others had mastered. For example, a student told us she had learned LOGO in elementary school, word processed all

her papers, conducted research on the internet, and had a computer at home while growing up. Nevertheless, she described herself as "very basic": "my whole family is good with computers; I just never felt comfortable with them because I didn't really know how to use them but I'm slowly learning now."

**Pedagogical Fit**

At this point in their education, our pre-service teachers had already begun forming a teaching philosophy, and when asked how technology fit into that philosophy, some of the responses showed a measure of uncertainty. They felt sure that technology would play some role, but just what that role entailed was unclear:

"Right now, because I don't know enough to teach my students how to use it I might not want that much [technology in the classroom] but if I was very confident in using the computer and programs and things like that I would want a lot of technology in the classroom."

Other students' conceptualizations of themselves teaching with technology were defined in opposition to what they observed in their practicum

"In my teaching I'd use it as an integral part. I think it goes hand in hand with instruction. I don't like to get up in front of the classroom and teach, I'd rather have kids working on the same topic area but doing different things, you know, like a computer center, and then kids working on other stuff, and I'd use that at the same time. I think now with a lot of older people in the teaching profession that it's [technology] just used as an enhancement. It's used like 'I don't have anything else to do so put the kids on the computer' because the teachers don't know how to use it."

**Implications**

Our student's responses suggest that we must be aware of the messages sent by the pre-service experience (both coursework and practical), and the ways in which technology is utilized in those contexts. In addition, our use of technology for teaching must not be seamless. We should make explicit exactly how technology functions in our classes, how it affects student understanding, and how it presents challenges our students must be prepared to handle with grace. Teachers of education should look to our student's past experiences and encourage them to discuss how technology has played a role in their lives. We cannot assume that our students come to us as blank "technology" slates. They have had encounters with technology, both positive and negative, throughout their school years and these encounters have left their mark. At the same time, we cannot assume these same encounters with technology sufficiently encompass all that a student needs to know in order to use technology effectively in his or her teaching. Despite what some teacher educators think, as suggested in a recent survey of technology use in schools of education (Leh, 1999), basic word processing and Internet search skills are only part of the knowledge teacher need to use technology judiciously and effectively.

Throughout this study, we were continually stuck by the prevalence of what we came to think of as the "3 or 4 computers in the back of the room" model of technology. For a majority of students, this "add-on" technology use, where students are sent to work on computers in the back of the room for remediation or enrichment, is the extent of their understanding of how technology fits in the classroom. In our course, then, we offer our students a much more complex picture of technology in education. We encourage them to consider that despite the push for technology in classrooms, there is little consensus that technology provides a positive impact on student learning or, in our current outcome driven society, on standardized tests (Jones and Paolucci, 1999; Mellon, 1999). By assuming that technology in schools is a given, predetermined expectation, rather than exploring with our students essential questions about access and impact on learning, we do them a disservice. Pre-service teachers should be actively engaged in creating their own informed opinions and perspectives on technology in their classrooms, and not be passive recipients of an overly simplified view that may be garnered from reading national technology standards (ISTE, 2000) alone. Another side of this complex picture is that of the relationship between learning theories and strategies and technology. Students should be engaged in thinking about how technology can be integrated into the various learning strategies to which they have been exposed in Schools of Education. It is unthinkable to position a single learning strategy as the best method for teaching; rather students are presented with a number of approaches that can be implemented depending on the students, the classroom and school context, the nature of the material, etc. And yet we easily might offer a single approach to technology driven by a single strategy, i.e., using drill based software programs in support of a delivery model of knowledge in education.

Finally, the overall message of our course is to encourage an innovative, responsible, and critical approach to technology in education in each of the areas we mention above. In other words, we seek to help our students develop a level of TPCK, an understanding of how technology can be used to teach content in rich and meaningful ways and the far-reaching implications of that use. The missing component in our program, and we presume in a majority of teacher education programs, is the facility to place our student teachers in classrooms with experienced teachers that possess a sophisticated level of TPCK. It is imperative that our cohort o f Twenty-First Century teachers, early on, have the opportunity to "work at the elbows" (Collins et al., 1989, Barab & Hay, 2000) of expert teachers integrating technology as a meaningful part of classroom instruction.

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## Appendix A

**Questions from Semi-structured Interview**

**A. Background information**

1. Talk a little about your personal use of technology—any projects, web sites, etc. you would like to describe or show us?
2. As both a student and a teacher, describe some of your experiences with technology in the classroom (how did you use technology and, if relevant, how did you teach with it?).

**B. Technology and classroom instruction**

1. When you think of the word "technology" what comes to mind? What comes to mind when you think of technology in classroom?
2. Describe your experiences with technology in K-12 courses.
3. What is your opinion of equity issues and technology (is technology a divider or an equalizer)?
4. Do you see technology as an enhancement to curriculum & instruction or an integral part of curriculum & instruction?

**C. Overall**

1. What does it mean to you to "transform classrooms with technology?
2. Describe or sketch your ideal technology classroom.

# Using Dreamweaver 3 For Generating Preservice Web-Based Teaching Portfolios

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**Abstract:** One of the tasks that our students have in our Educational Psychology / Introduction to Teaching sequence is that of creating an assessment and professional portfolio. This assignment becomes the foundation for their continuing portfolio, which they build on in the remainder of their Education coursework, and becomes the basis for their professional portfolio. Last year, for the first time, we changed our format from a portfolio that was stored in a binder to one that is stored on the World Wide Web. We found that this allowed us to assess our students in a way that also gave them an important tool as they enter the teaching profession. Challenges that we faced in this having our students complete this assignment, responses to those challenges and outstanding questions are addressed.

## Background

Colleges and departments of education have shown a growing interest in performance assessment. The stiff competition for teaching jobs has resulted in a chorus of voices telling both prospective teachers and practicing teachers, "You ought to develop professional portfolios" (Campbell, Cignetti, Melenyzer, Nettles, & Wyman, 1997). In our Educational Psychology and Introduction to Teaching courses, we found ourselves joining that chorus about five years ago with the addition of a final examination in the form of a portfolio assessment. Our expectation was that our students would continue to develop their portfolios until the end of their preservice education and would also use them as part of their professional growth in their teaching careers.

In addition to viewing portfolios as a good thing to do for our student's professional growth, our accrediting body's increased emphasis on performance-based assessment tools was moving us toward using portfolio assessment. The Interstate New Teacher Assessment and Support Consortium (INTASC) standards require, among other things, that beginning teachers demonstrate entry-level competencies of teaching through the development of a portfolio (Bullock & Hawk, 2001). The INTASC standards have been incorporated into the National Council for the Accreditation of Teacher Education (NCATE) new accreditation process for teacher-education programs. Thus, the new NCATE standards have been developed with an increased focus on the performance of preservice teachers, as they become teacher candidates. When Arthur Wise (1998) announced the new direction for NCATE, he noted,

> The emphasis on performance has been spurred by a realization among policy makers that changes in curriculum and courses have not significantly increased student achievement. The number one factor in enhancing student learning is the capability of the teacher. How to determine quality and knowledge are central questions as NCATE develops its performance-based accreditation system. (p.1)

Because the NCATE standards are a critical element in our education program's review process, we have found increasing institutional support for requiring a portfolio in our course. Dorothy Campbell (2000) and her colleagues note that the key question that a quality teacher-education portfolio hopes to answer is "What do candidates know and what can they do when they graduate?" That question will continue to shape the content of our portfolio assignment. Currently the content is based on the major content areas of the course but it will increasingly need to represent a significant portion of our department's response to and adaptation of the INTASC standards.

## Portfolio Components

While the content of our portfolio will undergo significant change during the next few years the basic components will likely remain the same. Bullock and Hawk (2001) identify four portfolio components: purpose, audience, evidence, and reflection. The purpose is for students to demonstrate their knowledge, skills, abilities, values, and beliefs about educational psychology and classroom practice. The content will expand as the students continue their professional course work. Students design their portfolios with both external reviewers and themselves as the audiences. External reviewers are currently their peers and the course instructors, but the review process will likely soon involve some sort of exit committee as the students become teacher candidates. Evidence currently collected includes papers that synthesize knowledge, lesson plans, units, use-of-technology examples and other professional documents. The students write reflective introductions to each section of the portfolio, explaining and reviewing the content to be encountered by the reader.

Initially a standard paper/notebook portfolio was the final outcome. Students presented their portfolios at the end of the course to a group of peers in a mock interview setting. As the course instructors, we then evaluated the portfolios as a final examination for the course. The portfolios were then returned to students with comments and suggestions for revision. The students were encouraged to revise and develop new material as they moved toward teacher-certification.

The final products were often well designed and clearly showed what the students had learned. But they were also large and cumbersome and did not seem to be all that useful as a beginning step toward a professional portfolio. We suspected that, while these portfolios would give those hiring our graduates an adequate and accurate picture of the student's knowledge and skills for teaching, they were not being used very often. Having only one large printed portfolio meant that a student would likely not use it except as part of an interview and often near the end of the candidate selection process. Thus a desire for more portability led us to explore other media as vehicles for the portfolio. Initially we thought that the students might create a CD-ROM that included all of their written work and could also easily incorporate video and other visual artifacts. These could be produced in multiple copies. However, as we were beginning to move in that direction, easy world-wide-web design tools became available. Thus during the spring semester of 1999, we made our first attempt at a web-based portfolio.

## Challenges

We faced a number of challenges in our attempt to move our students from paper portfolios to web portfolios. Some of them were relatively easy to address while others were more difficult.

The first challenge was to determine whether we had the technological resources at our disposal to make this assignment possible for our students. If the college's Information Technology department would not support students having ready access to computers and software that will allow them to do this task with relative ease then a web-based portfolio would not be possible. We were fortunate that, in addition to many of our students having their own computers, our college has a well equipped computer center and residence halls where students have access to computers with web authoring software, in our case, Macromedia's Dreamweaver 3.

Dreamweaver was a choice that we endorsed for a variety of reasons. The program is easy to use with a WYSISYG interface. The commands are intuitive, using many of the same features found in most software

so the learning time for those who are computer literate is minimal. The program is also very powerful, allowing the students to easily do simple web creation but also giving them the opportunity to do more sophisticated things (such as the inclusion of frames) if they wish to do so. Dreamweaver also includes an ftp client, which makes uploading of the web page to the college's site (or to another site of the students' choosing) relatively simple.

Even with the opportunity to use computers and the availability of software, some students were resistant to the idea of creating web portfolios. Some of them were under the impression that this would involve a lot more work than paper portfolios. Others who were uncomfortable with the use of computers were frightened of the prospect of being forced to use computers to such a great extent for something with which they were unfamiliar. We addressed this issue a number of ways. First of all, we chose to begin this project in a semester in which our class sizes were relatively small, only about 24 students between the two instructors. This allowed us to give added attention to those students who needed additional support with the technology. In addition, we met as a class with a member of our Information Technology staff who taught the introductory lesson on the use of Dreamweaver. This instructor and others in the IT lab were available for assistance other times as well.

Even with the promise of support, some students were unconvinced that creating a web portfolio was a good idea. We had coincidentally scheduled a class session in which three local high school principals visited our class and answered questions regarding expectations for new teachers and other educational issues. One of the first questions that our students asked challenged the notion that new teachers needed to be technologically adept. Specifically, one student wondered what these principals thought of web portfolios. The response from the principals was overwhelmingly positive about the portfolios, pointing out that it allowed them as potential employers to have access to some information about the prospective teacher easily, without going through all the steps of requesting information from the college. They also said that they look to their new teachers to bring a certain technological expertise to their school. They recognize that their current staffs have many teaching skills but could use help in including new technology into their teaching. They hope that younger, more technologically savvy teachers can help their schools better meet the needs of students in a technological society. Hearing these sentiments from school principals was compelling for our students. Complaints about the assignment diminished almost immediately.

Once we got into the project, though, we realized that more conceptual challenges needed to be faced. Our traditional portfolio assignment included a number of essays written by our students. For example, they were required to write papers that indicated their view of the learner and the curriculum. Other manditory written materials include a complete management plan and at least one unit plan. While it is technologically easy to convert word processed documents to web documents, we realized that technology was only part of the issue. Merely transferring essay to the web may lead to ineffective presentation. In researching web design issues we discovered that in reading web content "It was more than three times as common for users to limit their reading to a brief as opposed to reading a full article. Even when reading a "full" article, users only read about 75% of the text." (Nielson, 2000) Consequently, merely transferring word processed documents to the web would not be sufficient.

One of the purposes of assigning these papers was to encourage reflection on the part of the students regarding to their view of the learner and of curriculum. We did not want to lose that important piece of our curriculum, nor did we want our students to present themselves in their portfolio with the equivalent of sound bites. Our dilemma was how to allow our students to present thoughtful reflections in the context of a medium which seems to exist in contrast to such presentations.

To address this issue we asked our students to do two things. First the students wrote the essays for our classes as they ordinarily would, going through a peer review before submission. After the instructors have graded and commented on the papers they were returned to the students who were then asked to revise them again before including them in their portfolios. Recognizing the way web documents are read, however, we also asked them to prepare a 200-word abstract of the essay that they could post on the site along with a link to the full essay. In this way we not only met our objectives but also gave those looking at the portfolio (both fellow students as well as potential employers) an opportunity to quickly assess the

views of the students while being able to look at a more complete treatment of the subject. We also encouraged them to make liberal use of headings and links.

## Results

The results from our first attempt at web portfolios yielded mostly positive results. (Examples may be seen at http://www.calvin.edu/~lblack20/index.htm or at http://www.calvin.edu/~lkonin69/portf.htm) Many of our students created web portfolios that truly reflected the vision that we had for this assignment. One noteworthy result is that a few of the best portfolios came from students for whom work in web page authoring was a new and sometimes frustrating experience. These same students, who we would have expected to produce excellent notebook portfolios were able to produce excellent web portfolios in spite of their lack of experience. Conversely, some students who had exhibited proficiency with creating web documents prior to this assignment were able to produce good looking front pages but demonstrated the same lack of depth in their portfolios as they had shown in their papers and other assignments.

Even though all students were able to complete the assignment on time, there were a few concerns. This process required a lot more time on behalf of students unfamiliar with web page authoring than the traditional portfolio did. Much of this time was spent learning how to use Dreamweaver 3 and struggling with translating documents from Microsoft Word to html. We wondered if this was time well spent. In addition, despite attempts to get everything "just right", some of the pages continued to have broken links and images that did not work properly.

We addressed these concerns in subsequent semesters primarily by creating a technology assignment that is given earlier in the semester that required more web authoring proficiency. By addressing the technical aspect of the project earlier, we believe we can help the students focus more clearly on the content of their portfolios at the end of the semester.

## Questions

There are still some outstanding questions that we are considering as we continue to work with our students in this project. We continue to wonder about the issue of how to adjust for the way people read web content as opposed to paper documents. We are not fully convinced that an abstract is a sufficient remedy. We also wonder if students should prepare paper documents in addition to web documents. Are some employers still going to want to see a portfolio that they can carry with them and handle? Will a printout of the web site be sufficient or will the student need to reformat the entire portfolio for print? Is the web the proper place for the storage of these portfolios? Items stored on the web are available for everyone to see. Even though these are professional documents, students may not want to have them available to everyone. They may want potential employers to have to request them to have access to them. Are there other ways to store these documents (like CD-ROM or floppy disc) that would do as well and restrict access? Was our dismissal of the CD-ROM format premature?

In conclusion, reaction from our students, our colleagues at the college and the principals of schools in which our students work indicate that our preliminary efforts were successful. Students left our class with additional technological proficiency and with an artifact from the class that we could use as an assessment tool and that they could use in helping them in their search for employment.

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# INTEGRATING TECHNOLOGY INTO TEACHER PREPARATION AND PRACTICE

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## NATURE OF THE STUDY:

This paper is a report on a pilot project undertaken by the authors. In the spring of 2000, 15 preservice teacher candidates from a Faculty of Education were placed with associate teachers in elementary classrooms in local schools for a four-week practice teaching block. In addition to the normal expectations of such a practice teaching experience, there was an additional expectation that there be an enhanced use of technology. Either the preservice student was identified as 'relatively computer literate' or their associate was deemed to possess effective computer skills. In some cases, both the student and associate were competent in the use of the technology. The expectation was that both groups of subjects would derive benefit in their teaching practices and their personal use of Information and Communication Skills as a result of this pairing and this project.

## RATIONALE:

Information and Communication technologies, in their various forms, are becoming the driving forces behind many of the changes that are occurring in education at the present time. Teachers are being asked to incorporate these technologies into their courses and lessons on a regular basis. Schools are spending millions of dollars each year on technology – including network backbone, hardware, software and related materials. Parents are supporting computer programs in their schools through fund-raising efforts. Students are coming to their classrooms much more technologically literate.

The speed with which innovation and change have been occurring in the classroom and society in general has been blamed for a perceived increase in the level of stress. It is difficult to manage the list of new devices that have been introduced and have become commonplace. Before one can gain sufficient expertise with these mechanisms, we are again bombarded with a whole range of new mechanisms. For example, Sony has recently made available an MP3 player that is the size of a marker pen, has 64 meg of memory and is capable of playing 2 hours of near CD quality music. This device has no moving parts and therefore never skips musical sections. The new Motorola iRadio has the ability to group digital radio stations into genre so that your favorite rock music can be grouped on one screen and can be accessed right across the country. There is also a CD and a large built-in hard drive that allows you to store files and plays all types of music formats. Mercedes-Benz will be equipping some cars with Distronics, or Proximity-Controlled Cruising. A small grill-mounted radar sensor calculates the car's speed and distance from the car in front. In a fraction of a second it will automatically let off the gas and begin braking when it calculates that you are too close for your speed. There is also the Global Position System (GPS) that is being installed in cars to track a vehicle's position, lock and unlock doors, provide precise direction, guide the driver to the nearest gas station and prepare other information that can assist the driving endeavour. These products and others like big screen TVs, HDTV, DVD, and surround-sound speakers are all part of the landscape for current automobiles. If this is *now* what does the future hold?

It does not seem possible to maintain a working knowledge of all of the contrivances even if one had many hours to dedicate to such a task not to mention an excessive amount of money. Therefore, it seems like an opportune time to ask if educators, who are responsible for the daily care of children and operation of classrooms, can be expected to remain abreast of these changes. Of course the logical following question is how could educators not only learn to use the new technologies but also devise ways to use them to enhance lesson delivery and management functions? With all of the constraints and additional demands that seem to be impinging on their time, is it any wonder that much computer equipment appears to be underused by dedicated teachers?

Although technology seems to be present in many locations in schools, the consistent integration of technology and related applications with classroom teaching practices is not going as quickly or as seamlessly as it should be. Often, computers are found to be drastically underused, despite the fact that the students know what to do once they are in front of a keyboard. In its "Year 2 STaR Report" (1999), *CEO Forum on Education and Technology*, in the United States found that the single greatest deterrent to this taking place is teacher attitude and / or lack of training. While 80% of schools have Internet connections and the number of schools effectively using technology is almost 25%, only 20% of teachers reported feeling very well prepared to integrate educational technology into classroom instruction. The Office of Technology, U.S. Congress (1995) also listed the lack of teacher training as the greatest roadblock to integrating technology into a school's curriculum. Unfortunately, when in-service training is provided, it is often ineffective. The quick workshop that is delivered through PD days does not use current best practices in methodology to ensure that what is taught is relevant, retained, and used by teachers.

A discussion paper produced by the advisory panel on *Creating an Innovation Culture* sponsored by the Ontario Jobs and Investment Board had this to say about technology, education, and innovation proposals.

> " Technology and technological change have defined the 20th century.
> And, the 21st century could witness an even faster pace of change.
> A key challenge will be to not merely adapt to change, but to anticipate
> it and to take the steps to stay ahead of change to make the most of it.
> The new jobs of the future will depend on innovation. Innovation can
> lead to vast improvements in the ways we learn, teach,
> and communicate."

There have been many books, articles and discussion papers that focus on the nature of change in the classroom and all indicate that unless a culture of change exists, no meaningful change will occur.

Teachers are faced with a myriad of changes in their schools and may not always have the time to learn new technology and how to apply it. In many cases, instructional strategies have not been modified to take into account the many facets of the technology and how it should be used most effectively in the classroom. Teachers don't know how to use the technology or when to use it to its greatest advantage. However, it is a fact, oft repeated, that the demographics of the teaching profession in the province of Ontario will change drastically in the next five years. These new teachers will not only replace those who are retiring, but they are expected to come to their classrooms much better prepared to integrate technology competencies into their teaching practices.

Recently, there has been, in any number of professional journals, much written about the problem of ensuring that graduating preservice teachers possess the capability to successfully integrate the computer as a tool into their classroom programming. These several articles suggest that it is not merely enough to make sure that "computers" is being taught as a subject at the preservice level. There must also be some specific attempt to ensure that the skills being acquired during formal classes are being utilized during practice teaching placements and beyond. However, if they are not encouraged, by those already in the field, to use their technology skills in the delivery of program, then little change will occur. Since they really aren't too comfortable with the technology as professionals, if the culture of the staff room is to leave the technologies alone, then new rookie teachers will be reticent to break those taboos and forge new ground. The same CEO Forum report referred to above also points out that new teachers entering classrooms currently do not take advantage of the technology that is in place. Rather they adapt to the culture of the classroom already in place and leave the computers and peripherals alone.

There has also been much published about the same concerns for the regular in-service teacher. It seems that many are still finding it very difficult to integrate the use of the computer as a tool to enhance the delivery of lessons or to individualize instruction for their students. Often the reasons cited are lack of time, resources,

support to acquire the skills and/or the fear of not having the level of mastery that their students already possess. Workshops and training sessions outside of the time frame of the regular school day are increasingly seen as untenable and an intrusion on already overtaxed workloads. In-service that requires secondment is expensive for boards of education and once again strains overtaxed personnel and resources. However, alternative learning approaches, including the teaming of teachers in reciprocal teaching, peer-mentor and tutor-tutee relationship can be effective

Fullan & Hargreaves (1999), in their article Mentoring in the New Millenium, (Professionally Speaking, December) point out that a paradigm shift is occurring in how new teachers should be seen as they enter the profession. Whereas, in the past, new teachers were seen as relatively unskilled and in need of support by the system, we should now see them as possessing competencies that those already in the classroom could benefit from. We know that classroom culture changes slowly but, might it not be possible to use these new teachers and their skills to speed up the use of technology by the system as a whole by providing them with opportunities to mentor those relatively unskilled in the use of technology? Such mentoring would be seen as a positive approach to the enhancement of technology skills in the experienced classroom teacher.

We, the researchers, believe that there was a need for a research study that would look at these concerns and issues surrounding the integration of technology into teacher preparation and practice, taking advantage of the concept of mentoring posited by Fullan and Hargreaves. As outcomes of such a study, one might expect to:

- determine what technological competencies teachers need in order to effectively integrate information and communication technologies into their teaching practices and professional requirements;

- develop strategies to assist teachers to determine how, when and why to integrate technology into their program based upon the current Ontario Curriculum expectations, subject by subject;

- raise the comfort and confidence level of practicing teachers when using technology in the classroom;

- foster a culture of change in individual schools by encouraging a mentorship program that sees not only practicing teachers but preservice and newly appointed teachers as possessing skills that can make a positive contribution to the classroom and school environment.

**PROCEDURE:**

In the early fall of 1999, it was decided to identify by some means, students enrolled in the class of 1999-2000 at the Faculty of Education, who possess a higher than average level of computer expertise and literacy or were desirous of becoming so. The authors of this study would also identify classroom teachers in the schools who would consider themselves similarly expert and literate and would be willing to serve as partners during one of the teaching blocks of the preservice students. They would match up these students and classroom teachers and ensure that one of the expectations of the teaching block in the schools would be to use the technology to its fullest in their practice teaching lessons. It would be the responsibility of the Faculty representatives to ensure that lesson plans reflect this specific outcome.

Prior to the start of the teaching block, the researchers would administer an instrument to establish perceptions of professional competency specific to computers and information technologies. They would then track the success of these matches during the teaching block and track indicators of computer integration in the classroom. Following the end of the placements, the same instrument would be administered a second time to measure change. The in-service teachers, preservice teachers and faculty advisors were to ensure that lesson plans reflect the specific expectation of computers in the classroom.

Support was solicited from faculty advisors in the Faculty of Education, as they would have to agree to involvement on the part of the authors in their on-going work with students. Preservice students who were interested in the possibilities inherent in the project were encouraged to volunteer themselves as subjects. Principals in the schools were invited to volunteer to participate in the project with the intent that it would facilitate change in their staff around Information & Communication Technologies (ICT) competencies. Some 30 principals indicated a willingness to participate and from this list, sites were chosen based upon the requests of the students for placement.

Since one of the assumptions of the researchers was that both students and teachers would enhance their competency levels in ICT skills, it was agreed that some sort of rating scale had to be found to use as a measurement tool. After considerable searching, a suitable tool was found on the Internet at the International Society for Technological Education (ISTE) website. These ISTE Foundation Standards were the result of a partnership between ISTE and the National Council for Accreditation of Teacher Education (NCATE) as both groups move towards some sort of permanent definition of what specific ICT skills new teachers should have as they enter the profession. It was agreed that we would adapt this tool, having been given permission in advance by one of the authors who previously worked at the Millken Foundation which was underwriting the project, in part. (See article - "National Standards For Technology in Teacher Preparation" by ISTE Accreditation and Standards Committee in Connections ;Vol. 15, No. 1; Fall, 1998.)

The "Recommended Foundation Competencies in Technology" checklist was given to the preservice teachers when they were gathered at a meeting. They were also supplied with the same form at the end of their teaching block when they had returned for classes. Similarly, a meeting was called of all the identified teachers in the field and the form was distributed to them then. The second copy of the form was distributed by interoffice mail after the teaching block was completed. At each meeting, both researchers outlined the major expectations for the four-week teaching block and answered any questions either the students or their associate teachers had.

There are a total of 61 competencies in the rating scale used in this study. These were divided into 9 categories. These are -

- 1.1 Basic Computer / Technology Operations & Concepts
- 1.2 Personal & Professional Use of Technology
- 1.3 Application of Technology in Instruction
- 2.1 Social, Ethical & Human Issues
- 2.2 Productivity Tools
- 2.3 Telecommunications and Information Access
- 2.4 Research, Problem Solving and Product Development
- 3.1 Teaching Methodology
- 3.2 Hardware, Software Selection, Installation and Maintenance.

On each of the competencies, all respondents were asked to assess themselves as at the Entry, Adoption, Adaptation or Appropriation level. To arrive at a single numerical descriptor which could be used to assess change over time, the scoring of the competencies check list was done through a simple assignment of a value (1 for Entry - 4 for Appropriation) to each of the possible categories. A total for each category was arrived at, as well as a percentage representing how far below perfect (Appropriation) on all competencies combined the respondent perceived himself or herself to be.

At the meetings referred to above and through written communication, the pairs of preservice / associate teachers were asked to identify an area of ICT which both felt could benefit from collaboration. The assumption was that each dyad needed a focus for their collaboration and choosing one area upon which to focus would better

facilitate growth. The researchers assumed that, following the teaching block's completion, not only would participants rate themselves as higher in that one specific area, but that there would be generalized growth over all the competency categories.

Following the meetings with the two groups of participants, there were phone calls to those individual classroom teachers unable to make the whole group sessions. There were individual briefings for those students who missed their whole group session as well. There were visits to each of the sites during the four-week teaching block and time was found to interview each of the preservice candidates as well as their associates separately. These interviews took the form of informal discussions to elicit impressions and subjective feedback on the success of the placements, the pairings and the use of the technology.

**OBSERVATIONS & FINDINGS:**

Both the preservice and their designated associate teachers were anxious to become involved with the project. Both groups viewed this project as a way to gain experience with technology in an educational setting by collaborating with others who had similar interests and possibly who had superior expertise. They wanted, even welcomed the chance to work with the technology in an environment where such experimentation was not only encouraged but also expected.

The students also viewed participation in this project as a possible venue to gain recognition for their desire to collaborate with practicing professionals and to gain experience working with the technology to improve their own teaching practice. Some even verbalized their expectations that participation in such a project might have positive effects on their future employment possibilities.

Teachers in the field perceived the project as a vehicle to advance their knowledge of technological applications in the classroom by working with preservice teachers who might have a higher level of expertise with the technology. Some also saw this as an opportunity to convey some of the ideas and skills that they had developed over the years as they advanced their knowledge of the teaching environment.

Principals were very anxious to volunteer their schools and nominate associates to become involved. In each case, they were very intrigued by the possibilities inherent in the situation and wanted to provide their staff member with an opportunity to become more computer-literate or technologically competent.

During the four-week teaching block which was the focus of this initiative, visits were paid to each of the sites where preservice student and associate teacher pairings occurred. Informal interviews were conducted on site with both preservice and practicing teachers too elicit feedback on the process and establish whether any further intervention was required or any additional resources needed in order to facilitate program planning. After the fact, the comments made in discussion were grouped according to similarity of statement and the number of similar responses tabulated. Table 1 below summarizes that information.

Table 1
Comments from Participants

| COMMENTS | NUMBER OF TIMES REPEATED |
|---|---|
| I learned many new things about technology. / I gained experience with the technology. | 15 |
| The process of mentoring was very worthwhile. / The mentoring process was very good. | 14 |
| I made much progress with my skills. / My competency level has significantly improved. | 14 |
| I learned a lot from my partner. | 13 |
| Technical problems (scheduling, hardware malfunctioning, Internet access down) prevented the successful completion of our plans / expectations / outcomes. | 8 |
| We found areas to collaborate on quite easily. / It was easy to identify an area of mutual interest to work at. | 8 |
| I learned a lot about how to teach using technology. | 8 |
| I learned a lot about how to integrate technology into my program planning | 8 |
| I put the technology front and centre as part of my program planning because it was expected of me. | 6 |
| My fear level in terms of using the technology in front of group of students has been significantly lowered. | 6 |
| I could have used / enjoyed / profited from more time with my partner. | 5 |
| My student / I was a resource for the entire staff. | 5 |
| I could have used much more time. | 5 |
| I gained a new perspective on the reality of the technology in a school setting. | 3 |
| I learned more about the role of technology in the achievement of specific curriculum expectations. | 3 |
| I could have used more specific guidelines for this entire process. | 3 |
| I learned very little or nothing as a result of this process. / I experienced no growth in my skill level as a result of this process. | 2 |
| I had more free time to work with students as a result of this process. | 2 |

As can be seen from Table 1, the subjective feedback from the respondents in this study reinforces the original assumption of success. Repeatedly, in one way or another, individual teachers and students commented on how much they were enjoying the partnership, how much they were learning, how much more competent they felt about the technology and its use in the classroom. One teacher even suggested that as a result of her experience as a result of the project, she would not hesitate to try and integrate ICT skills from the outset in her first year of teaching. She revealed that, in the past, when she reflected upon the future and the use of the computer, she was sure she would be unable to manage teaching and the technology at the same time. However, her experiences within this study forced her to change her mind and lowered her fear level considerably. Nor was she the only one who felt that way. Invariably, comment was made in passing about lowering fear levels and not just with the preservice teachers.

It was very pleasing, as well, to go from school to school and find the associates so enthusiastic and exuberant about the project. The comments in Table 2 and Table 3 reinforce the positive feedback elicited by classroom teachers. What was not entirely surprising was the fact that the younger preservice student became a resource for the whole staff. In two cases, specifically, a process had been worked out whereby the staff as whole was working individually with the preservice candidate to enhance competencies in one area or another. In one situation, it was with presentation software, in another it was in the area of spreadsheets.

Originally there were 15 placement sites with one site having a preservice student working with two teachers. The results displayed and herein discussed represent feedback from all 16 associate teachers. Unfortunately, one of the weaknesses of the process lies in the return of the measurement instrument. It took several weeks and much repeated reminding to gather the instruments from the teachers who were associates. As of the writing of this paper, we never did get returned survey forms from all 15 students. For a variety of reasons discussed below, we ended up with data to use from only 8 of the preservice students. The graphs and tables included in this article represent data gathered and tabulated in the above-mentioned fashion.

As Table 2 and Table 3 indicate, the predicted outcomes were evidenced by the results. Both groups did, in fact, experience growth in their perceived competency levels over all the criteria. Using the same standard of measurement for perceived competency levels, associate teachers self-rated their own growth by 6% over all, while preservice student teachers saw their competency levels grow by 19%.

While it would be very interesting to analyze the results by category and perhaps speculate on why growth was greater in some categories than in others, this particular study was meant to focus on general perceived competency. The classroom teachers in this study did not grow as much as was expected overall, perhaps due to the fact that they were chosen in most of the situations because of their leadership and proven ability in ICT skills. The exact opposite is borne out by the results of the group of preservice teachers. Growth was real and significant in each category and in general. This result supported the comments elicited during the interviews as indicated in Table 1.

Table 2

**Associate Teacher Self Assessed Degree of Competency in Nine Categories of ISTE Recommended Foundation Competencies in Technology (In Percentages)**

| Time of Testing | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | 2.4 | 3.1 | 3.2 | Over-All |
|---|---|---|---|---|---|---|---|---|---|---|
| Prior to Teaching Block | 62 | 58 | 60 | 51 | 49 | 59 | 48 | 51 | 48 | 54 |
| After the Teaching Block | 71 | 64 | 67 | 57 | 58 | 67 | 47 | 58 | 54 | 60 |

Table 3

**PreService Student Self Assessed Degree of Competency in Nine Categories of ISTE Recommended Foundation Competencies in Technology (In Percentages)**

| Time of Testing | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | 2.4 | 3.1 | 3.2 | Over-All |
|---|---|---|---|---|---|---|---|---|---|---|
| Prior to Teaching Block | 59 | 64 | 62 | 48 | 58 | 61 | 47 | 55 | 45 | 55 |
| After the Teaching Block | 80 | 79 | 84 | 61 | 78 | 87 | 69 | 77 | 55 | 74 |

In this section the results of the data analyses are presented. A profile of the sample has been presented earlier in the paper. Individual comparisons (t-tests) were calculated to identify significant differences between the pre-teaching block and post teaching block periods within the two groups (i.e. the teachers and the students).

Table 4 illustrates that there were no significant differences between the means for the teachers' pre teaching block and post teaching block for section 1.1 $t(15) = 0.262$, $p > 0.05$; for section 1.2 $t(15) = 0.141$, $p > 0.05$; for section 1.3 $t(15) = 0.255$, $p > 0.05$; for section 2.1 $t(15) = 0.245$, $p > 0.05$; for section 2.2 $t(15) = 0.052$, $p > 0.05$; for section 2.3 $t(15) = 0.112$, $p > 0.05$; for section 2.4 $t(15) = 0.071$, $p > 0.05$; for section 3.1 $t(15) = 0.112$, $p > 0.05$; or for section 3.2 $t(15) = 0.278$, $p > 0.05$.

Even though no significant differences were found, it should be noted that there was an increase for the means in all 9 sections from pre teaching block to post teaching block. Teachers also reported increases in their perceived skill levels and were positive about their gains. Further explanations for the statistical result with the teacher group are advanced below, as well.

Table 4

**Change in Perceived Skills by Category for TEACHERS (n=16)**

| Section # | Pre Teaching Block | | Post Teaching Block | |
|---|---|---|---|---|
| | M | SD | M | SD |
| 1.1 | 12.0000 | 4.3050 | 14.1250 | 4.6601 |
| 1.2 | 17.8125 | 4.9155 | 20.5625 | 6.0108 |
| 1.3 | 11.4375 | 4.8300 | 13.5625 | 4.6039 |
| 2.1 | 3.8750 | 1.9958 | 4.6875 | 1.9568 |
| 2.2 | 13.0000 | 5.2915 | 16.8125 | 6.1343 |
| 2.3 | 6.8125 | 2.3726 | 8.1250 | 2.4732 |
| 2.3 | 15.3750 | 5.6554 | 19.4375 | 8.1156 |
| 3.1 | 25.0000 | 9.2952 | 30.9375 | 11.8461 |
| 3.2 | 14.5000 | 7.8994 | 17.6875 | 8.3644 |

Table 5 illustrates that there were significant differences between the means for the students' pre Teaching Block and post Teaching Block for section 1.1 $t(6) = 0.009$, $p < 0.05$; for section 1.2 $t(6) = 0.011$, $p < 0.05$; for section 1.3 $t(6) = 0.024$, $p < 0.05$; for section 2.2 $t(6) = 0.010$, $p < 0.05$; for section 2.3 $t(6) = 0.019$, $p < 0.05$; for section 2.4 $t(6) = 0.001$, $p < 0.001$ and for section 3.1 $t(6) = 0.001$, $p < 0.001$.

Also Table 5 illustrates that there were no significant differences between the means for the students' pre Teaching Block and post Teaching Block for section 2.1 $t(6) = 0.156$, $p > 0.05$ or for section 3.2 $t(6) = 0.195$, $p > 0.05$.

Table 5

**Change in Perceived Skills by Category for STUDENTS (n=7)**

| Section # | pre Teaching Block | | post Teaching Block | |
|---|---|---|---|---|
| | M | SD | M | SD |
| 1.1 | 11.8751* | 4.0591 | 16.0000* | 3.0000 |
| 1.2 | 20.4286* | 6.9488 | 25.4286* | 4.5774 |
| 1.3 | 12.4286* | 3.9097 | 16.8571* | 2.4785 |
| 2.1 | 3.8571 | 1.7728 | 4.8571 | 1.5736 |
| 2.2 | 16.2857* | 6.5247 | 21.8571* | 4.4132 |

| | | | | |
|---|---|---|---|---|
| 2.3 | 7.2857* | 2.7516 | 10.4286* | 1.9024 |
| 2.3 | 18.7143** | 7.9313 | 27.7143** | 7.1581 |
| 3.1 | 28.5714** | 12.3134 | 40.0000** | 7.9373 |
| 3.2 | 14.2857 | 5.2509 | 17.7143 | 4.6085 |

** $p<=0.001$ *$p<0.05$

Significant difference between pre Teaching Block and post Teaching Block results for the student group.

DISCUSSION:

This project began with the assumption that there would be benefits in matching preservice students and associate teachers and putting the development of ICT competencies in the forefront of their planning. The former perceived themselves to be technologically competent and wanted to put into practice these skills in their practice teaching blocks. The latter would be anxious to either further their skills or mentor a student to help him or her become similarly competent. The results of these pairings, while positive, should be viewed in light of several factors.

- The completion of the survey forms used was not done at the same time in the same circumstances by both groups, or even by individuals in each group. Some participants made their choices and returned them immediately. Others needed to be repeatedly reminded until they were returned. In the end, only 8 of 15 preservice students completed and returned both the pre and post surveys within the time constraints of the project.

- Often, respondents did not fully understand the terminology of the descriptors on the measurement instrument and questioned just exactly what each line was alluding to. There was also a great deal of reticence to self-rate oneself at the higher end of the rating scale because they felt that next to a technician or technical support person, they had to be much lower down in their skill set. Teachers and students both had a tendency to under-appraise themselves in terms of their general levels of technical ability.

- Although the original intent had been that each pair would identify a specific area that they intended to work at developing competency in, at no time were they asked to follow that up and identify the area they had agreed upon. It would have been much better for interpretation and generalization of the findings if there had been some indication of the area to be focussed on so that the results for that one area might be compared to that of the other areas and ICT skills in general.

- Since this was a project that evolved over time and solidified its main outlines, the process of matching up preservice students and associate placements was very happenstance. No criteria were defined to set parameters for the working environment of the teaching block.

- The matches made between students and their placements were in found at all grade levels and therefore included rotary and non-rotary teaching situations. Indeed, one of the matches was found in a secondary school and because of its rotary nature, the expectations of both the associates and their single assigned student could not be easily compared to a situation in a primary classroom.

- Many of the results were significantly altered by problems with the technology itself. In several situations, major work being done on the networks and their infrastructure prevented access on a continuing basis by all concerned. In other situations, the demands upon the networked machines made it necessary for planning to take into account shared access rather than access upon demand.

This project documents the impact on practicing teachers and pre service students who participated in a program that was designed to increase their focus on the use of information technology in their teaching practices. It was found that an average of four weeks of focussing on the use of technology in classroom practice resulted in increases in perceived skill levels for:

1.1 Basic Computer / Technology Operations & Concepts
1.2 Personal & Professional Use of Technology
1.3 Application of Technology in Instruction
2.1 Social, Ethical & Human Issues
2.2 Productivity Tools
2.3 Telecommunications and Information Access
2.4 Research, Problem Solving and Product Development
3.1 Teaching Methodology
3.2 Hardware, Software Selection, Installation and Maintenance.

Moreover, participants in this program reported that they enjoyed the experience and the chance to pay particular attention to the technology. Additionally, statistical analyses demonstrate that student teachers had significant gains in 7 of the nine sections. Those areas of identified gains are:

1.1 Basic Computer / Technology Operations & Concepts
1.2 Personal & Professional Use of Technology
1.3 Application of Technology in Instruction
2.2 Productivity Tools
2.3 Telecommunications and Information Access
2.4 Research, Problem Solving and Product Development
3.1 Teaching Methodology

The measured increases are meaningful for the teachers who decide to use this mentorship approach for increasing their own technological skill and perhaps raising awareness of the technology at the school and board levels. It is important to recognize that this project described elsewhere in this study represents one component of the ongoing quest for expertise with technology and its use in an educational setting.

RECOMMENDATIONS:

As pointed out above, this project was very successful and fulfilled most of the expectations of the researchers who directed it. However, this was only a pilot. The authors look forward, next year, to broadening the scope of the process. They plan to oversee the mentorship pairings in both the second and the third teaching blocks. It is also expected that the study will include classroom sites in the coterminous Roman Catholic board. The researchers will make the following changes to the process:

- The survey instrument will be administered to everyone at the same time and collected immediately, both at the beginning and at the end of the teaching block.

- Each pair of teachers will have to identify a competency skill set that they wish to work on enhancing so that the researchers will then be able to compare results between the specific competency and the general set of competencies.
- There will be greater coordination between the placements and the students interested in being part of the project so that there are more schools to choose from for test sites.
- We will begin in the fall to involve our partners at the Catholic District School Board so that it can involve all Preservice students, regardless of practice teaching assignment location.
- We will rework the wording of the Competency Measurement Instrument so that the individual items are self explanatory and easy for teachers to understand.

We acknowledge that there is much to work at to improve our project scope and process. However, we also are very pleased with the results it has yielded for us as researchers and for the implications of those findings.

CONCLUSIONS:

Teachers in classrooms around the world are struggling with how to keep up with the changes in technology that are brought into the school by students. They are grappling with the problem of how to deliver effective classroom program based upon the new curriculum as it is centrally defined, while also finding the time to integrate skills that are required for success in the future, which are, by definition, in a constant state of flux. Professional educators work in an environment where the goals of the program are not matched by the level or state of the technology it depends upon for delivery. Finally, they are trying to implement new methods of program delivery, assessment and evaluation while being expected to become professionally developed in Information and Communication Technologies. All of these expectations add tremendous pressures on their day to day functioning.

Preservice teachers are coming to the Colleges of Education having many of the ICT competencies in place but unable to apply these to their developing teaching repertoires. They have been kept abreast of all the changes in the world of technology by definition of the culture they have grown up in and somehow expect to be able to use these in their classrooms. Instruction and the expectations of practice teaching do not purposefully include technology so newly hired teachers begin to become acculturated to an environment that does not place high value on the use of the hardware and software already in the schools.

When individuals from both groups are brought together to mentor each other not just in sound professional teaching practice but also in the integration of the new technologies with the old, both gain immeasurably. Mentorship is a two way street in our classrooms and by purposefully including technology we provide in-service for our practicing teachers in ICT that is 'in time' and on demand. It provides support for the in-service teachers for risk-taking because they are involved in mentoring students who are in a learning mode. It also provides chances for preservice teachers to use their ICT skills while learning how to apply them to their prospective careers, and modeling for both groups how to integrate technology in useful and productive ways.

Given that there is a paucity of research demonstrating educational projects that are of benefit to teachers who wish to use technology more effectively, the findings from this pilot study are indeed encouraging. Nevertheless, further research is warranted to establish the most efficacious balance between traditional classroom approaches and the use of computer based instructional methodologies. Since four weeks was the time allocated for this study, one might reasonably question whether an increase to 8 weeks of involvement with the program would result in an equal ratio of skills gains.

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# Technological Foundations: Integrating the Use of Technology in Teaching and Learning in an Educational Foundations Course

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Abstract: This paper presents one example of how technology was integrated successfully into an existing educational foundations course. Preservice teachers at the University of Virginia acquired knowledge of educational technology and developed technological competencies while learning about their future profession in EDIS 201: Teaching as a Profession. Student feedback collected during and after the course suggests that the strategies for integrating technology were appropriate and enjoyable. Technology blended with constructivist teaching methods made learning more engaging, effective, and efficient.

## Rationale for Technology Integration

This paper presents one example of how technology was integrated successfully into an existing educational foundations course. Preservice teachers at the University of Virginia acquired knowledge of educational technology and developed technological competencies while learning about their future profession in EDIS 201: Teaching as a Profession. Student feedback collected during and after the course suggests that the strategies for integrating technology were appropriate and enjoyable. Technology blended with constructivist teaching methods made learning more engaging, effective, and efficient.

In 1996, Willis and Mehlinger challenged teacher educators to consider the benefit of an integrated approach to technology in the professional preparation of teachers (1996). They suggested preservice teachers might benefit from exposure to technology beyond simple participation in stand-alone computer courses and called for integration of technology across all existing components of teacher education programs namely foundations courses, methods courses, content-area courses, and student teaching. In 1997, the National Council for Accreditation of Teacher Education [NCATE] seconded this idea of an integrated approach for technology in teacher education. NCATE called for schools of education to "create a vision of what their programs would be like if they took full advantage of information technology" (NCATE, 1997, p. 9). In July 2000, the International Society for Technology in Education released a comprehensive list of technology standards developed for NCATE. These new standards will be used to determine how schools of education prepare their all of their graduates to use technology across all areas of professional preparation, including foundations courses.

Foundations courses are a standard component of most teacher education programs. They address a broad spectrum of contemporary issues in the profession, while also exploring the sociological, philosophical, and historical contexts of education. These courses serve an important role in prospective teachers' introduction to the profession—often allowing preservice teachers to build frameworks for future understandings of the field. Most preservice teachers experience at least one of these courses during their first year of professional preparation. They are often a "common experience" in which preservice teachers across diverse programs share experiences, ideas, and beliefs with colleagues

Proper preparation and support increase the likelihood that the integration of technology into the instruction of these courses will be successful. Technology, when blended with constructivist learning strategies, might create better instructional opportunities for students and revitalize teacher education faculty. Here, we illustrate one example of how two different teacher educators during two different semesters used technology to help students examine crucial course content in a more engaging and effective manner.

## A Case Study

At the Curry School of Education, EDIS 201: Teaching as a Profession is an introductory course for students planning careers in education. In this survey course, students examine education history, philosophy in action in schools, student diversity, curriculum, effective teaching, school organization and governance, and other topics affecting the role of the teacher as professional. Approximately 35 students, most in their second-year of a five-year program, take the course each semester. During fall semester of 1998, 1999, and 2000, technology was used in a variety of ways to: 1) assist the instructors in more effectively communicating course content, 2) involve students actively in thinking about their future profession, 3) build community among students with diverse interests and backgrounds, 4) provide students opportunities to develop comfort and competence with technology applications, and 5) model effective and engaging instruction with technology. These techniques addressed new NCATE standards. (See http://www-unix.oit.umass.edu/~kilbane/ncate/matrix.html)

In EDIS 201, technology was used to allow instructors to "do things differently and to do different things (Riel & Fulton, 1998). Teaching during two separate semesters, each instructor found different methods for teaching a traditional course. Both used "The Foundations of Education" (McNergney & Herbert, 2000) as a course textbook and met with their students twice a week for an hour and fifteen minutes. But what happened during many of these class meetings and outside of class made education for students more efficient, more engaging, and more effective.

## Doing Things Differently

Some basic uses of technology allowed the instructors to approach traditional activities differently—making course operations more efficient in some cases. The class webpage enabled the instructor to update assignments more easily, provided students with easy access to online resources (syllabus, readings, videos, multimedia case studies) used to enhance the use of the course textbook. Additionally, the course website allowed students to communicate with one another outside of class about issues of concern including their field experience placements. PowerPoint presentations took the place of traditional lectures providing instructors with an easier way to organize content and provide instruction for different learning styles. A Quicktime video of each student articulating her beliefs about teaching at the beginning and end of the semester allowed classmates to learn each others' names and faces and made it easy for virtual guest lecturers to "get a feel" for the students and their ideas about teaching and learning. Inspiration, a semantic mapping program, facilitated class brainstorming about various educational concepts.

## Doing Different Things

Technology also allowed instructors to implement new kinds of activities that encouraged students to think critically about course content. The software program Excel supported a problem-based lesson on school budgets and finance. Students manipulated vast amounts of information on educational history using a database program. To integrate and personalize ideas from the text, students designed philosophy of teaching Web pages and learned to post them on the public server space provided by the University. They also participated in a forum on careers in education with the US Department of Education's Technology Teacher in Residence using iVisit, a desktop videoconferencing program.

## Obstacles to Integration

Technological innovations will continue to influence the practice of education, though the combination of online technologies with current course content will not always be seamless. O'Bannon and Brownell (1999) suggest that faculty members prepare themselves for a fundamentally new way of conveying knowledge while ensuring that the requisite learning takes place. The authors will discuss the obstacles encountered as they integrated technology in EDIS 201, and suggest strategies to anticipate and address such problems.

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# Perceptions of Teachers' Technology Competency Skills in Arizona

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**Abstract:** This study investigated the perceptions of the education community in the Phoenix, Arizona metropolitan area regarding technology competency skills for preservice and inservice teachers. Participants included 67 preservice teachers, 67 inservice teachers, 45 school principals, and 21 school district human resource directors. Two sets of survey instruments were used for this study. One survey containing 26 items of technology skills for preservice teachers was distributed to preservice teachers, inservice teachers, and principals. Mean scores were calculated to test for significant multivariate effects on items among three groups. Another survey regarding hiring decisions was distributed to principals and human resource directors. Frequency and percentage analysis were used for the second survey. The results showed that preservice teachers placed more emphasis on overall technology skills than inservice teachers and principals and there were significant differences by group in nine of 26 items. The opinions from principals and human resource directors regarding hiring decisions were also explored.

## Introduction

There are growing demands and continuing needs to infuse instructional technology in all professional education programs to better prepare teachers and administrators to use computer technology in classroom learning (Hill & Somers, 1996, Northrup & Little, 1996). However, recent research studies indicate that teacher-preparation programs in most universities are not adequately preparing future teachers to teach with technology (Strudler & Wetzel, 1999). A report prepared by the National Commission on Teaching and America's Future (NCTAF, 1996) stated that teachers programs are described as "fragmented, superficial, and unconnected to real classroom experiences". Wetzel (1993) has suggested that the best way to meet the International Society for Technology in Education (ISTE) teacher technology standards is through the combination of a core computer literacy course model and an integration model with specific standards being met. Although many universities offer specific preparation programs in the area of educational technology for preservice teachers, most of them have not yet developed curriculum that meets the ISTE standards for basic skill. This is especially true in states that do not require evidence of computer competency for teacher certification. Preservice teachers do not routinely use technology while in the field or work with supervising teachers who model the integration of technology (Moursund & Bielefieldt, 1999). Therefore, many preservice teachers are still entering the classroom with minimum technology skills and feel incompetent to utilize technology effectively to support classroom activities. In *Teacher's Tools for 21st Century: A Report on Teacher's Use of Technology* (Smerdon & Cronen, 2000), only one-third of teachers in the U.S. reported feeling well prepared to use computers and the Internet for classroom instruction. Teachers with fewer years of teaching experience were more likely to use home computers and/or Internet for planning lessons and creating instructional materials. The lack of release time for teachers to learn how to use the computer and Internet was the biggest obstacle reported by 82% of U.S. teachers. This study investigated the perceptions of the importance of technology competency for preservice and inservice teachers and the results will be used to create a strong foundation for an effective technology training program for preservice teachers. With the input from the school system, we hope to

design training programs that meet the needs of the schools while developing technology competency skills for preservice teachers that meet or exceed the national standards set forth by ISTE. With these technology skills, preservice teachers will meet the hiring requirements of schools and will be competent to integrate technology appropriately in the classroom.

## Research Questions

The following research questions were investigated in this study:

1. What are the preservice teachers', inservice teachers', and school principals' perceptions toward the importance of teacher technology skills?
2. Are there any significant differences in the perceptions of preservice teachers, inservice teachers, and school principals toward the importance of technology skills?
3. What are the current professional development mechanisms and opportunities for developing inservice teacher technology skills?
4. What technology skills and competencies are currently being considered during the hiring process of teachers?

## Method

### Subjects

Participants were preservice teachers enrolled in technology courses at a university and inservice teachers and administrators in the public school system in Arizona. The subjects included 67 preservice teachers, 67 inservice teachers, 45 principals, and 21 human resource directors from public school districts in the Phoenix metropolitan area.

### Materials

The first survey was based on the National Educational Technology Standards and the North Carolina Public Schools Technology Competencies for Educators. The survey questions focused on the basic technology skills and competencies defined in these documents. Researchers asked preservice teachers, inservice teachers, and principals to rate the importance of 26 items of basic technology skills for a teacher. In the second survey, school principals and human resource directors were asked whether basic technology competency skills were an important factor in the hiring process and determined their preferred forms of assessing technology skills for new graduates.

### Procedures

The survey for preservice teachers was administered during their regular class meeting times at a university. The surveys for inservice teachers, principals, and human resource directors were distributed at several local conferences and workshops and mailed directly to randomly selected public schools in Arizona.

### Criterion Measures

The rating scores on the first survey that range from not important to very important on the five-point agreement scale were converted by the researchers to their numerical equivalents (1 = not important to 5 = very important). Mean scores were calculated for each survey item by different groups of participants. A multivariate univariate analysis (MANOVA) was used to test for significant multivariate effects on items within different groups. Follow-up univariate analyses were performed on the individual items in each area for which a significant MANOVA was obtained. Frequency and percentage were tabulated and calculated for the second set of survey.

## Results

Four hundred and ninety surveys were distributed. The return rate was 54% for preservice teachers, 34% for inservice teachers, 39% for principals, and 54% for human resource directors.

1. What are the preservice teachers', inservice teachers', and school principals' perceptions toward the importance of teacher technology skills?

The mean scores for each statement that assesses the importance of a preservice teacher's ability to perform specific technology skills were analyzed and are shown in Table 1 (http://www.public.asu.edu/~hengyuku/SITE.htm). The highest level of agreement on importance for the survey was with the statement "Basic computer operations - start up and shut down the computer and its peripherals; start an application" (Overall Mean = 4.82). Three other statements with high levels of agreement on importance (Overall Mean > 4.50) indicated that preservice teachers should be able to: (1) create a document; name, save, retrieve and revise a document and use printing options (M = 4.78), (2) use word processing/desktop publishing to create letters and instructional materials (M = 4.56), and (3) use the Internet to browse, search, and send e-mail (M = 4.53).

The lowest level of agreement on importance was with the statement "Developing web pages and/or sites for instructional use and relating information to parents" (Overall Mean = 3.17). Three other statements with low levels of agreement on importance (Overall Mean < 3.50) included (1) creating a database to manage information (M = 3.48), (2) setting up and operating a presentation system that works with a computer (M = 3.47), and (3) producing electronic slides/overheads (M = 3.40).

2. Are there any significant differences in the perceptions of preservice teachers, inservice teachers, and school principals toward the importance of technology skills?

The overall mean score for the 26-item survey was 4.03. Overall mean scores by respondent groups were 4.21 for preservice teachers, 3.98 for inservice teachers, and 3.80 for principals, $F(2, 147) = 4.60$, $p < .05$. The multivariate analysis of variance at $p < .01$, followed by the Tukey HSD on the overall means revealed statistical differences between preservice teachers and principals.

An ANOVA was performed on each of the 26 items and the results are shown here in Table 1A. Statistically significant differences occurred between the three respondent groups on nine of the 26 items. Preservice teachers agreed significantly more strongly than both inservice teachers and principals on six statements. These six statements were (1) setting up and operating a VCR and monitor/TV, $F(2,172) = 10.17$, $p < .01$, (2) creating spreadsheets to manage information, $F(2,171) = 6.55$, $p < .01$, (3) creating a database to manage information, $F(2,172) = 8.45$, $p < .01$, (4) setting up and operating a presentation system that works with a computer $F(2,171) = 5.63$, $p < .01$, (5) producing electronic slides/overheads, $F(2,171) = 8.20$, $p < .01$, and (6) developing web pages and/or sites for instructional use and relating information to parents $F(2,174) = 6.71$, $p < .01$.

Both preservice teachers and inservice teachers agreed significantly more strongly on three statements of the technology skills than principals. These statements were (1) create a document; name, save, retrieve and revise a document and use printing options, $F(2,175) = 4.82$, $p < .01$, (2) apply strategies for identifying and solving routine hardware and software problems that occur during everyday use, $F(2,175) = 5.62$, $p < .01$, and (3) evaluate software and technology for instructional use, $F(2,172) = 6.00$, $p < .01$, as part of a certification process.

3. What are the current professional development mechanisms and opportunities for developing inservice teacher technology skills used in schools today?

Inservice teachers and principals were asked about the use of technology in instruction at schools and the types of technology professional development opportunities that were available for inservice teachers. Their responses were analyzed and are reported in Table 2 (http://www.public.asu.edu/~hengyuku/SITE.htm).

| Which of the following technology skills are important for a preservice teacher to be able to perform as part of a certification process?<br><br>Item Statement | Overall Mean (N = 179) | Preservice Mean (N = 67) | Inservice Mean (N = 67) | Principal Mean (N = 45) | Significant Difference |
|---|---|---|---|---|---|
| 1. Create a document; name, save, retrieve and revise a document; use printing options. | 4.78 | 4.84 | 4.87 | 4.56 | Preservice> Principal Inservice> Principal |
| 2. Set up and operate a VCR and monitor/TV. | 4.35 | 4.73 | 4.21 | 4.00 | Preservice> Inservice Preservice> Principal |
| 3. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use. | 4.02 | 4.18 | 4.15 | 3.58 | Preservice> Principal Inservice> Principal |
| 4. Evaluate software and technology for instructional use. | 3.85 | 4.09 | 3.88 | 3.43 | Preservice> Principal Inservice> Principal |
| 5. Create spreadsheets to manage information. | 3.69 | 4.06 | 3.42 | 3.52 | Preservice> Inservice Preservice> Principal |
| 6. Create a database to manage information. | 3.48 | 3.92 | 3.12 | 3.34 | Preservice> Inservice Preservice> Principal |
| 7. Set up and operate a presentation system that works with a computer. | 3.47 | 3.82 | 3.23 | 3.26 | Preservice> Inservice Preservice> Principal |
| 8. Produce electronic slides/overheads. | 3.40 | 3.80 | 3.21 | 3.09 | Preservice> Inservice Preservice> Principal |
| 9. Develop web pages and/or sites for instructional use and relating information to parents. | 3.17 | 3.55 | 2.93 | 2.95 | Preservice> Inservice Preservice> Principal |

**Table 1A:** Mean Ratings and Significant Differences by Group and Item Statement.

When researchers asked whether teachers are evaluated in their use of technology in instruction, the results revealed that only 10 inservice teachers (15%) and 11 principals (26%) indicated "Yes" while 55 inservice teachers (85%) and 32 principals (74%) responded "No."

When researchers asked which areas inservice teachers and principals feel their faculty could improve their current skills a total of 83 respondents (74%) indicated "Computer use for instruction", 80 respondents (71%) indicated "Use of Internet resources for instruction", 77 respondents (69%) indicated "Multimedia – video and electronic slides", 67 respondents (60%) indicated "Computer use for management – grades, lesson plans, and instructional materials", and eight respondents (7%) indicated "Other".

When researchers asked what types of technology training opportunities are available for inservice teachers a total of 93 responded (83%) "District workshops", 71 (63%) responded "Peer training", 53 (47%) responded "Consultant training at school", 31 (28%) indicated "University professional development or courses", 24 (21%) indicated "Industry courses", and 4 (4%) indicated "None".

4. What technology skills and competencies are currently being considered during the hiring process of teachers?

The responses regarding hiring decisions for preservice teachers from both principals and human resource directors were analyzed and are shown in Table 3 (http://www.public.asu.edu/~hengyuku/SITE.htm). The researchers asked whether they would rate a new or preservice teaching applicant with well-developed technology skills higher than an applicant with minimum technology skills. The results revealed that 35 principals (78%) and 12 human resources directors (57%) indicated "Yes" while 10 principals (22%) and 9 human resource directors (43%) responded "Not considered."

Principals and human resource directors also were asked about how they currently assess an applicant's skills to use technology as an instructional and management tool. A total of 41 respondents (62%) indicated "Application interview", 28 respondents (42%) indicated "Portfolio", 21 respondents (32%) indicated "Transcript", 12 respondents (18%) indicated "Certificate of training", six respondents (9%) indicated "District interview", four respondents (6%) indicated "Not assessed", and three respondents (5%) indicated "Other".

For the question regarding what methods they would prefer to use to assess an applicant's technology skills as an instructional and management tool in the future a total of 26 respondents (41%) indicated "Portfolio", 26 respondents (39%) indicated "Application interview", 17 respondents (26%) indicated "Certificate of training", 16 respondents (24%) indicated "District interview", eight respondents (12%) indicated "Transcript", and four respondents (6%) indicated "Other".

## Conclusions

The results from this study can offer a foundation for developing a new model for technology courses for preservice teachers. This model can be implemented at universities and, in addition, provide guidelines for local community colleges and other educational facilities for the development of technology courses that cover the basic skills required by the National Educational Technology Standards. The results can also demonstrate to preservice teachers what technology skills that future employers are expecting from them and provide assistance to those employers in the correct assessment of a teacher's technological skill.

Research has shown that the educator who has developed skills before entering the classroom will use technology more in instruction and will make more of an effort to continue acquiring new skills. Research has also shown that teachers with fewer years of teaching experience are more likely to use technology as a tool in instruction and planning. Our survey results corresponded with these findings. The preservice teachers placed more importance on many of the technology skills than inservice teachers or principals did, and we can assume that they will want to use these skills in the classroom. The inservice teachers surveyed agreed more than the principals did that many of the basic technology skills in the survey were important. This is an indication that they are finding opportunities to use these skills in the classroom and are convinced of their importance.

It is interesting to note that both principals and teachers found areas for improvement in the current technology skill sets of teachers and that those skills include computer use for instruction, using the

internet and multimedia for instruction, and using technology for grading and management tasks. Again, these are the basic skills determined by the ISTE standards. Schools are currently providing workshops and other forms of commercial training for teachers to improve technology skills, and 63% of the teachers reported learning technology skills from a peer trainer. These findings point out the need for universities and other educational institutions to provide technology training for preservice teachers

Basic technology skills must be developed before integration into instruction can be achieved. Results from this survey are being used in dialogue with university professors and community colleges to develop computer courses that cover basic skills outlined in the National Educational Technology Standards. The goal is to develop classes that not only would benefit the professional educator, but skills that would be used by the paraprofessional in a school setting. Once a student has a foundation of basic skills, the university preservice courses can focus on the integration of technology as a teaching tool. The technology course would develop the pedagogy for integration and methods courses would model and require the application of technology in student projects. Modeling the integration of technology would not only be in methods courses, but also in field study placements. When possible, the education colleges can also look outside of their own curriculum and identify other coursework that will benefit educators as they develop their technology skills. For example, technical writing, graphic design, and multimedia development can all play major roles in instructional development.

Our survey results also indicated that administrators are looking for skilled applicants and assess technology skills in various ways. Current assessment of technology skills is done by an application interview (62%) and by portfolio (42%). The survey results for future assessment show that these two assessment tools remain the most important, but that portfolio is as preferred (41%) as the application interview (39%). Schools of Education can provide a great service to the educational community by creating a consistent portfolio mechanism that identifies those students who have achieved a high level of technology skill and who are prepared to integrate technology into their classrooms immediately.

If our children are to become technically literate, it falls to the university to produce well-trained teachers who can provide models of technology skill as well as instruction and practice opportunities for their students. We believe that technology training will never be a static process and there will always be new skills to be learned. It will be important for university teaching programs to be riding the leading edge of technology in the future.

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# Learning with Internet Resources: Task Structure and Group Collaboration

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Abstract: The purpose of this project was to study how task structure and group collaboration may influence the way children learn with Internet resources. A group of 27 elementary school children and two classes of pre-service teachers participated in this study during the summer 2000. The children were assigned to work on a WebQuest designed by the pre-service teachers either individually or in pairs. Data were collected through an observation scheme and journals. The results showed differential patterns of behaviors and emotions when children learned individually and in small groups. In addition, the differences were often related to the different characteristics of the learners and the task structure.

## Introduction

The Internet, with its vast array of information, offers students opportunities for learning from rich, up-to-date and authentic resources and for developing information-seeking skills. On the other hand, complaints are often heard from students that it is time-consuming to find useful and relevant information on the Web. Although more expansive and up-to-date than any encyclopedia, the information on the Web is not organized and filtered as that in encyclopedia (March, 1998). A lot of valuable time can be wasted if students lack the necessary research skills and appropriate guidance is not provided to them.

WebQuests, an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web, were developed by Dodge (1995) to help educators design meaningful and structured learning activities for students. Since then, WebQuests have become increasingly popular as a component in teacher education courses and in the K-12 schools. However, few studies have been conducted to date investigating the effects of using WebQuests, the adequacy of the structures provided and the influence of social context. A recent meta-analysis (Lou, 1999; Lou et al., 1998) of 103 studies comparing small group and individual learning with technology indicated that the effects of social context appeared to be moderated by type of technology-mediated learning activities, task structures, and group or individual outcomes. The purpose of this project was, therefore, to study how task structure and group collaboration may influence the way children learn with Internet resources.

## Method

A group of 27 elementary school children ranging from grade 2 to 7 participated in this study during the summer 2000. These children were brought in by two classes of pre-service teachers who were taking a technology literacy course learning to use various software and ways to facilitate children's learning with technology. One of the course components is to design a WebQuest. In order to make the activity more meaningful and to observe how children learn with technology individually and in small groups, we suggested to the pre-service teachers that they bring in one or two children for the WebQuest try-out. Thus, each pair of pre-service teachers designed their WebQuest specifically for the children they knew. Each WebQuest contained all the five essential components (i.e., introduction, task specification, detailed procedures, a list of resources, and some concluding remarks) as suggested by Dodge (2000).

In one class, the WebQuest try-out was conducted in two days. About half of the children participated on Day 1, where each child worked on the WebQuest individually. On Day 2, the other half of the children worked in pairs. In the other class, the activity was conducted in one day. About half of the children worked individually and half in pairs. At the beginning of the activities, the pre-service teachers provided a brief introduction to the WebQuest activity each child or each pair of children would work on. Then the children worked on their own while the pre-service teachers sat beside the child(ren) observing, taking notes, and answering children's questions when needed. For those working in pairs, they were instructed to share and help each other.

Data were collected using an observation scheme with broad questions on how children interacted with each other and with the learning activities. In addition to the observation notes, each pre-service teacher also wrote a journal after the study, reflecting on what they observed and learned from the study.

## Findings

Differential patterns of behaviors and emotions were observed when children learned individually and in small groups. In general, children working alone asked more directional questions of the facilitators, whereas pairs appeared to rely more on each other than on the facilitators. When working in pairs, the children shared work, decisions, as well as excitement and they appeared to enjoy the tasks more than those working alone. However, some observers noticed that the learner in control of the mouse was often actively involved in making decisions, while the one not in control often struggled to keep up.

Type of tasks appeared to have differential effects on children. Tasks that combined information-seeking activities with multimedia design appeared to motivate the children more than the former alone. In many cases, both individuals and pairs became more engaged and motivated when they applied the information they gathered in some multimedia design activities.

Although each WebQuest designed was quite structured and contained all the five essential components, a few children, especially those that were at younger age and were working alone, felt somewhat at a loss as to what to do after reading through the package and listening to a brief oral introduction by the facilitator. In addition, a few children expressed some frustration having to weed through irrelevant information on some Web sites.

## Implications of the Study

The results of this exploratory study contribute to the knowledge of how children at different grade levels learn with Internet resources in small groups and individually. Although WebQuests are intended to provide structure when children learn with internet resources, results of this study suggest that the effectiveness of WebQuests may vary based on the type of tasks designed, the age level and cognitive ability of the learners, and whether children learn with others or by themselves. However, more studies may be needed to replicate the results.

This study also indicates that incorporating observation studies in teacher technology training courses can be a valuable experience for pre-service teachers. Through close observation, the pre-service teachers involved in this study noticed both the strengths and limitations of their designed learning activities and realized the importance of effective instructional design in motivating the students and enhancing their learning. They also realized that both individual cognition and social interaction play an important role in children's learning (Anderson et al., 2000). The activities designed have to be closely related to the children's prior knowledge as well as interests. A few pre-service teachers were disappointed that the excitement and enthusiasm they expected of their learners were not exhibited. Through close observation and reflection, they found what was lacking in their designed activities and suggested ways that their activities and learning experiences may be improved.

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# Culture Clash in the College Classroom: Changing the Work Teachers and Students Do

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**Abstract: This paper examines the experiences of beginning teacher education students in an inquiry-based, technology rich course that has been designed to change the work that both teachers and students do as they explore contemporary issues in the profession of teaching. Analysis of these experiences is framed by concepts from cross-cultural psychology, often used to understand experiences of individuals who abruptly find themselves living in a different culture. The premise is that classrooms characterized by changed teaching and learning design and activity are, in fact, "new cultures" to those who participate in them.**

## Introduction

In 1994, responding to a State of Ohio initiative to replace its certification program with one that licensed its new teachers, faculty in the College of Education at Kent State University began the process of reevaluating its teacher education program. That reevaluation led to the completely redesigned program that has been in place since the fall of 1998. Central to the goals of the new program has been to change the work students and teachers do: to make course work more interactive, to engage students and teachers in inquiry-based research, and to demonstrate student outcomes, experience, and achievement in new ways. In all these areas, the integration of technology has been a major tool.

In all segments of the program, students and teachers have experienced major changes in the work they do, how that work is done, and with whom. As might be expected, the transition to the new program has not been easy and not least of the difficulties has been—for all of us—the necessity of learning new ways to "do school." The purpose of this essay is to focus on the experiences of students and teachers in one particular course—the initial core Inquiry seminar in which students are introduced to three major ideas: contemporary changes in the profession of teaching, the impact of a diverse population on classroom cultures, and the integration of technology into instruction.

## The Argument from Design

The physicist, Freeman Dyson, writes of cosmological theories of the development of the universe, one of which is called "the argument from design" [Dyson 1979]. In that theory, the thesis is that a single "designer" created the universe, thus ensuring at least some degree of coherence in the design. Our small universe did not have the benefit (and the costs) of a single designer. Rather, it had the costs (and the benefits) of many "designers." As is customary in an era suffused with the "argument for collaboration," the reevaluation of our teacher education program began with a relatively small and partially representative committee, expanded—like the universe—to a number of partially representative committees, expanded again to the full teacher education faculty, reduced itself on a number of occasions to other, still partially representative committees for further consideration, and was finally accepted in 1997 by a group called, in our College, the Teacher Education Council, which is fully representative of all program areas involved in the preparation of teachers.

Along the way, many ideas were put forth, rejected, brought back, altered, refined, discarded, brought back again, and altered again. In the end, our "universe" settled into the elements of design with which we are working today.

The first of these is that it is a four-year program. Students start in teacher education as freshmen, or as newly-converted upper-classmen, whichever comes first.

Second, the program is inquiry-based. That is, increasingly more responsibility is placed on students to engage with us in their own education. This means that, wherever possible, knowledge and skills are framed in terms of questions, not answers, and students are encouraged—one could say, "forced"—to begin to frame their educational experiences in terms of their own questions about the relation between school and society, about the profession, the classroom, their own future students, and about methods of instruction.

Third, the program has what we might call "strands of design." These include emphases on a community of inquiry, integrative studies, reflective practice, responsiveness to differences, and the integration of technology into instruction. Each of these strands, although in different degrees as appropriate, are woven throughout the program.

Fourth, students are assessed not only through investigation, projects, writing, and testing, but finally in terms of initially, student portfolios, and later, professional portfolios. Soon, all students will have electronic portfolios.

Fifth, the program enlists classroom teachers and agency professionals as partners in the education of pre-service teachers. This is done in a number of ways, beginning with placement in schools in the freshman year and extending through student teaching.

Finally, the program includes introduction to a variety of forms of research, culminating with a major action-research project associated with student teaching.

## The Inquiry Seminars

A central feature of the new curriculum design is a series of four Inquiry Seminars. The first three of these seminars combine elements of sociocultural and psychological foundations, are thematic in nature, and are designed in a spiral, so that concepts and issues introduced initially are revisited repeatedly, each time from a different angle or in more depth, or both. The fourth seminar, "Inquiry Intro Professional Practice," is taught in the program areas in association with student teaching. In addition, a series of three inquiry-based seminars is offered in individual program areas, beginning in the sophomore year. Students thus have seven such seminars in their whole program, three in foundational areas and four in program or licensure areas.

The first, Inquiry I, is called "Inquiry Into the Profession." The focus of this course is on our own students and their development as beginning pre-service teachers. It has three major elements: 1) inquiry into the nature of the teaching profession, its history and its current status and requirements; 2) inquiry into the diverse nature of learners in the United States today; and 3) inquiry into the integration of technology into instruction. It is not only an introduction to the teacher education program; it is also an introduction to a new *culture* of teacher education. The challenges inherent in this course appear, in varying degrees in all of the Inquiry seminars, as well as in the program as a whole. But because this particular course is the first, the challenges of a new culture are more apparent here.

## The New Culture of Teacher Education

The new *culture* that students find when they enter the Inquiry I course can be characterized in the following ways:

it is a shift from passive to active orientation;
it is a shift from "getting" answers to formulating questions;
it is a shift from "knowing" to reflection;
it is a shift from teaching to learning;
it is a shift from individual work to collaboration;
It is a shift from certainty to ambiguity; and, in our case,
It is a shift from paper (textbooks, articles) to electronics (browsers, web sites)

## Positing a Culture-Clash in the New Program

. While there has been a great deal of literature on student "resistance" to new kinds of classroom organization and instruction, I think it is more helpful to conceptualize the situation in terms of a clash of cultures. We are familiar, I imagine, with the concept of "culture clash," as representing what happens when one suddenly finds oneself in a different cultural milieu. My observation is that much the same thing is happening to our students, and--to a large extent--to ourselves as we struggle to find new and better ways of educating teachers. Thus, I want to borrow a schema from cross-cultural psychology to describe what happens when students who have learned, for the most part, how to be effective students in traditional teaching and learning situations, react when they find themselves, with little preparation, in a very different kind of classroom culture.

The schema is adapted from Cushner and Brislin [Cushner & Brislin 1996] as one that may be useful in analyzing and understanding the challenge we face with our students. Briefly, the schema "illustrates three psychological stages though which individuals usually proceed when immersed in an intercultural encounter" [Cusher, McClelland, & Safford 1996]:

Stage One: Emotional Arousal
Stage Two: Understanding Unfamiliar Behavior
Stage Three: Personal Adjustment and Growth

## Emotional Responses

Emotional responses arise quickly when one is confronted with unpredictable behavior on the part of others and when their own behavior does not produce expected results. Among the emotional responses are anxiety, ambiguity, disconfirmed expectations, a need to belong coupled with a certain fear of rejection, and unhappiness at having to examine their own preconceived notions.

These emotions are almost immediately aroused in our students by a number of activities in the class. They are anxious because we have them reading trade books with no bold-face headings that tell them what is "important to learn." They are anxious because we give them "teaching opportunities" in the class almost right away. They are anxious because we require them to articulate their own judgments, based on their inquiries, and there is no right answer.

They quickly develop a sense of ambiguity about the class for a number of reasons. For example, at first it seems to them to be a kind of "easy" class, because much of it is discussion. But it soon occurs to them that "opinions" are not enough; they need not only to *support* their opinions but those opinions are subject to public scrutiny in the class.

Their expectations are disconfirmed rather quickly, as well. I cannot emphasize enough the degree to which most of them have learned to "do school" successfully—by taking good notes, by learning concepts helpfully bold-faced or underlined in a recognizable text book, by learning definitions, and by giving "right answers." How, they say, can they take notes on a free-flowing discussion? What concepts and ideas should they "learn"? How can they define an idea like "cultural identity," which, for our mostly white, middle-class

students, "belong" only to people of color? What if there *are* no right answers? Indeed, what if questions—inquiry—are more important than answers? My, how the rules have changed!

Not "knowing the rules" of appropriate behavior in this new situation makes it difficult for many to feel that they "belong" in this milieu. At the very least, they expect this course to help them "learn to teach," which they define primarily as exercising control of classrooms, imparting information that they know and their students don't, and generally being effectively "in charge." And they say, to themselves and to their instructions, many variations of "What is this, and what am I doing here, and how is this going to help me get a job as a teacher." Indeed, the students who most easily come to "belong" are often those who have never been truly socialized to "doing school" in the traditional way. They are kind of "closet rebels," and they ask extremely interesting questions, which, of course, is what inquiry is all about.

Finally, they have a difficult time—and are generally driven crazy—by having to first, identify, and then examine the development of their own cultural identity—particularly since most are completely unaware that they have one. In the process, they must step out of their own cultural enclave and "see" it, when it is perceived as all but invisible. To say that many are unhappy about this activity is something of an understatement. To say they would really like a textbook and be left alone is something of an understatement as well.

## Understanding Unfamiliar Behavior

After about a month, most accept they are stuck in this all-too-required class, and begin to try to figure out what this class is about, and why it's important, and what reconstitution of their own mindset is necessary. In short, they have to acquire knowledge about this classroom culture and they have to learn the new rules. This, too, is something one has to do when one finds oneself in a new cultural milieu. There are several kinds of knowledge that they are required to gain.

First, they must learn a new kind of communication, and, in part, a new language. They are very used to one-way communication patterns in school—from the teacher to the student. They are also used, in traditional classrooms, to speaking answers, not generating questions. They have been taught that the text, or the teacher, or some expert of some kind "knows" the answer and they must "learn" it. They have a hard time even *thinking* of questions—because, after all, who are *they* to question the text, or the teacher? Further, they are not accustomed to having a question answered with another question—how frustrating is *that*?

The language, of course, is English—but we throw a great deal of educational jargon at them, and to give them credit, they pick it up rather quickly, immersed in it as they are. Collaborative learning, the *Praxis Series*, reflective teaching, AACTE, NCATE, state educational funding formulae, portfolio assessment, the induction year—and on and on and on. Indeed, they are learning a "professional" language.

In addition, they must learn new values and new rituals. The chief difference, I think, in values lies in the area of individual work: they come from a culture in which one must keep one's eye on one's own paper and not talk with one's neighbors, into a culture where helping one another, teaching one another, making sure everyone learns, are the overriding values. While they do individual work—largely writing—they also work in small groups a good deal—and are rewarded (with grades) on the basis of the effectiveness of the group, not the individual. This is a rather different relationship to one another than they have come to expect.

There are new classroom rituals, as well. Look at each other, not just at the teacher; go to work on on-going projects when first entering the room—don't wait for the teacher to get you started; and, of course, a whole lot of rituals involving the computers that are in the classrooms where these courses are taught.

Status and roles often change, too, in this kind of classroom, particularly those of the heretofore "excellent student." The most plaintive exclamation is often, "But I *always* get As on my papers!" after a student who, using the rules she has learned well, writes a paper that merely paraphrases someone else—that

"expert" I mentioned earlier. And does not get an A. Another, nearly universal, status that they have acquired in school is the very status as "student"—one who listens but does not venture an original idea or a critique. "What do you want???" they ask me. "I want you to *think*?" I answer.

Finally, differences in time and space are hallmarks of different cultural milieux. Accustomed to 50-minutes liberal arts classes at this stage of their college experience, they spend 2 ½ hours in this class—time to explore, to inquire, to discuss, to work on projects—and to get *bored*! And the space is also used differently; there are five computers for 20-25 students; there are tables and chairs on wheels; they never know when they come to class just how the place is going to *look*. Quite often, *they* are responsible for decided how it will look. Good grief!

## Making Adjustments

By about two-thirds of the way through the 15-week class, most—but not all—students have become reasonably adept at the "new" culture of this classroom. They have accomplished what anyone dropped into a different culture must do—they have undergone some degree of personal change. They have adopted a different frame of reference for thinking about teaching—with new categories and new values (e.g., questions are good; answers are open for discussion). They have learned, more or less, to work effectively in small groups—and often take a good deal of pride in "their" group. They have begun to learn that, as teachers, they will be expected to be learners—a new concept for those for whom the teacher is the ultimate authority with the power of the grade. They have begun to sense the scope of this new culture inhabited by "professional" teachers; and they have begun to develop a healthy respect for that culture. They have some new ways to differentiate effective classrooms from ineffective ones, and have begun to refine their notions of "good teaching."

They have also begun—only begun—to learn to integrate technology, especially computer technology, into instruction. Even those for whom a computer is a new and frightening *thing* in the classroom, the end of the semester finds them mostly comfortable with them, and talking to each other in a language they didn't know before. "Well," they say to one another, "a PowerPoint presentation is really just a fancy overhead; what about actually linking the kids to web sites or having in-class chat rooms or threaded discussions?" I'm amazed.

## New Roles for Teacher Educators

Given the nature of our program, and the degree to which we are all—students and faculty alike—"strangers in a strange land," I believe that the role of the instructor in these courses is many-layered. Of the greatest importance is understanding that we are, indeed, in a different culture, and being overt about it. That is, we must, all along the way, not only *model* this different pedagogy, but *explain* what we are doing, *why* it is different from what students are used to, and *how* it is different (as well as how it is the same as) what they are used to. We must also enable students to stand back from and reflect on their own experiences in these courses, and this program; we must listen to them and adjust accordingly; and we must give them—and ourselves—the time necessary to "play" with it.

Since many of the sections of Inquiry I are taught by graduate teaching fellows, this also means a significant investment in both initial and on-going education for instructors, which is difficult, inasmuch as we are inventing it as we go along. This means, of course, that we must *share* the development of this culture with them—not simply *tell* them what to do. They, too, have grown up in traditional schooling systems, and they, too, tend to "teach as they were taught."

If this "new" culture is of intrinsic worth, it is worth our best and most creative efforts to understand it, and to pass it along to our students. In a society (and a University) that values high-stakes testing and accountability, and does not particularly value long-term solutions to immediate problems, that is not an easy

task. What is at stake, however, may very well be the ability of our students' students to flourish in a century about whose requirements we can only guess.

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# Ready or Not – Here They Come

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**Abstract:** ISTE NETS for Students and the new NETS for Teachers raise expectations of what students and teachers should know and be able to do. Because of this, we sometimes assume that teacher candidates come with more technology experience than they actually do.

Focus groups with undergraduate Foundations of Technology classes indicate that students leaving high school have had little experience using technology in school. None had college professors who modeled technology use.

As teacher education programs are redesigned, stand alone technology classes are often eliminated. However, teacher education programs can not assume that students will come with extensive experience in technology. An Essential Technology Skills Assessment was developed to help students gain basic skills needed to be successful in technology rich classes.

This session will focus on the technology skills and experiences our students are bringing to teacher education programs and one evolving process for building their entry technology skills.

## Introduction

Focus groups with undergraduate Foundations of Technology classes indicate that students leaving high school as well as those returning to college after an absence have had little experience using technology in school. Most had used word processors and some had used telecommunications applications. Only one had used technology to support project based learning. While there were pockets of students with more advanced skills, most were still at the novice level of use of other applications.

When asked how technology was included in college courses, most indicated they used word processing to complete assignments but the Foundations of Technology course was the first where professors modeled technology use. In a few classes, they used e-mail to communicate with the instructor. They used the Internet to find information. Most did not know how to search effectively or to evaluate the information they found.

ISTE NETS for Students and the new NETS for Teachers raise expectations of what students and teachers should know and be able to do. Because of these higher standards, we sometimes assume that teacher candidates come with more technology experience than they actually do. However studies continue to show that only about 25% of the teachers in the country feel comfortable enough to use technology in their classes. School districts and teacher education programs are working to improve the percentage of teachers who effectively use technoloogy in the classroom.

Schools of Education are being asked to provide appropriate experiences in less time with fewer credits. This sometimes leads to the elimination of the stand-alone technology class. Many studies have shown that stand alond technology classes are not effective by themselves. Students need to use technology through out their program (ISTE). Others have found that foundation technology courses provide students with the skills they need to be able to use technology in their other classes. Some studies suggest that a combination of a foundations class and technology infusion in all other classes if the most appropriate way to prepare technology proficient teachers. Not all Schools of Education have been able to provide that.

## Identifying and Assessing Pre-requisite Technology Skills

Through support from the federal Alaska Partnership for Teacher Enhancement (APTE) grant, our teacher education program is being redesigned to meet the needs of our state. The results of this partnership was a one year, post-graduate, intensive, internship model. One of the changes to the current program was students would no longer take a stand-alone technology course. Educational technology was being integrated throughout the program. However, we could not assume that students would come with extensive experience in technology. Students need alternatives methods of developing pre-requisite skills when there is no foundations technology class.

To ensure that students entering the new certification program would have the basic skills needed to be successful in their classes, an essential technology skills assessment was created as part of our PT3 grant. The technology assessment is based on the new ISTE National Educational Technology Standards (NETS) for Teachers (Level 1 performance indicators).

The Essential Skills Assessment (http://cwolf.uaa.alaska.edu/~afahm/ ) was designed to show students what they already knew and fill in the gaps where there were missing skills. It assessed only the basic skills that we felt were essential for students to know to be able to use technology successfully in their classes. Many university education program web sites were surveyed to develop a common list of basic skills We tell students the assessment helps them gain only enough skills to be able to keep their heads above water using technology in their courses.

The Essential Skills Technology Assessment is a performance based assessment that addresses 11 skill areas: 1. Personal History of Tech Use, 2. Internet tools (e-mail, listserv), 3. Search strategies, site evaluation, information literacy, 4. Simple Web Page & Bookmarks, 5. Word processing, 6. Spread sheet, 7. Data base, 8. Graphics (including. scanner, camera), 9. Non-linear hypermedia presentation, 10. Linear Slide Show, and 11. Basic computer operations and troubleshooting. There were three ways for students to demonstrate competence in each area of the Essential Technology Skills Assessment. Option A asked them to provide evidence of prior learning. Option B was an on-line tutorial that helped them gain the skill individually. Option C was an on-campus workshop where they learned the skill. Students were allowed to mix and match options to meet their needs and skills. One option, that was not considered as the during the development of the skills assessment, evolved during the assessment interviews. That option was tutoring by the Tech Assessor during the scheduled assessment interview time.

Students were instructed to visit the Essential Technology Skills Assessment web site where they could work on the skills in any order. They were given general instructions which included the expectations for each of the options.

*Instructions for Options to Completing the Essential Technology Skills Assessment.*

Option A: Evidence

1. Use a word processor to reflect on your skill. Describe what you know and how you learned it. Tell about the evidence you are submitting to show your competence.
2. Gather evidence that demonstrates you are proficient in the skill as described in the table.
3. Assemble the reflections and evidence on disk. Share the results with a Tech Skills Assessor.

Option B: Tutorial

1. Complete an online skills tutorial.
2. Save your work to disk.
3. Use a word processor to write about what you learned and how you learned it.
4. Bring the files on disk and share your results with a Tech Skills Assessor.

Option C: Workshop

1. Participate in an essential skills workshop on campus.
2. Workshops will be scheduled for each of the skills.
3. Check the class calendar for dates.

Graduate assistants and undergraduate School of Education computer lab aides were used as Tech Assessors. At the beginning of the program, Tech Assessors met and determined the criteria for successful completion of each task. As students completed tasks, they scheduled interviews with a Tech Assessor. If they successfully completed the task, they were checked off. If not, they were told what they still needed to do and asked to come back to be rechecked.

## Findings

Twenty four students participated in the Essential Technology Skills Assessment. All students were asked to write a short, one to two page paper to complete Technology Skill 1. They generally chose Option A to complete Technology Skill 2. Internet tools (e-mail, listserv). While students felt they knew Technology Skill 3. Search strategies, site evaluation, information literacy, in reality the Tech Assessors found they needed assistance with this skill. This was one of the skills where the Tech Assessors tutored them during the assessment session. Some students already had their own web page and were able to use Option A for Technology Skill 4. Simple Web Page & Bookmarks. Most students did this learned this with the Tech Assessor. Almost all students chose Option A to demonstrate Technology Skill 5. Word processing. About half of the students chose Option A and the other half Option C for Technology Skill 6. Spread sheet. We decided to teach Technology Skill 7. Data base to the whole group when we introduced them to electronic portfolios. A majority of the students chose Option C for Technology Skill 8. Graphics (including. scanner, camera), Technology Skill 9. Non-linear hypermedia presentation, and Technology Skill 10. Linear Slide Show. We presented Technology Skill 11. Basic computer operations and troubleshooting to the whole group when we distributed the iBooks we were loaning them.

Another part of our PT3 grant provided leased iBooks for each of the students in the new program. This allowed them to take the technology from the university to their PDS site and to their homes. We are evaluating the effect of this access to technology on technology use by faculty and students.

Students completed additional technology activities in the Foundations Class. Those activities were also based on the new ISTE/NCATE NETS for teachers (Level 1). Students were instructed to keep electronic copies of all their work so it would be available for the electronic portfolio they were to compile by the end of the program.

## Conclusions

As we were developing the new program, we recommended that basic technology skills be a prerequisite for entrance into the program. The Essential Technology Skills Assessment was designed to help students meet the prerequisite level of basic skills. The intent was for them to complete it prior to beginning the program. The fast timeline for developemt of the program did not allow that to occur with the first cohort. Students were notified of their acceptance into the program by early June. Almost immediately they started the program with an online experience in mid-June, followed by a 9 credit Foundations of Education class, which integrated technology, in July and August. So rather than coming with the basic skills, they were having to complete the technology assessment and develop the skills as they were taking classes.

While the Essential Technology Skills laid a foundation, completing it in conjunction with the foundations course was too intense to be effective. The students did not become comfortable with the technology before they were asked to use it for class. They did not have time to thoughtfully complete the foundations content assignments. In short, they were overwhelmed.

Faculty realized what was done with the first cohort did not work. Because timelines from acceptance to starting the program will continue to be short, it was difficult to require a technology prerequisite. However, the post baccalaureate certification program continues to evolve. Next summer we plan to split the foundations course into two sections. Technology skills will be taught in conjunction with

history of education in the first section. The second section will contain the other foundations content and will continue to develop technology skills and provide students with technology integration activities.

If the program had a technology prerequisite, an expanded Essential Technology Skills Assessment could be an appropriate method for students to demonstrate minimal technology competency.

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# Using Multimedia and Technology to Teach Mathematics and Science: Research-Based Professional Development Materials


Abstract

The ultimate goal of this project is to have a new crop of teacher candidates finish their undergraduate teacher education program with a full understanding of the interconnections between mathematical scientific principles. This project supplied preservice teachers with the equipment and knowledge of how to use the latest technology that makes real-life data collecting and computational explorations routine. This was done by incorporating the use of multimedia and technology in the classroom in an effort to actively involve students in an integrated, reformed, technology-based, visual instructional model. Through the use of mathematical modeling and scientific inquiry, the tendency to teach each of the disciplines in isolation will be removed.


## Need For the Project

Recognition of the importance of technology in teacher certification is gaining momentum. According to Arthur Wise, president of NCATE (National Council for Accreditation of Teacher Education), "beginning October 1, 1995, accredited schools of education must meet NCATE's new standards for technology in teacher education to become or remain accredited." (Wise 1995) NCATE recommends that (1) K-12 staff and university educators must work together to integrate technology into curriculum and classroom practices, (2) teacher educator and K-12 staff must receive training and support, and (3) **models must be developed with technology supporting content areas.**

The Office of Technology Assessment issued a report entitled *Teachers and Technology: Making the Connection* (1995) which found the most technology instruction in colleges of education focuses on teaching about technology as a separate subject, not teaching with technology with technology across the curriculum. These institutions do not model use, nor do they teach pre-service teachers how to use information technology for instruction. Most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice. Telling preservice teachers about what is possible is not enough; they must see their instructors use technology in their own learning, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these effectively in their own teaching. Curriculum integration is central if technology is to become a truly effective educational resources.

Preservice teachers need to understand the applicability of multimedia and technology to their teaching of mathematics and science. Using multimedia and technology to teach mathematics and science would change undergraduate teacher education for the preparation of middle school mathematics and science teachers. In addition, the methods courses and the materials would cut across disciplinary boundaries by integrating mathematics and science. By providing a solid foundation for the preservice teachers' proficiencies with computer/calculator applications in mathematics and science, this project would become a model to support the preparation of mathematics and science preservice teachers in their content area.

## Purpose

The project initiated reform in the mathematics and science preservice middle school teacher education on the campus of North Carolina State University. The preservice teachers were prepared for effective instruction in the scientific/information based twenty-first century. The objective of the project are:

1. to develop professional research-based materials for use in undergraduate teacher preparation courses which incorporate laboratory experiments and/or field experiences that actively engage students to use scientific process and explore concepts; these materials will reflect the necessary integration of mathematics, science, and technology into the preservice pedagogical content preparation of undergraduate students.

2. to use cooperative/collaborative learning, peer teaching, learning communities, and technology to improve pedagogical in methods courses.
3. develop a methods course that requires preservice teachers to use visual imagery, manipulatives, multimedia, and technology to enhance the learning and teaching of mathematics and science.
4. to encourage change by providing preservice teachers an opportunity to reflect about the use of technology and multimedia in teaching mathematics and science and the teaching strategies needed to fully integrate the mathematics and science curriculum.

## Project

This project involved about 15 mathematics and science dually certified middle school preservice teachers per year. This curriculum reform focused on the use of graphing calculators, calculator-based laboratories, digital cameras, multimedia, and computers to collect and analyze real-time experimental data. The calculator-based laboratories facilitated the development of the students; understanding of instructional strategies that facilitate the integration of mathematics and science into the curriculum. Professional materials for use using technology to teach mathematics and science and integrating mathematics and science into other disciplines through the use of technology are in the process of being developed. Both students and teachers involved in the project created interactive, multimedia laboratory reports for presentation purposes.

In addition, the researcher required all the participants (preservice teachers, cooperating teachers, and students) complete a Teacher Technology Survey to determine their attitudes about the usefulness of the technology for selected activities designed to integrate the mathematics and science. The students were given a pre-assessment before selected activities and a post-assessment after completing the activities. Data was gathered and analyzed (results are not yet available) to determine the effect of the technology on the participants attitudes about the use of the technology on learning the concepts, and to determine the effect of the technology on their conceptual development of various scientific topics.

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# Preparing Teachers to Succeed in Online Professional Development Courses

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**Abstract** Specific learner characteristics are apparent in students who successfully complete online professional development courses. Self-motivation, time management skills, field independence, and proficient technological skills have each been sited as beneficial to the online learner. This paper reviews those characteristics and suggests changes that may contribute to preparing teachers to succeed in this learning environment.

## Introduction

Colleges, Universities and other institutions currently offer a wide variety of courses online. Advancements in technology will allow for a greater number of these courses to be delivered in the future as more options, such as streaming audio and video, become widely available. Online courses addressing the professional development of teachers are part of this new trend. Many states are increasing requirements for continued certification by expecting their teachers to complete a specific number of professional development hours or credit each year. Teachers may choose to accomplish this in an online learning situation.

Studies indicate that specific learner characteristics are apparent in students that are more successful in this type of learning environment. These characteristics include self-motivation, time management skills, field independence, and proficient technological skills. Many undergraduate students have not mastered and do not possess these skills and subsequently, may fail to learn in this environment. For this reason these skills should be developed in the undergraduate pre-service teacher education program so those students may be successful in professional development courses offered in the online format.

### Self-motivation

The development of self-motivated, life long learners is a common goal for most teacher preparation programs. Faculty recognizes the importance of fostering these ideals in future educators. Motivation has been linked to a student's confidence in their ability to successfully complete a task. This confidence is developed over time through a variety of techniques such as descriptive feedback and frequent communication with faculty when needed.

Studies indicate that student motivation plays an important role in the successful completion of an online course. Confidence is necessary in the ability to grasp the content, and to complete the task. Although students usually graduate with a mastery of the content, they may lack the skills necessary to complete an online class.

### Time management

Excellent teachers must manage the students' class time efficiently and effectively. A well-prepared teacher competently plans the schedule and follows through on time lines with ease. Faculty foster these skills by providing guidance or structure for the completion of projects early in a students career and then systematically fading those structures to allow students to develop their own strategies.

Time management strategies are essential for success in an online classroom environment. Students report extreme difficulty in managing the time needed to complete an online class. Due to the flexibility, they often must be responsible for setting their own time schedules. Teachers should be well suited to planning their time.

### Field dependence

Students who are field dependent will require a greater amount of structure throughout their educational career to complete specific tasks. Given this structure, they can successfully complete assignments. Careful planning of rubrics that outline expectations and specific learning outcomes are beneficial. Cooperative learning groups that include field independent students also assist the field dependent student. Students who are field independent can often provide the structure necessary for the field dependent learner. Strategies allowing students to develop a structure when none is apparent will provide the guidance necessary for these students to succeed.

### Technological skills

Finally, technology skills must be developed and mastered to succeed in an online classroom environment. Technological proficiency is not obtained through an event such as a training session or even a computer course. It is a process. Mastery of the needed skills must be developed over years. Students need to learn about an application, have opportunities to practice the appropriate use of such a program, and then continue to develop their skills. This process must begin early in the student's educational career. Currently, students enter into programs with diverse abilities in the area of technology. All students must be skilled in the basic computing skills. These include word processing, spreadsheet, presentation technologies, communication tools such as the use of E-mail, and electronic research techniques. One method to address this is to require a computing course in the first year or an introductory set of sessions for academic computing.

In addition, faculty in all disciplines throughout the institution should be encouraged to integrate technology into their own teaching, as appropriate, and particularly in assignments for students. For example:

- College writing courses may consider including writing E-mail and bulletin board exchanges as a separate method and style of communication.
- Public speaking courses may require the use of presentation software in one speech.
- Internet resources may be included in the compilation of research references.
- Web based bulletin boards may be utilized to share views and exchange ideas.
- Faculty may require some assignments to be submitted electronically.
- Course syllabi as well as other learning materials may be available through the class web site.
- Some communication to students may be provided through E-mail.
- All students should be expected to complete written assignments in a word processing program.

## Summary

When students are required to utilize the technology throughout their educational experience, over time, they will master the technological skills needed to enable them to become competent self-directed learners in an on-line classroom environment.

The development of self-motivation, time management strategies, and technological proficiency will benefit all students whether or not they intend to complete professional development courses offered in an online format. The systematic development of these learner characteristics will ultimately promote student success and should be incorporated into programs initially and throughout the educational experience.

**Empowering teachers through cognitive literacy skills development: Implications for restructuring teacher education programs through technology infusion**

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## Abstract

Technology has opened Pandora's Box in many respects. Perhaps one of the greatest challenges is building college students' advanced literacy and technical skills, especially preservice teachers. This aspect of technology in education is raising unprecedented levels of new concerns for educators. It has presented educators and policymakers with problematic decision-making about how to attract, sustain, and prepare students for careers and living in an increasingly technological education society (Prager, 1993). The Comprehensive Educational Restructuring and Technology Infusion Initiative Pt3 Project is addressing the problem ($CERTI^2$ 2000). Educators need direction for retooling to restructure instructional approaches to help entering students construct new knowledge and skills. A electronic portfolio and performance-based assessment may be the key to identifying new teacher competencies and instructional practices. A recap of how 11 partners joined hands at the University of Cincinnati to connect K-16 teacher education restructuring and technology infusion.

***Keywords: advanced literacy, teacher preparation, technology and pedagogy***

## Overview

Today's students are faced with a great challenge as the first generation expected to have knowledge and skills to meet industry's demand for more high skilled and qualified workers (SCANS, 1991). In 1997 a report, *Mathematics Equals Opportunity* provides information about problems that college students face that do not take rigorous science and mathematics courses. Additionally, given the emphasis on advanced literacy skills in these courses and in technology pedagogy environments (teaching with technology), students without them may have serious gaps in advanced literacy and critical processing skills, especially preservice teachers (Riley, 1997). These students risk having doors to colleges and new career opportunities closed because they lack required advanced literacy and technical skills now in demand by our technological society. Advanced literacy skills are those that require students to demonstrate a high capacity to think, reason, solve complex problems, and communicate their ideas to others while continuing to learn basic skills. Ongoing support is especially important in environments where pedagogy and technology are being interconnected. National studies report that liberal arts, minority, and low-income students continue to be less likely to have challenging academic courses in their secondary education experience are most likely to need additional support to develop these skills (NAEP, 1996).

### Defining Cognitive Literacy

Research on guidelines for preparing students to function in a 21st Century workforce indicates that literacy is being redefined by technology integration in education and this presents new instructional challenges to teacher educators (International Reading Association, 1997; National Council of Teachers of Mathematics, 1989). Because I believe the proposed new definition of literacy is rooted in cognitive science I will use the term *cognitive literacy.* Cognitive literacy defines the process of demonstrating a high capacity to think, reason, solve complex problems, and communicate ideas while continuing to learn new basic skills.

### The Problem

The International Society for Technology in Education (ISTE) and the National Educational Technology Standards project (NETS) is leading the nation in making teachers and teacher educators more aware of the need for reskilling in basic computer and technical skills (ISTE & NETS, 2000). During the past few years reports from a number of experts on entering skills and competencies of entering college support findings that some college students may lack advanced literacy skills necessary to master more challenging subject matter have emerged (Levy & Murnane, 1996). Research shows the highest concentration of students lacking rigorous academic skills may be education majors or those planning to

enter the teaching profession (ETS Score Reports, 1990-1998). Too often it appears the problem may be deeply rooted in the definition of what it once meant to be literate than it does in students' ability to perform and learn challenging subject matter (National Assessment of Educational Progress Scales/NAEP, 1969-1998). As new technologies continue to transform education, the research suggests our understanding of literacy is being reconstructed by cognitive learning theory (CLT). Sticht and Armstrong (1994) in *Adult Literacy in the United States: A Compendium of Quantitative Data and Interpretive Comments* discuss concise and comprehensive research about literacy and assessment, which led me to reason cognitive literacy may be premised in cognitive science. These findings are reflected in my discussion about methods to instruct, assess, prepare, and improve students' cognitive literacy skills through new instructional strategies and ways of thinking from a more pragmatic view. A primary assumption in this paper is that learning takes the form of both knowledge- and skilled based domains in technology-pedagogy (teaching with technology) and that:

1. Human cognitive systems emphasize the role of knowledge in literacy along with the information processes involved in oral and written language use and reasoning with graphic tools of thought (flow charts, tables, etc.) and
2. Information processing views of learning emphasize the active, constructive nature of cognitive development (including literacy) in social contexts.

The connections between these two approaches may provide new information for policy makers and educators to develop guidelines about the extent of students' needs and how to best meet these needs with programs and new instructional approaches (Herman, Aschbacher & Winters, 1992).

## Background

Our research at the University of Cincinnati revealed that the first years in college for new students can be the most critical years of their educational experience. The first years will no doubt be a primary determinant in whether they will remain or join the open-door generation [those who leave without their desired credentials] (U.S. Department of Education Longitudinal Study, *Bachelors and Beyond, 1993-94*). When we consider the shortages projected for teachers in the next century, the potential lack of early success is especially concerning. It becomes more concerning when we reflect on the number of potential teachers lost during the beginning years--the time when students are considering the teaching profession or some other direction.

There is a need to examine the definition of cognitive literacy through technology-pedagogy perspectives and the most effective approach (es) for infusing new instructional strategies into general and specialized academia. These skills are being called the "new basics" (Weitzel, 1999). More importantly to determine which comes first--the knowledge or the skills in connecting technology-pedagogy? or are the two increasingly dependent on the other in new learning environments? The review discusses five issues centered on educators helping college students develop cognitive literacy:

1. Cognitive Literacy in Education
2. Revisiting Literacy Through Cognitive Literacy Perspectives
3. Implications for Restructuring Pedagogy by Focusing on Cognitive Literacy
4. Software for Building Cognitive Literacy Skills

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# Teacher Preparation and Online Learning: Is It Working?

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**Abstract:** The collaborative exploration, development and implementation of the use of web technology in the UW-Green Bay Professional Program in Education for early childhood students is discussed. This paper begins with a discussion of the origins of this innovative response to the process of teacher preparation, beginning with the award of a 3-year FIPSE Grant to support the vision and ending with the incorporation of distance learning to deliver course content and class contact hours. An overview of the technological issues, problems and glitches is shared, from institutional resistance to software incompatibility to instructional design, as well as the solutions that were used to address them. A summary of what is working, what is not, and why is presented and recommendations for what needs to be done next are made.

## Introduction

The University of Wisconsin-Green Bay is committed to providing students in the Education Program with relevant, best-practice environments in which to demonstrate a variety of competencies needed for certification. To achieve this goal, the Education Program is moving toward a teacher preparation model built on collaborative relationships with local school districts, to share and combine the experiences of pre-service students and seasoned practitioners, and to provide earlier, more extensive, and more relevant field experiences for students in preparation. One of the first initiatives to emerge was and innovative response to the national call to reform teacher preparation. The UW-Green Bay Professional Program in Education, in collaboration with public schools and private childcare and family resource programs, was awarded a 3-year FIPSE Grant for the development of an on-site Early Childhood Teacher Preparation Program that matches program competencies with PK-12 school and community needs in a technologically-relevant, community-based model. Pre-service teachers now engage in performance-based learning in community-based early childhood settings where they receive hands-on training in problem-solving, collaborative teaching, and competency-based performance and assessment strategies, learn to develop family-school-community partnerships to increase family involvement, and help provide greater continuity between the early childhood and elementary school years.

The 22-credit program sequence was converted into competency-based outcomes and transformed into on-line "core" offerings. Students now access core content on-line while spending 4 to 6 hours a week in a series of clinical rotations that include infant/toddler sites, nonprofit childcare centers, inclusive childcare programs, public and private preschools, Head Start classrooms, and full-day kindergartens. Competency acquisition is supported by a field-based faculty mentor who models best practice and provides students with ongoing feedback and support. Seminars at the university give pre-service teachers an opportunity to critically reflect on their experiences and problem-solve issues of concern, and a variety of ongoing performance-based assessment tools and techniques are used to measure student learning outcomes as they are reflected in increased knowledge, relevant and appropriate application in real-life settings, and positive changes in learning in the young children they work with.

## Technological Implementation

The provision of more intensive and extensive field experiences required the adoption of a web-based format for the delivery of course content. Several software packages written to take advantage of the hypermedia profile common to the World Wide Web were available. Among them, several were designed for general education purposes. From those options, one specific package, WebCT, was selected to translate course material to web-ready form. This initial move to introduce technology into teacher preparation served as a major catalyst for change, beginning a sequence of events that led the institution to create an environment supportive of technology. The University was running its computer operations under the Windows NT version 4 environment and at that time, would not support the Web–based software, WebCT. Working collaboratively with the computer science department, a powerful version of a Linux Operating system was installed on a medium duty desktop computer purchased with grant funds. As expected from typical Universities and IT departments, the non-windows operating system, Linux, was under tight scrutiny with regards to security, reliability, and performance, but the project was allowed to go forward. This computer operated solely as the server for WebCT. Later this server would be networked and accessed by all students registered in the first web-enhanced early childhood course. Two additional education-based courses would use WebCT, but only as a supplement to the traditional delivery of course content. Table 1 illustrates how WebCT was used in these courses.

**Table 1**

| | **COURSES** | | |
|---|---|---|---|
| | **Early Childhood** | **Math Related** | **Technology Related** |
| Receive Assignments | Yes | No | Yes |
| Turn in Assignments | Yes | No | Yes |
| Read articles on-line | Yes | Yes | Yes |
| Forum Discussions "chat" | Yes | No | No |
| Calendar | Yes | No | Yes |
| Bulletin Board | Yes | Yes | Yes |
| Threaded Discussions | Yes | Yes | Yes |
| Audio Examples | Yes | No | No |
| Video Examples | No | Yes | Yes |
| Student Note Taking | Yes | No | Yes |
| Student Web Page | No | No | Yes |
| Course Image Database | No | Yes | No |
| Internal Email | Yes | No | Yes |

Along with the university's inability to support Web-based software, came issues dealing with the generation and management of simple web page development and the conversion of course documents to web page format. A standards-based curriculum, with clearly defined competencies was designed to ensure pre-service teacher proficiency in all applicable standards and content knowledge, but the instructional design of a web-based course differs substantially from that of a traditional course and campus-based expertise in instructional design did not exist. It became necessary for project faculty to join forces with an alternative degree program on campus with grant funding to begin distance learning for nontraditional learners. Resources were pooled to bring in an outside consultant to provide training in instructional design.

If hardware and software issues were not enough, the human side of technology made the transition of course delivery from traditional to electronic an almost insurmountable task. Educators at all levels, from university faculty to classroom teachers, were feeling national, state and local level pressure to implement newly designed rigorous standards in technology into district curriculums and classroom activities. Effective integration and implementation of technology within a classroom curriculum, however, demands that educators know and understand how to operate the technology effectively, efficiently, and productively. Knowing that proficiency in the use of WebCT should precede the facilitation of student learning using WebCT, and that there was no time to develop proficiency in the use of WebCT and meet grant timelines, it was decided to move ahead. The faculty motto became, "Risk takers initiate change, and we will learn from our failures as well as our successes."

All of these implementation issues – institutional resistance, lack of resources and support, and insufficient training in the use of the software –contributed to the later difficulties that were encountered during the setup, course conversion, maintenance, and delivery of web-based coursework.

## Technological Conversion

The journey from traditional to Web-based learning was a rocky one, as faculty and students immersed themselves in the unfamiliar territory of on-line learning. Right from the start there were obstacles and challenges (sometimes referred to as bugs, glitches, software irregularities, lack of technology literacy, etc.) that required adaptation, improvisation, and problem solving to overcome. They too became part of the learning process for faculty and students alike.

An instructional technology specialist and member of the Education faculty was identified to take the lead with respect to technology issues and training. This faculty member had a solid foundation and background in technology literacy, taught a major instructional technology course that all education students were required to take, and had the expertise for software and hardware training. In addition to the teaching and learning components of web-based delivery were other critical areas in which he was highly competent: (a) troubleshooting, (b) testing that deals with the electronic transition of courses, and (c) maintaining and managing the computer server running WebCT.

The first major task of our WebCT Administrator was to develop a strategy to convert and deliver courses from a traditional to a web-based design. The first step was to do research into WebCT. This involved asking questions of people who had experience working with the program, gathering information about web-based learning from numerous resources on the Internet, and visiting the WebCT homepage. Feedback from experienced users was overwhelmingly positive and, as we later discovered, negativity usually stemmed from misunderstanding, lack of experience, or lack of vision. Surprisingly, WebCT could be downloaded from the website at no cost and installed on the computer server, where all of the WebCT elements could be explored by participating staff. Some of these elements included: (a) WebCT access from anywhere in the world using the internet browsers such as Netscape Navigator and Internet Explorer, (b) uploading of files of many types from remote computers, and (c) WebCT course maintenance from remote computers. Additionally, users had the ability to browse, download, and print assignments and other course material, submit electronic mail within WebCT to other members and instructor(s) of the course, and browse a calendar of events that they can edit for their own use. Students were also able to browse digital images, listen to audio clips, and even view video clips. WebCT more than satisfied the on-line learning strategies and outcomes needed to effectively teach course content online.

The next step was to thoroughly explore the operation and procedures within WebCT and form some type of logical process for the production of the on-line courses. After testing and analyzing the program, a list of tasks was generated that needed to be accomplished before and after an enhanced course was set into *live* status. Before the course goes *live,* electronic text files that were formatted for HTML (Hypertext Markup Language) file type needed to be created. These files included course syllabi, assignments, articles to read, lectures, and audio clips. Once formatted for Html, the files could then be loaded onto WebCT.

Throughout the process of preparing the courses for web-based delivery, obstacles were identified in three major areas: converting electronic course components from non-html form to html, converting hard copy course components to electronic html documents, and local and network file management. The pros and cons of these three areas are discussed below.

### Converting Non-HTML Electronic Course Content to HTML (Hypertext Markup Language)

The course content for all three courses consisted of computer generated media such as documents created in word processing, spreadsheet, and presentation formats, as well as hard copy media such as copies of articles, worksheets, and "passed down" curricular material. The hard copy media required a much more difficult process of digital conversion and will be explained following this section.

***Word Processing Documents:*** Most of the major "brand name" word processors could convert documents into html form but did so at a cost. At a minimum, they added "garbage or extra baggage consisting of html code and JavaScript to the main document code to increase document efficiency and cross platform and cross browser uniformity. In the case for the three courses, this "baggage was not necessary and tended to add potentially serious formatting problems within high-end web-based programs such as WebCT. If the word processing software had worked as intended, then the traditional course documents along with special formatting such as attributes like bold, text color, etc., along with

tables and graphics, would have transferred efficiently and in a seamless manner. This "easy" method was not the case for this project and would involve a little more work and some recreation of certain aspects within documents. Before the document conversion could occur, a suitable software application, which would not require a large learning curve, needed to be identified and taught to each WebCT instructor. Two designated software packages, Microsoft FrontPage and Netscape Composer were found to satisfy the requirements of only writing the necessary background html code that would be compatible with the two major browsers and system platforms. The first step was to save the original document as "text only" which would strip the document down to plain text with no attributes including no tables, tabs, or columns. The next step was copy the text into a blank html document. Once the text was within an html environment, the process of converting the document continued until all attributes were assigned including font type, size, color, indentation, etc. Tables and graphics were lost in the text translation and needed to be recreated and/or imported back into the html document. The number of columns, graphics, and tables corresponded directly with the amount of time and effort needed to convert a document.

***Spreadsheets:*** Any documents created in a spreadsheet environment had to be recreated using tables within an html environment. Text and graphics needed to be added in the same manner as the document conversion for word processing.

***Presentation software:*** The conversion to html for presentation software was the easiest and quickest to accomplish due to the unique and extremely powerful built-in html conversion feature. This feature simply created a graphic image of each entire page and created an multi-page html document complete with hyperlinks, JavaScript, and navigation buttons.

**Converting Hard Copy Course Components to Electronic HTML Documents**

This process dealt with scanning hard copy documents and then utilizing an OCR (optical character recognition) process to covert the document to contain editable text. This process can prove to be a very time consuming process and required some considerable problem solving techniques to overcome. The main reason that we had to scan documents was because we did not have the original document in electronic form. Some of the trouble spots dealt with the original document to scan. If the document was in good condition, contained only 1-3 continuous columns, and no graphics, then the scanning and OCR process was efficient and effective. Unfortunately, most of the documents contained multiple, non-continuous columns with tables, graphs, and other graphic images. These presented major problems in the scanning and OCR process and created a very labor-intensive project. One solution was to scan an entire page as an image and then create links to the image or create image documents. While this proved to a viable and efficient option when the WebCT course was accessed on campus, it proved to be a frustratingly slow process from the students typical home computer where download speeds are extremely slow in comparison. It was decided not to use this option and were forced to succumb to the labor-intensive alterative of scanning and converting text, column by column, scanning graphics one at a time, and then literally cutting and pasting and recreating new documents that resembled the originals. It was realized that once a document was finished, it could be used again for future courses, but the overall choice was to keep non-electronic original documents to a minimum.

**File Management**

File management deals with two areas, local on the users own workstation, and over a network either a LAN (local area network) or WAN (wide area network). Additionally, this topic was one of the most important elements for the conversion of course materials and working within the WebCT environment. In fact, file management turns out to be the single most important reason, both positively and negatively, why people and educators carry such a high level of anxiety about using technology. The project quickly made good file management practices relevant and necessary because of the potential loss of data, accidental overwritten files and "updated" versions of documents being mistaken for other documents. Strategies were quickly put into place to ensure that all converted documents and traditional course documents were kept separate. Additionally, the WebCT program required course instructors to upload all course material into a built in "file manager" where they would be linked to specific course areas within the WebCT course modules. The easiest and most efficient way to organize files and folders was to create and maintain duplicate file and folder structures on local workstations and within the WebCT "file manager" environment. Besides local (user workstation) file management, network file management became extremely important because not all software and

hardware was located locally, meaning that users were required to import and export files from non-local workstations to workstations used to upload files into the WebCT environment.

## Technological Delivery

The WebCT project proved to be a success as educators took the challenge of converting traditional course content and documents into html documents that would serve in a web-based environment. Within the teaching realm, instructors and students faced numerable challenges throughout the first semester dealing with low student proficiency in technology, software incompatibility , problems with access to the internet, limited student contact time, perceptions of interaction or lack of it, lack of backup plans when the server went down, and frustration in learning a new mode of content delivery. Most of these challenges were minimized or eliminated after the first semester with university conversion to the NT system, university-wide support for WebCT, and increased faculty experience in managing a web-based course. Despite recurring obstacles, the long-term positive outcomes far outweighed these initial issues, and the project served as a major catalyst for change in the students level of technological proficiency, in the use of technology in the Education Unit and other units across campus, and in the level of support provided at the university level.

## Results

Program effectiveness was assessed through survey data collected on: (a) the use of technology to deliver content; (b) student comfort level and perceptions of success; and (c) student and instructor evaluations. Student evaluations were completed after each "core" offering, and final program evaluations were sent to pre-service students near the end of their student teaching experience. Faculty evaluations were completed by all instructors at the end of the 3 year project.

The positive features identified by the faculty and students were substantial. Faculty believed that web-based course delivery has the potential for high-level interaction, with instructors having the opportunity to track the cognitive processing and conceptual development of all of their students and correct faulty inferences before they escalate. Student complaints of insufficient availability were accurate but stemmed from unaddressed issues of workload. A 3-credit online course requires substantially more time if it is to be sufficiently interactive than does a course delivered in the traditional manner.

Flexibility in delivery and access was viewed positively by faculty and students alike, but there were differing perspectives on the issue of self-responsibility for one's learning. Students needed to complete weekly assignments within a designated timeline in order to participate in weekly chat or discussion groups. This requirement was a mismatch for the traditional "cramming before the test" model that many college students opt for. Faculty viewed this as an opportunity for students to develop or strength personal responsibility skills, but many students found it difficult to adapt. Faculty also noted that there were opportunities for frequent feedback and review via email, the bulletin board, chats, and quizzes. In addition, the model was seen to support the provision of more relevant performance-based settings with mentoring support.

In the area of technology use, information was gathered on the variety of technological components and strategies used within WebCT, flexibility in the use of the medium to adapt the delivery model to diverse student populations, and pre and post-survey data on technology knowledge, skills and attitudes. Pre and post-survey data on technology knowledge, skills and attitudes over the 3 years of the grant, reported significant gains for students across all areas, and by the third year, 67% of Education students reported having taken a web-based or web-enhanced course by the second semester of their professional studies. Student comfort levels with technology, as well as their perceptions of success, as measured by course evaluations, also increased significantly for all course offerings across the 3 years of the grant. All instructors reported trying all the components available within WebCT, and, except for issues of workload, found them all to support the learning process. No data was reported on adaptations because of the absence of student requests.

Most of the issues, obstacles, and concerns were addressed earlier in the article. Additional concerns expressed in faculty and student feedback included: (a) institutional, faculty and student resistance, (b) TIME ,TIME, TIME (instructional design, student contact, backup plans, communication among partners), (c) a lack of models to assess pedagogy, (d) the difficulties involved in scheduling and communicating with students in the field, (e) the critical need for the mentor component and the lack of institutional support for the workload issues, (f) the provision of more training for faculty in how to facilitate and support interaction in a web-based course; and (g) the need for a multimedia lab in the education unit for training.

## Conclusions

On the strength of our data, the following recommendations are made and have important implications for the future success of online learning and teacher preparation.

- Institutional resistance must be addressed and new faculty roles defined.
- Issues of workload must be reexamined within the existing "course-for-credit" structure of higher education.
- Universities must provide strong, ongoing training and support for online teaching.
- If student learning is to become performance-based in intensive field settings, a mentoring component must be established along with online course delivery. It is a critical component.
- A variety of "models" for providing mentoring support need to be explored, beginning with a redefinition of "teaching" across all educational systems.

Across the nation, the major force driving change in educational systems is technology. Distance learning is here to stay. In the area of early childhood, there is a national effort to increase both the quantity and quality of early childhood providers. Professional development continuums and articulation initiatives are being established at the state level to move this population into higher education. Early childhood staff and directors affiliated with the new apprenticeship programs, working in Head Start programs, or accessing scholarship funding with work requirements, will find online teacher education courses an attractive and accessible option for pursuit of a degree. In other areas of education, federal Title II guidelines for teacher preparation require more extensive and intensive field experiences, again making a web-based or web-enhanced model a desirable alternative for delivering course content. Institutions must create campus environments that attract and support technologically driven change in teacher preparation.

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# First Things First: Addressing Teacher Concerns Toward Technology

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**Abstract**: Many teachers, especially more experienced teachers, have been unable to find effective ways to use technology in their classrooms. One possible explanation for this lack of success is that the use of technology in the classroom has been viewed in terms of simple skill acquisition instead of as a change process that affects the behavior of individuals on a very profound level. This study analyzed the concerns of PK-12 teachers (n=659) toward the use of instructional technology using the Stages of Concern Questionnaire. Results indicate that the highest two stages of concern for the respondents reflect intense, personal, lower level concerns along with a desire to learn from what other teachers know and are doing. The lowest stage of concern for the aggregate data indicates that the respondents have minimal to no concerns about the relationship of students to the use technology.

## Introduction

The ultimate goal of instructional technology integration into PK-12 education is improved student achievement, but teachers must view technology in a positive manner, be comfortable with the technology, and use it effectively before improved student achievement can occur. Teacher technology training frequently produces less than desirable effects for a number of reasons including lack of time, funds, and direct connection of the technology training to the curriculum. As a result, the effect of technology on classroom instruction frequently fails to live up to its potential.

Even teachers who hold positive attitudes toward technology may have difficulty transferring these attitudes into actions. Millions of dollars have placed technology in PK-12 classrooms, but there has been considerably less attention paid to helping teachers make the transition into a technology-rich learning environment which would, in turn, impact student learning (National Center for Education Statistics, 1999). As greater numbers of technology installations occur in schools, the demands on classroom teachers to integrate technology into instruction increase. Many teachers, especially more experienced teachers, have been unable to find effective ways to use technology in their classrooms (Smerdon, Cronen, Lanahan, Anderson, Iannotti, Angeles, & Greene, 2000). One possible explanation for this lack of success is that the use of technology in the classroom has been viewed in terms of simple skill acquisition instead of as a change process that affects the behavior of individuals on a very profound level.

Fuller (1969) and Hall (1978) conducted studies on teacher concerns toward innovation which resulted in the development of theories regarding change. Frances Fuller theorized that preservice teachers were preoccupied with concerns about self, task, and impact. Hall, Wallace, and Dosset (1973) discovered those three sequences of concern were present when inservice teachers faced implementation of innovations. Hall's hypothesis specifies seven stages of concern through which individuals progress when something new is introduced into their environment. The stages of concern (from lowest to highest levels) include Awareness (0), Informational (1), Personal (2), Management (3), Consequence (4), Collaboration (5), and Refocusing (6).

Ultimately, the Concerns Based Adoption Model (CBAM) was developed and has become a change model widely used by those individuals planning for staff development accompanying any educational innovation. Hall and Hord (1987) stressed the relevance of information regarding individuals impacted by the

change. Personal comfort with instructional technology is essential to an individual's concern with its implementation and impact (Martin, 1989). According to Hall (1976), an individual's concerns directly affect performance; and since concern levels correspond with levels of performance, lower level concerns must be removed before higher level concerns can emerge.

## The Study

The following research question was investigated: What are technology using teachers' concerns about instructional technology as measured by the Stages of Concern Questionnaire? The question was answered using the theoretical basis of the Concerns Based Adoption Model (CBAM) (Hall, Wallace & Dorsett, 1973). CBAM is a research-based framework that explains the process individuals follow as they undergo the process of change. The Stages of Concern Questionnaire is designed to capture teachers' current concerns about adopting such an innovation, in this case instructional technology.

Respondents (n=659) were PK-12 teachers, including at least two respondents from each of the 50 states, who currently use instructional technology in some form related to their teaching. All transactions were electronic. The survey was provided to respondents on the Internet; email was used to transmit the responses. The sample was purposively selected from PK-12 teachers who subscribe to four email lists. Demographic information is seen in Table 1 below.

| Variable | *n* | percent |
|---|---|---|
| Grade Taught | | |
| PK-K | 26 | 3.9 |
| 1-3 | 140 | 21.2 |
| 4-6 | 140 | 21.2 |
| Middle School | 120 | 18.2 |
| 7-9 | 23 | 3.5 |
| 7-12 | 69 | 10.5 |
| 10-12 | 141 | 21.4 |
| Highest Degree Earned | | |
| Bachelors | 245 | 37.2 |
| Masters | 204 | 31.0 |
| Specialist | 182 | 27.6 |
| +30 hours | 24 | 3.6 |
| Doctorate | 4 | 0.6 |
| Years Teaching Experience | | |
| 0 - 5 years | 102 | 15.5 |
| 6 - 10 years | 120 | 18.2 |
| 11 - 15 years | 108 | 16.4 |
| 16 - 20 years | 98 | 19.0 |
| 21 - 25 years | 103 | 15.6 |
| over 25 years | 128 | 19.4 |
| Hours of Technology Training Received in the Past Year | | |
| 0-30 | 334 | 50.7 |
| 31-50 | 129 | 19.6 |

| | | |
|---|---|---|
| 51-70 | 59 | 9.0 |
| +70 | 137 | 20.8 |

*table continues*

| Variable | *n* | percent |
|---|---|---|
| Home Computer | | |
| yes | 619 | 93.9 |
| no | 37 | 5.6 |
| missing cases | 3 | .5 |
| Classroom Computer | | |
| yes | 629 | 95.4 |
| no | 28 | 4.2 |
| missing cases | 2 | .3 |
| Length of Technology Use | | |
| 0-3 months | 13 | 2.0 |
| 3 months - 2 years | 67 | 10.2 |
| 2 years - 3 years | 70 | 10.6 |
| over 3 years | 505 | 76.6 |
| missing cases | 4 | .6 |
| Time for Technology Training/Preparation Provided During School Hours | | |
| yes | 210 | 31.9 |
| no | 449 | 68.1 |

**Table 1:** Respondent demographics.

The Stages of Concern Questionnaire (SoCQ) uses a Likert scale response format to measure seven hypothesized stages of concerns individuals have toward implementing change. The questionnaire contains 35 statements (five statements for each stage) that allow respondents to describe a concern they currently feel on a scale of 0 to 7. A response of 0 indicates a very low concern; a response of 7 indicates a very high concern.

The Stages of Concern Questionnaire was originally validated in 1979 (Hall, George, & Rutherford) and has been validated numerous times since its creation as it has been used in many studies over the past 20 years. Cronbach's alpha was used to establish the instrument's internal validity, with a sample ($n$=830) of teachers involved in team teaching and professors concerned about innovation. A sub sample ($n$=132) participated in a test-retest of the instrument over a 2 week period. Alpha coefficients ranged from .64 to .83, and the test-retest correlation ranged from .65 to .84, indicating the internal consistency and stability for each of the seven stages (Hall et al., 1979).

The Stages of Concern Questionnaire was converted to hypertext markup language and placed on the Internet. Email messages were sent to mailing list and listserv managers, asking them to share the URL for the

online instrument with their participants.

## Findings

One way of looking at group concerns is to aggregate individual data by developing a profile that provides the average scores for each stage of the individuals in a group. Participant responses on the SoCQ were initially analyzed using SPSSX (Statistical Package for the Social Sciences). Mean scores were plotted following the procedures outlined by Hall, George, and Rutherford (1998) using the SoCQ Quick Scoring Device. Typically, the group averages reflect the dominant high and low Stages of Concern of the entire group. The highest two stages of concern were analyzed along with the lowest stage of concern.

The raw score for each of the seven scales is the sum of the responses to the five statements on that scale. The mean scores for each item were computed for each item. The mean scores were converted to percentile scores in order to interpret the results. The percentiles are represented graphically in Figure 1.

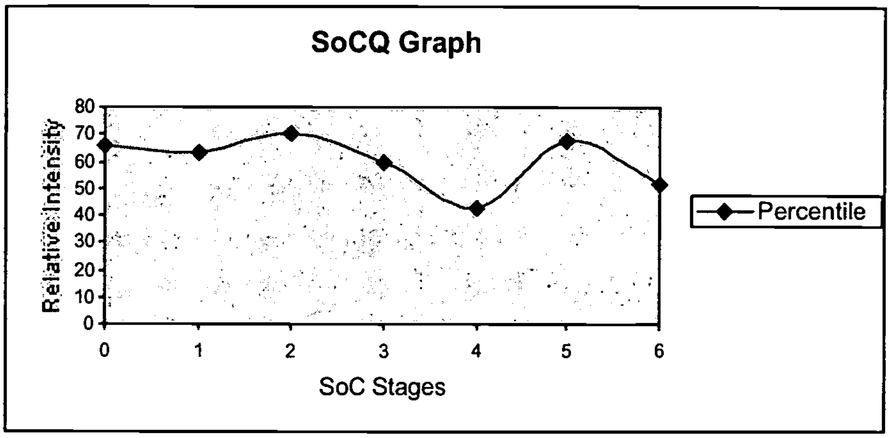


**Figure 1:** Graph of the percentiles for each stage of concern.

Interpretation of the scores is based on guidelines contained in *Measuring stages of concern about the innovation: A manual for use of the SoC Questionnaire* (Hall, George, & Rutherford, 1998). The highest stage of concern for the aggregate data was Stage 2. A high Stage 2 indicates an intense personal concern about instructional technology and its consequences for the respondents on a personal level. Though these concerns reflect uneasiness regarding technology, they do not necessarily indicate resistance to technology. Personal concerns deal with what Fuller (1969) calls self concerns. A high Stage 2 score indicates ego-oriented questions and uncertainties about technology. Individuals at this stage reflect high concerns about the status, reward, and potential or real effects of technology. Individuals with intense personal concerns may, in effect, operationally block out more substantive concerns.

The second highest concern was Stage 5. This stage reflects strong concerns about working with colleagues in coordinating the use of technology. The high Stage 5 typically indicates great concern about coordination with others in relation to the innovation. Since Stage 1 is also moderately high, it may be that these respondents have concerns about looking for ideas from others, reflecting more of a desire to learn from what other teachers know and are doing. The low stage of concern for the aggregate data was Stage 4. A low Stage 4 indicates that the respondents have minimal to no concerns about the relationship of students to the use of the innovation.

## Conclusions

These results indicate that the intense, personal concerns of teachers may have been sacrificed as emphasis has been placed on student achievement. If it is desirable for teachers to be concerned with the application and use of technology with and for students, teachers' personal concerns must be addressed first. Concerns about innovations appear to be developmental in that earlier concerns must first be resolved (lowered in intensity) before later concerns emerge (increase in intensity). If these early concerns toward technology remain intense, teachers may even attempt to discontinue its use, in order to reduce the intensity of these concerns.

Administrators and trainers hoping to positively impact student learning through use of instructional technology first need to provide a clear demonstration of how the use of instructional technology tools can address the personal concerns of teachers. Use of a concerns-based training model rather than a skills-based training model is one method for addressing attitudes and feelings that may be inhibiting teacher use of technology. This finding supports those of Fuller (2000) who found that teacher technology support is more critical to student use than direct student support in a school. She also found that teachers who receive adequate, personal support for the use of technology tend to have students who use technology more and use it more effectively.

It is critical to note that another person cannot simply manipulate higher level concerns development. Holding and changing concerns is an individual matter. However, timely provision of experiences and resources can assist with concerns arousal and resolution, encouraging the development of higher level concerns. Providing training or other interventions that are not aimed at the appropriate concerns (e.g., attempting to force high level concerns) is an almost certain way to increase the intensity of lower, less desirable stage concerns. Training must target the individual concerns of teachers before moving on to concerns of how others, even their own students, will use the available technology.

Results also indicate a strong curiosity for increased information as to how other teachers are using technology. Although the demographic data indicates that computers are readily available to the majority of the respondents and that a substantial number of hours have been spent in technology training efforts, about two-thirds (68%) of the respondents indicated they are given no time during the school day to practice what has been taught. McKenzie (2000) says that making solid change with regard to the use of instructional technology necessitates time away from the "daily press" of teaching. Providing additional professional development opportunities for technology training should enable sharing and interaction among peers, not just with a trainer.

Despite millions of dollars invested in hardware and software, many teachers are still very uncomfortable with the use of instructional technology in their classrooms. Administrators under pressure to improve student performance are frequently reluctant to address teacher concerns, thus thwarting efforts to accomplish their goals.

From the perspective of concerns based theory, institutionalization of an innovation only occurs when a majority of the individuals within the target group have resolved (lowered) their concerns on Stages 1, 2, and 3. In order for any innovation to become a vital, lasting part of that institution, high intensity Informational, Personal, and Management concerns must be resolved. (Hall, George, & Rutherford, 1978). The results of this study indicate that this institutionalization has not occurred. "If these early concerns remain intense, then the user is apt to modify the innovation or their use of the innovation, or perhaps discontinue use, in order to reduce the intensity of these concerns" (p. 13). Administrators and trainers seeking to make technology an integral part of teaching and learning first need to provide a clear demonstration of how the use of instructional technology tools can address the personal concerns of teachers.

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# Technological Tools and Mathematical Guided-Discovery

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**Abstract: Using technological tools to guide mathematical discovery is a relatively new adventure. Graphing calculators, dynamic geometry software, and spreadsheets are powerful and adaptable technological tools to create engaging guided-discovery activities for diverse backgrounds of middle and secondary students whether the to-be-discovered objects are concepts, generalizations, algorithms, heuristic problem-solving strategies, or something else. This paper shows how to use these technological tools to manage mathematical guided discovery so that the intended learning takes place with relative certainty within an appropriate amount of instructional time. A final premise is that the *process of discovery* is at least as important as what is to be discovered, since learning by discovery promotes understanding, learning to discover, problem solving, independent thinking, and life-long learning.**

Teaching by discovery is probably as old as formal education itself given that its origins can be traced as far back as 430- 320 B.C. to Plato and Socrates. Nonetheless, discovery learning, guided or otherwise, using technological tools such as graphing calculators, spreadsheets, or dynamic computer software is a relatively new teaching adventure! Depending upon the age and mathematical background of the students engaged in selected guided-discovery activities, the objects to be discovered can vary - e.g., concepts, generalizations[1], algorithms, heuristic problem-solving strategies[2], or whatever. TI-83 graphing calculators (Texas Instruments, 1996) , CABRI Geometry II software( Laborder, and Franck. (1994-1997) , and Microsoft@ Excel spreadsheets, for example, are technological tools that can be used to create high fidelity mathematical settings in which students are able to discover enhanced significance for mathematical concepts such as - ***independent variable, dependent variable, function, regression line, expected value, residual,*** and ***symmetry of power functions.*** The use of such tools is highly recommended since they facilitate discovery, managing it with relative certainty in estimable amounts of instructional time. This paper illustrates how to engage students in mathematical guided discovery activities with the use the tools and demonstrates the stages of discovery in technological setting which like those in other settings, and note that sensitivity to the learners' reactions, familiarity especially, is critical to producing positive results. This paper advocates appropriate infusions of emerging technology into mathematics instruction and offers its approach as an example of how it might be done[3].

The events of guided discovery seem to fall into five sequential stages, not necessarily mutually exclusive, which we call: **The Relax and Get Ready Stage; The Exploring Instances Stage; The Exchange Emerging Views Stage; The Information Gathering Stage;** and **The Review and Summary Stage**[4]. These stages provide a guide for dialogue between teacher and learners that elicits genuine discoveries of mathematical concepts or generalizations as illustrated in the activities that follow. The first activity (refer to **Activity 1**) is entitled ***Why Worry About Spilled Ink? Measure It!.*** This activity

[1] See pages 60 to 65, and page 176 in: Cooney, Thomas J., Edward J. Davis, and Kenneth B. Henderson. *Dynamics of Teaching Secondary School Mathematics.* Boston: Houghton Mifflin Co., 1975 & 1983. ISBN: 0-88133-061-2.

[2] George Polya states, "Thus, a teacher of mathematics has a great opportunity. If he fills his allotted time with drilling his students in routine operations he kills their interest, hampers their intellectual development, and misuses his opportunity. But if he challenges the curiosity of his students by setting them problems proportionate to their knowledge, and helps them to solve their problems with stimulating questions, he may give them a taste for, and some means of, independent thinking." See page v in: Polya, George. *How to Solve It.* Princeton, New Jersey: Princeton University Press, 1945, 1957 (2nd Ed.), & 1973. ISBN: 0-691-02356-5

[3] The National Council of Teachers of Mathematics has stated, A the study of algebra is bound to change dramatically with the infusion of currently available and emerging technology" (1996); this, indeed, is occurring more generally.

[4] See the **Phases of Learning** in the van Hiele model pages 5 and 6 in: *Learning and Teaching Geometry, K-12: 1987 Yearbook.* Mary Montgomery Lindquist (1987 Yearbook Editor) and Albert P. Schulte (General Yearbook Editor). Reston, Virginia: National Council of Teachers of Mathematics, 1987. ISBN: 0-87353-235-X

educes relatively young learners[5] to face new situations with a spirit of inquiry that promotes exploration, collection of data, analyses of the data, and the use of technology to investigate relationships among objects. The second activity (refer to **Activity 2)**[6], entitled ***Symmetry of Power Functions*** shows how technological tools might facilitate and simplify discovery. Both activities advance the idea that technological tools in guided discovery activities promote learning to discover.

In both activities, the initial stage calls for the teacher and students to engage in conversation and activity related to the ultimate intended discovery; but not necessarily work required for the discovery to occur. The work done here is simply for the ***purpose*** of having the learners **Relax and Get Ready**. It can be done in a playful, attention-getting manner, yet include low-stress discovery related work. The teacher's solicitations for actions should help students relax and get ready for the process of discovery. In the ***Spilled Ink*** activity (refer to **Activity 1**), for example, the teacher might ask, "What is a blob?... The diameter of a blob?... The average diameter of a blob?". The teacher could direct students to practice making blobs with their medicine droppers. Then students may be asked to practice making a blob with one drop, then a blob with two drops. They could continue making blobs, for practice until the teacher notices that "blob-making" has been mastered! In the second activity, the **Symmetry of Power Functions**, the teacher may simply ask the students to graph functions, not necessarily power functions, on a TI-83 graphing calculator. If necessary, however, the teacher might "talk students through" the graphing of functions such as $y = (x+3)(x+2)$ or $y = (x+3)(x-3)$ and invite individuals to graph derivations or variations of these. If opportunities arise naturally, leading questions may be introduced such as, "You noticed the graph shift, what type of shift did it make?... Can you make the function graph shift again?... Up?... Left?... Can you predict the shift?... Control it?". If symmetry is noted, "Is it line symmetry? With respect to which line? Which axis, the y-axis or x-axis?... Is there rotational symmetry? About which point?". The purpose of these instructional moves is twofold: (1) the teacher encourages the students to relax and to be cognitively ready with knowledge and skills required of the activity; and (2) the students accustom themselves to what direction further study will take. For **Activity 1**, although students can be asked to turn their graphing calculators on at this time if applicable to review certain procedures[7], such can also be delayed until necessary.

During the *second stage* or **The Emerging Views Stage**, level-specific vocabulary related to the discovery objectives is introduced to the extent necessary as students explore characteristics of instances of data samples collected through materials that the teacher has carefully sequenced (e.g., diameter of circular blobs in the ink activity, or as they make graphs and explore characteristics (symmetries) for even and odd power functions in the ***Symmetry of Power Functions*** activity. The sequence of instructional moves[8] becomes more focused and formal and should gradually reveal to the students that instances within the guided-discovery activities are leading towards stable, observable patterns (e.g., the number of drops used to form blobs influences the size of the diameter; the symmetry of specific even and odd functions are indicating particular types of symmetry). Thus, many of the activities during this phase will be organized as sequences of short tasks designed to elicit specific responses.

In stage three, **The Exchange Emerging Views Stage**, drawing fro m their mathematical backgrounds, students build upon previous experiences as well as on their explorations of instances that embody the relationship between the number of drops required to make a blob and its diameter in **Activity 1**, or the kinds of symmetry found in even or odd functions in **Activity 2**. Students should be permitted to express and exchange their emerging views about the structures or patterns that have been observed. Other than to assist students with use of appropriate and accurate language (Vygotsky, 1978), plus correct uses of the technological tools, the teacher's role is minimal. It is during this phase that the notion of relations (e.g., independent variable, dependent variable, function, line symmetry, rotational symmetry) begins to become apparent.

Next, in phase four or **The Information Gathering Stage**, as information is gathered (e.g., varied and specific graphs) students encounter more complex tasks, possibly tasks with many steps (especially in using TI-83 graphing calculators), or tasks that can be completed in several ways, and they respond to convergent as well as open-ended questions.

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[5] Intended for grades 6 to 8.

[6] Intended for grades 8 to 12.

[7] Students may or may not have had previous experiences with graphing calculators in general, or TI-83's in particular. Some assessment of students' prerequisite technology related knowledge and skills is warranted.

[8] Instructional moves include such things as: assertion, exemplification, non example, counterexample, comparison and contrast, characterization, motivation, instantiation, non instance, counter instance, analysis, interpretation, justification, review, paraphrasing, pattern generation, analogy, demonstration, practice, and so on. The Cooney, Davis, and Henderson text *Dynamics of Teaching Secondary School Mathematics* incorporates these and makes use of them in designing instructional, teaching-learning strategies.

By orienting themselves in the field of investigation, many relations between the objects of study become explicit to the students. Extensions might surface, as well as associations to other topics in mathematics.

In the fifth and last stage, **The Review and Summary Stage**, students review and summarize what they have learned with the goal of forming an overview of the new network of objects and relations. The teacher can assist in this synthesis "by furnishing global surveys" of what the students have learned. It is important, however, that these surveys not present anything new, the emphasis being on the attainment of psychological closure. The relations that have emerged would be summarized and their origins reviewed. At the end of this phase, students have attained a new level of thought. The new domain of thinking replaces the old, and students are more appreciative of learning via guided-discovery. Technological tools can structure and facilitate movement through these stages and the learning of the objects selected for discovery. Using such tools is thus highly recommended!

## Activity 1: Why Worry About Spilled Ink? Measure It!

**Introduction:** In this activity, intended for 6th-8th grade students, the diameter of a blob is studied in relation to the number of drops. Collecting the data for this experiment works best if students use a double layer of paper towels. Using medicine droppers, they should try to make small "ink" drops of equal size in about the same location away from the edge of the towels and away from where the towels have creases. Blobs should be measured as soon as the "ink" finishes spreading. Some blobs will be somewhat elliptical but not circular; take an arithmetic average of the largest and smallest diameters to provide usable data. If the "ink" blobs are made and measured carefully, the data form a discoverable pattern. This activity lends itself very well to a mathematical guided discovery lesson given that students generate data physically, and probably have little reason to know what it will look like. The stages for mathematical guided-discovery have been laid out below, but recall that they are not necessarily mutually exclusive from one another. Nonetheless, the point to be made is that the technological tools play a key role in the discoveries that will be made, specifically in that the technological tools facilitate the discoveries, and even make them more explicit!

**Equipment Needed:** Ink or colored water, food coloring, paper towels (quality brown & smooth, not especially absorbent towels), one ruler per group of four, and one medicine dropper per group. A TI-83 Graphing Calculator or Excel spreadsheet.

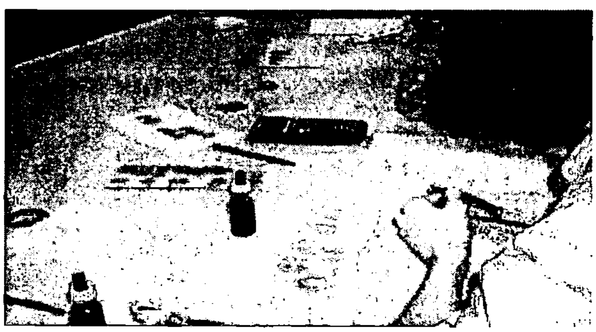
## Mathematical Guided-Discovery Stages

### A. The Relax & Get Ready Stage

Have students practice making blobs using the medicine droppers.

### B. The Exploring Instances Stage

Have students determine whether a blob is circular or non-circular elliptical.
Have students determine when the average of the smallest and largest diameter should be determined.
Have students measure the diameter of a blob made with one drop.
Have students measure the diameter of a blob made with two drops.
Continue until blobs have been made with six drops.



### C. The Exchange Emerging Views Stage

Record the findings in a table in the respective rows and columns where the independent variable is the number of drops to make a blob and the dependent variable is the diameter of the blob.

Graph the data using the STAT function of a TI-83 graphing calculator or using an Excel spreadsheet.

#### D. The Information Gathering Stage

Graph the curve that best fits the data using technological tools.
Suppose 11 drops were to be used, what would be the diameter of the formed blob?
How many drops would be needed to form a blob with a diameter of 80 cm?
How many drops would be needed to form a blob with a diameter of 95 cm?
How would the graph change if larger drops were to used?

#### E. The Review and Summary Stage

Have the students explain the process of discovery, their findings, and their conjectures regarding the relationship between the variables explored. Have the students write a generalization regarding the relationship between the number of drops needed to make a blob and the measure of its diameter, or the average of the smallest and largest diameters.

## Activity 2: The Symmetry of Power Functions

**Introduction:** In this activity, intended for 8th-12th grade students, the symmetry of power functions is studied in relation to the exponent (even or odd) of a power function. Collecting data for this experiment works best by graphing functions in the order listed below using a TI-83 graphing calculator, then analyzing the graphs of the functions, and analyzing the TI-83 graphing calculator TABLE output when appropriate. The questions that follow direct students to arrive at discoveries regarding symmetries of power functions. By using the TI-83 graphing calculator as guided, the learners are able to focus on the varying characteristics between graphs without spending enormous time drawing less than "perfect" or "near perfect" graphs[9], specifically regarding symmetry (if any). The mathematical guided-discovery stages as depicted below purport to draw distinctions between stages of work and thought processes as also suggested by The Van Hiele Model of Thinking in Geometry Among Adolescents (NCTM, 1988). Again, the stages are not necessarily mutually exclusive, but do lead to psychological closure as per the discoveries.

## Mathematical Guided-Discovery Stages

#### A. The Relax and Get Ready Stage

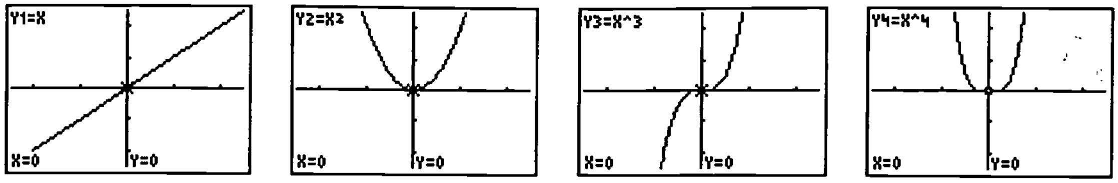
Have the students do some warm-up graphing (open-ended or structured, as appropriate); include such functions as y = (x+3)(x+2) or y = (x+3)(x-3), and others.

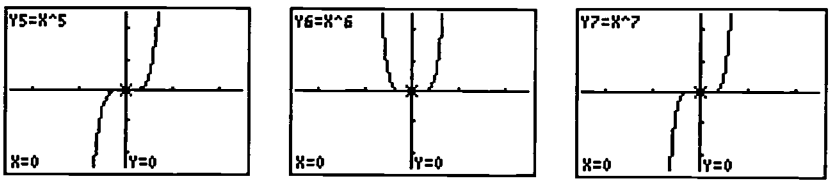
Keep relatively informal, yet interject leading questions, "What is line symmetry? What is the point symmetry? What is rotational symmetry?" should opportunities arise naturally.

#### B. The Exploring Instances Stage

[9] Readers familiar with graphing calculator will note a multitude of details (window settings, connected or dot plotting modes, "square" axes, ...) associated with drawing and interpreting the graphs.

Graph the following functions[10]: $y = x$, $y = x^2$, $y = x^3$, $y = x^4$, $y = x^5$, $y = x^6$, $y = x^7$
What patterns do you notice in the graphs?



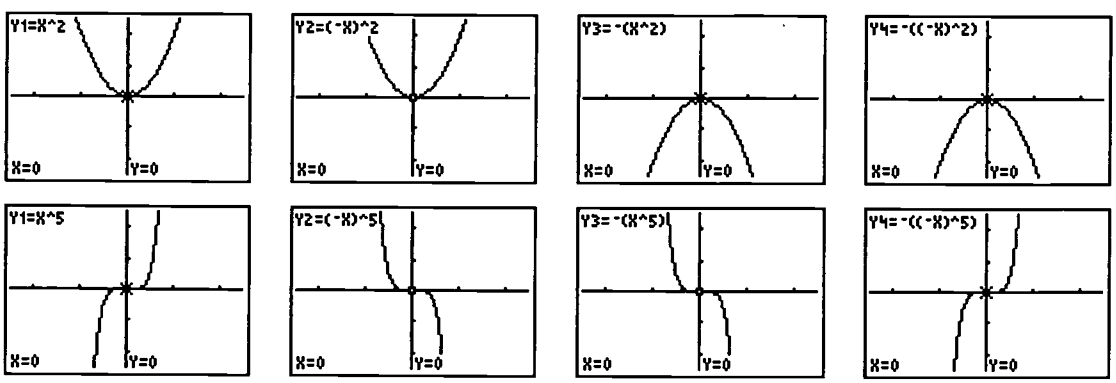




**Window Settings**
**Xmin= -5 Xmax= 5**
**Ymin= -5 Ymax= 5**
**Xscl = 2 Yscl = 2**
**Note: Plots are NOT "Square"**
**Connected**
**Expression ON**

Graph the following functions on a TI-83 Graphing Calculator, first[11], let n = 2, then 3, then 4, then 5, then 6, then 7.

| | **Function** | **Does it have line symmetry? If so, describe it.** | **Does it have point symmetry? If so, describe it.** |
|---|---|---|---|
| **a)** | $y = x^n$ | | |
| **b)** | $y = (-x)^n$ | | |
| **c)** | $y = -(x^n)$ | | |
| **d)** | $y = -((-x)^n)$ | | |

The cases for n = 2 and n = 5 are done for you using the same window settings as above.




Which power functions n = 2, 3, 4, 5, 6, 7, … have line symmetry?

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[10] In each case, y is a real-valued function of the real variable x. Thus, $\mathbb{R}$, the set of all real numbers, is the domain and an appropriate codomain for each function.
[11] What happens when n is equal to 1?

Which power functions n = 2, 3, 4, 5, 6, 7, ... have point symmetry?

**C. The Exchange Emerging Views Stage**

Look at the even power functions. What symmetry do they have?
Look at the odd power functions. What symmetry do they have?

**D. The Information Gathering Stage**

Suppose n is even. Is $x^n = (-x)^n$ ? What are the possible values for n?[12]

Still supposing n is even. Is $x^n = -(-x)^n$ ? Again, what are some possible values for n?
When n is even, what symmetry does the power function possess?[13]

Now suppose n is odd. Is $x^n = (-x)^n$ ? What are the possible values for n?[14]

Still supposing n is odd. Is $x^n = -(-x)^n$ ? Again, what are some possible values for n?
When n is odd, what symmetry does the power function possess?

**E. The Review and Summary Stage**

Have students review the different explorations made, and have them write a generalization regarding even power functions and odd power functions. Students should be encouraged to make connections between the concepts of symmetry and the even and odd power functions and to express them in a generalization expressing their views[15]. By doing this, students may be assessed regarding multidimensional aspects that are integral to instruction (NCTM, 1991).

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[12] The even natural, counting numbers 2, 4, 6, 8, 10, 12, ... n = 0 could also be considered, and one might possibly introduce some negative even integers, -2, -4, -6, ...

[13] Here, we are helping the students inductively formulate the discovered generalization as a means of describing the observed/noted patterns. This also takes place in the next section.

[14] The odd natural, counting numbers 3, 5, 7, 9, 11, 13, ... n = 1 could also be considered, and one might possibly introduce some negative odd integers, -1, -3, -5, -7, ...

[15] Here we have "mathematics in the making." Their observations, speaking more formally, constitute mathematical conjectures and, once proved, theorems.

# The R.O.A.D Learning System (Read, Own, Apply, Discuss) An On-line Method for Enhancing Teacher Pre-service and In-service Professional Growth

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**Abstract**: We (NEWTcom: a non-profit organization) have been developing a state of the art, Web-based, interactive, multimedia enhanced web-service to support the training and on-going development of teachers. We aim to serve both in-service and pre-service educator needs. The service is being built in collaboration with the Ottawa Carleton District School Board, the Ottawa Center for Research and Innovation (OCRI) and the Communications Research Center of Canada (CRC). We would like to show the resource to staff-developers and teacher-trainers to get their feedback and advice for further development. The goal of this session is to introduce this type of training medium to leading educators.
This hour long interactive presentation will be of interest to education faculty staff, school district staff development officials and state educational officials concerned with the on-going professional development of teachers.

## Introduction

R.O.A.D Learning™ has a central philosophy based on "professional growth" rather than the "improvement model". What do we mean by that? One of the central problems with the "P.D." process in teaching is that it historically proceeds from the "improvement model". The idea is that, "you need professional development!" This conveys the subtle, but clear message that you need to improve because your skills are inadequate. This is poor starting point.

Looked at from another perspective, Dr. Wilder Penfield, a pioneer in the field of brain surgery, was not an inadequate doctor the day before he risked a new procedure, mapping the actual functions of the brain to help a patient. He was a darned good doctor. The point is that he chose to engage in "action research". In the process, he extended his own capacities as a doctor, and pushed the envelope of his profession. He was not engaged in "professional development", but professional and personal growth.

This is the mind-set that teachers must be given the opportunity to acquire. R.O.A.D™ rejects the "improvement model" and embraces the personal, professional growth model. We do so with our distinctive content, delivery model and features.

R.O.A.D. Learning™, therefore, fills a need that the World Wide Web has not met: the professional growth of teachers. Web sites that deal with teaching ideas for specific K-12 subjects are legion. There are, however, few that focus on the foundational best practices of the teaching profession.

None do it the way we do. We offer a World Wide Web site and service, supported by an Internet CD-ROM containing large movie examples of teacher behavior, delivered quickly to the end user's computer, rather than slowly via the Internet.

The service presents practical, next-day-usable strategies for enhancing success in the classroom for teachers. R.O.A.D.™ is written in an engaging style and is supported by multimedia (images, animations and movies). R.O.A.D.™ offers a safe, virtual environment in which practitioners can experiment with new methods, collaborate and share results with their peers, reach levels of scored mastery of knowledge, and skill sets, and have their professional development tracked for official purposes. No other web-sites offer this feature.

R.O.A.D™ offers a safe, virtual environment in which practitioners can experiment with new methods, collaborate and share results with their peers, reach levels of scored mastery of knowledge and skill sets, and have their professional development tracked for official purposes.

The service also "gets to know the user". Responding to user pre-test surveys of knowledge and skill, it suggests best starting points and next actions. Furthermore, the service allows the end user to acquire expert mentoring while engaged in learning. These mentors are automatically connected to the user via e-mail and thereafter by whatever means suit the mentor and user.

Finally, the service is self-perpetuating. We are a publisher of high quality, research supported strategies for teaching. New modules are constantly under production that must meet our exacting standards before they will be made available at our site.

**Relationships and Community Building**

RO.A.D. supports and facilitates a number of critical relationships depending on how its users choose to deploy and implement it.

*Peer to Peer*

In this case, a teacher or teacher trainee is linked to others in the same course, school, school district, or work group. They can simultaneously be members of many groups over great distances. They can send email within the service (no need to exit to another system), publish their action in the classroom to the PUBLIC Journals for comment, and schedule and organize meetings that will be either face-to-face or via telephone or computer.

Learners can access modules that are engagingly presented and which demonstrate foundational teaching skills (some include movies from an accompanying Internet CD-ROM , or animations of sequenced actions). This content, written by experienced, Master teachers, can become the focus of inter-peer discussion and distributed action research.

R.O.A.D.™ can also support collaborative, curriculum workgroups that are geographically dispersed. Communications are asynchronous, thus solving the common problem of the lack of discretionary and "flex' time amongst teacher. Peers interact when and where they wish or are able. All they need is a connection to the Internet. Very low connection speeds and modems will work just fine.

*Instructor to Training Teacher*

In this instance, a faculty member has a virtual office. There they can view their student role, a learning contract editor for the whole class and for individual students. They can also access each student's OFFICIAL Journal. The Journal results from items submitted from the student's PRIVATE Journal and successful completion of MASTERY EXAMS (an on-line database of questions tied to the behavioral learning objectives for each module). Students may take these exams as often as they wish (new questions are presented randomly, and old questions have the answers and foils scrambled) and are not said to have achieved Mastery until a grade of 90% is achieved. Attempts that fall short of this goal only appear in the student's PRIVATE Journal.

Furthermore, the Instructor can email through the service to individual students or to the entire class at once. Instructors may also change the order of presentation of modules and lessons within modules. They can also edit the master index, and insert new lesson pages with the a simple cut and paste, and a click of a button. This gives the faculty the ability to author existing content "on-the-fly" or to author new modules as they see fit.

*Mentor to Student/Teacher In the Field*

Training teachers can be supported while on their practice teaching rounds. They remain in contact through R.O.A.D™ to their peers and instructors. Meeting via conference call, real-time, or on-line chat can be organized to solve individual or shared problems.

Novice teachers can be specifically assigned to experienced ones who are anywhere in the world. Alternatively, such teachers can request mentors from a pool of mentors previously established. In this case, each mentor previously declares the number of people he or she is prepared to mentor. The novice simply requests a mentor. This triggers R.O.A.D™ to search for an available mentor. The available mentor is notified of the request for coaching. A message can then be sent by the mentor, either accepting or declining the invitation to mentor. From that point on, the nature of their relationship evolves to meet the needs of this new coaching pair.

**Authoring New Content**

One of the greatest barriers to Web publication of best practice for teachers is a lack of comfort or savvy with Web authoring tools. Web development houses routinely make a fortune from this discomfort. In a cash strapped system such as education, this is not acceptable. R.O.A.D™.'s creatorrs, therefore, developed a set of simple, on-line tools for putting useful content up on the Web. This new content is then automatically managed and delivered by the R.O.A.D™. software to learners. Thus, an author can publish important new information directly into R.O.A.D remotely, never leaving his or her office, with no greater skill than word processing. Our author's tools are on-line and include:

- A form that orders the presentation of lessons, sets prerequisites and creates interactions (applications or reflections). This provides the end-user with all the navigation and tools the author wants them to have.
- A template form for creating and editing a pretest based in behaviorally stated objectives. This will permit the learner to focus his or her learning tasks to those topics and concepts with which each is least confident first.
- An editable form to create an author's recommended "default learning contract". This can used 'as is' by an instructor or modified to meet local needs).
- A template form for creating and editing on-line Mastery exams.
- A template form for giving the new course/module a title and a descriptive overview of the general goals and specific content that will be covered in the content.
- A form that allows the author to choose the graphic themes, button styles and even the language of the navigation and link buttons: English, French, Spanish, whatever the language of delivery of the author.

**Conclusions**

Our purpose for presenting R.O.A.D™. at the S.I.T.E. conference is to get feedback from educational leaders. Since our system does not require the installation of any software (all anyone needs is a standard Web-browser), we can modify the delivery shell to address comments from the field, and have these upgrades available to all users within hours. We are certain that our presentation will result in useful dialogue as we strive to improve and extend our work for the educational community.

# Preparing Pre-Service Teachers to Use Technology

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**Abstract:** This paper describes how the UW-Oshkosh Teacher Education Program prepares pre-service teachers to integrate technology into instruction. Specifically, how the social studies methods and instructional technology courses are: using a framework for authentic instruction and assessment to help students develop and refine their pedagogical knowledge; using interdisciplinary teams to help students reflect on content, teaching methodologies, and appropriate use of technology; and having students develop and demonstrate technology based teaching materials.

Peter Martorella, in 1997 called the use of technology in the social studies classroom a sleeping giant. While he made mention of periodic unconfirmed reports of the giant's awakening, this does not appear to be a widespread phenomenon. This same "giant" slept in the secondary social studies methods course at the University of Wisconsin Oshkosh. While stirring occasionally, there seemed no way to sustain its consciousness, given the uneven computer knowledge among the preservice teachers taking social studies methods and a fragmented approach to teaching technology and then social studies methods .

Prior to 1997 social studies preservice teachers at University of Wisconsin Oshkosh did not have the opportunity to become part of a community of learners where they would learn about technology, become skillful in its use, and integrate it into to their teaching experience via the construction of subject matter units to be taught in clinical experiences and student teaching. Yet research suggests that offering these experiences heightens students success with technology and helps to foster positive values towards its use during instruction (Kellenberger, 1996). Further, the social studies methods course and the educational technology courses were disconnected making it difficult to model how technology could be integrated with other forms of instruction to foster powerful teaching and learning. Regular modeling of integration of technology in teacher education courses has been shown to positively influence latter adoption of technology in the classroom according to Willis (1997) and Keiper, Harwood, & Larson (2000). Our practical response to these ideas in the College of Education and Human Services at the University of Wisconsin Oshkosh was to create a learning community between three courses – Social Studies Methods, Instructional Technology, and Reading In the Content Area.

## Why A Learning Community?

The research base about the effects of instruction assisted by technology in social studies is small but what does exists is encouraging. Richard Diem (2000) has suggested that technology is valuable and effective in problem based learning. He bases this observation on the research conducted by Eastmond and Gibbons (1998) and Stites (1999). Wenglinsky (1998) who studied mathematics achievement indicated that technology does make a difference in student achievement if computers are used to teach higher-order not lower-order thinking skills. Yet technology is

unlikely to be used effectively in classrooms unless teachers have an adequate pedogagical framework for authentic instruction, assessment, and student performance. Such a framework can serve as a lens from which to view content, pedagogy, and how technology can help achieve powerful teaching.

Fred M. Newmann, Walter G. Secada and Gary G. Wehlage,1995 in *A Guide To Authentic Instruction and Assessment: Vision, Standards and Scoring*, offer a research based framework for thinking about the content and pedagogy. The book is a compilation of the findings of a national research study of teachers who practice authentic instruction, assessment, and student performances. Newmann et al. believe that a central purpose of schooling is to teach students to use their minds well. To achieve this end, lessons and the resulting assessment tasks and student performances must represent construction of knowledge, disciplined inquiry, and value beyond school (see figure 2). Construction of knowledge is a blend of the learner's prior knowledge of what others have produced about a topic or problem, how the learner organizes new information and considers alternatives to produce an original conversation, piece of writing, repairing or building physical objects, or through an artistic performance. Often conventional curriculums ask learners only to identify or reproduce the information others have produced. Disciplined inquiry which requires the use of prior knowledge, in-depth understanding of the content topic or problem rather than superficial awareness, and an expression of conclusions through elaborate communication. Value beyond school is when the in-class accomplishments of the learner have value apart from documenting the competence of the learner. Learners make connections between substantive knowledge and either personal experience or public problems.

Figure 2. Authentic Pedagogy

| Authentic Achievement | Authentic Assessment Tasks | Authentic Instruction | Authentic Student Performance |
|---|---|---|---|
| **Construction of Knowledge** | • Organization of Information<br>• Consideration of Alternatives | • Higher Order Thinking | • Analysis |
| **Disciplined Inquiry** | • Content<br>• Process<br>• Elaborate Written Communication | • Deep Knowledge<br>• Substantive Conversation | • Disciplinary Concepts<br>• Elaborated Written Communication |
| **Value Beyond School** | • Problem<br>• Audience | • Connections to the World Beyond the Classroom | |

Source: *A Guide to Authentic Instruction and, Assessment: A Vision, Standards, and Scoring*, 1995.

Social studies learning community students are required to use Newmann et al.'s conception of authentic pedagogy. Preservice teachers begin to design and organize instruction which promotes engaged learning, fosters critical thinking, and can take advantage of electronic resources for data collection, organization, and presentation. This type of instruction seeks to harness the power of technology to support powerful new forms of learning as opposed to focusing upon reiteration of facts, events, and causes as stated by others.

Another reason for establishing the learning community was to foster team work among the three courses in the learning community. To accomplish complex goals, organizations require teamwork. The reality of the workplace for most preservice teachers is that they will be working in teams, whether interdisciplinary middle school teams or single-discipline high school departments. In methods courses across the country, preservice teachers engage in cooperative learning, try out related teaching strategies, and develop instructional materials to support this approach.

Another rationale for creating our learning community was to allow students taking both courses to focus their energies on long-term collaborative projects. Moreover, allocating one section of Instructional Technology to social studies preservice teachers enables instructors to offer in- depth explanations related specifically to social studies. Unfortunately, the same kind of teamwork is not often modeled by faculty members, who treat each course as a separate entity. The development of a social studies/technology/reading learning community is an attempt to model collaboration and develop meaningful connections between courses.

The uneven computer skills displayed by our students and their weakness in designing instruction that utilizes technology to help achieve powerful teaching and learning goals during practice teaching was yet another reason to

more fully integrate technology into the secondary education program. The learning community allowed us to become more authentic with assessment and student performance. Assignments are performance based, and students must demonstrate their understanding of how to integrate technology into social studies teaching. Previously, assignments in the technology course were perceived by some students as disconnected from their subject area, since a direct application was not necessarily evident.

Finally educational policymakers believe that technology is the answer to many issues associated with quality in education. Whether this is true is certainly debatable, but school policy is often based upon such perceptions. Schools are buying truckloads of computers. Preservice teachers who do not know how to use technology in instruction will not fit in well with schools of the 21st century.

## Developing a Structure

Developing a learning community in social studies methods and technology required coordinating many elements. We needed to find instructors willing to work together and coordinate their schedules to allow for joint planning time. Syllabi, assignments, and timing of instructional segments had to be carefully arranged so that the courses built upon one another. Student schedules also required coordination for a specific section of the technology course to be allocated to the learning community. The result was nine hours of weekly instructional time-three hours each for Social Studies Methods, Instructional Technology, and Reading in the Content Area.

Within this community, students could choose either a disciplinary or an interdisciplinary team to work with during the semester. All major assignments in both courses were team efforts. A major semester-long project served as a "hub" to tie teams, courses, and learnings together. Each student team developed a 10 day resource and teaching unit about a significant historical or contemporary problem/issue based on authentic teaching, the use of technology, and reference to social studies standards. For each unit, teams developed comprehensive lesson plans, to developed a problem/issue statement, identified unit goals, and collected resources. In the technology course, teams consulted with the instructor to identify what types of technology could best achieve their instruction, knowledge, and skill goals.

One unit focused on the different factors that contributed to the North's victory in the Civil War. To introduce the problem, this team used PowerPoint to present data about railroad mileage and track-gauge, transportation networks, economic indicators, strength of armies, geographic factors, data on trade, and so forth. Then the team used web page development tools to developed a research web page with links to history-related websites, dealing with the quality of military leadership on each side. Another student design team applied their web page development skills and knowledge to developing a WebQuest that had students determine whether America's "War on Drugs" will share the same fate as Prohibition. The enabling technology skills and competencies were developed in the instructional technology course.

While the unit project was the basic connective tissue for the two courses, other topics and assignments bound them together. For example, while working on the use of charts, graphs, and other forms of data organization in the methods course, students also learned how to use spreadsheets and the graphing capabilities of various computer programs. Electronic communication (e-mail) facilitated communication between design teams. Each team was required to plan five complete lessons that employed one of the following instructional strategies: case study, cooperative learning, introducing a problem or issue, teaching a concept, and value analysis. For each lesson, one team member assumed responsibility for authorship and the other two members served as evaluator/critic. Team members used e-mail to send draft lessons and critiques to each other and to the instructors. Finally, teams were asked to review a videodisc and use multimedia authoring programs to design a presentation for teaching about an issue or problem. For example one team used images, speech, and music from the ABC Interactive Series *Powers of the Supreme Court* laser disc to introduce the issue of freedom of expression in their unit.

## Obstacles and Solutions

Several obstacles may present themselves before a learning community like this can become a reality. The instructors must have some knowledge of and skill in using, technology. Although no one person has to know it all, it is helpful to have each professor's knowledge complement the other's. Collaborators also need time to coordinate topics, procedures, and student assignments.

Time for advising and scheduling students is also critical. We were fortunate in having a very supportive college advisor and a centralized scheduling system, but even so, scheduling was not without its difficulties.

Finally, successful collaboration between methods and technology courses requires sufficient infrastructure and resources. Our university provides each student with Internet access from any campus general access computer lab or residence hall. Students receive an e-mail account when they register for classes. Most computer labs have both Macintosh and Windows computers. All of the computers are on the campus electronic network "backbone" and therefore are connected to the Internet. We work in a technology classroom and an adjacent modernized multimedia lab.

A future obstacle will be having enough technology and workspace when other learning communities are brought on line. One potential solution to this condition is our new travelling computer lab which consist of Apple iBook computers using wireless technology.

## Evaluation and Refinements

From our perspective, while the learning community was successful as a first time offering, several refinements need to be made. First, the successes. Student enthusiasm and motivation were strong, as evidenced by the number of hours the teams spent working together outside of class and in the computer lab. Methods, content, and technology were addressed in a holistic manner, and the design of collaborative unit projects enabled students to make direct application of what they were learning.

From our perspective, the "hub" teaching unit that combined technology with social studies methods was far and away superior to our previous unilateral assignments in separate courses. The problem-oriented teaching units designed by students were rich in information and purposeful about its use. Students developed both skill and confidence in their use of technology that far exceeded what had been possible in the methods course alone.

In subsequent offers of the learning community we plan to make a number of revisions. First, we need to take better account of the range of student computer skills. We misjudged how much time we would have to spend developing the basics. This tended to push back the more technical, and sometimes complicated, aspects of using computer technology, and resulted in an end-of-the-semester crunch. We have, for example, modified what we want to accomplish in the areas of multimedia and web page development.

Will the giant awaken in the social studies? This is anybody's guess. We hope that our example of a learning community based on collaboration between social Studies Methods, Instructional Technology, and Reading in the Content Area courses may help to stir the giant in our college.

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# Building A Professional Cyberspace Community

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**Abstract:** This paper is a report of a newly-initiated project designed to connect preservice teachers, cooperating teachers, student teachers, and higher education faculty through the use of a world-wide-web site. Goals of the project were to enhance the teacher preparation program and curriculum, to provide professional development for P-12 faculty and mentoring support for novice P-12 faculty, to provide professional development opportunities for higher education faculty, to provide educational resources for web-users outside of the cyberspace community that was developed in the project and to form the basis for continual teacher education program input and assessment.

## Introduction

Those familiar with the teacher accreditation guidelines of the National Council for the Accreditation of Teacher Education (NCATE) are very familiar with the concept of "professional community" as it relates to pre-service teacher education. This professional community encompasses all who play important roles in the development of preservice educators: education faculty, arts and sciences faculty, inservice mentor or "cooperating" teachers, P-12 students and their parents, the community, and preservice educators themselves. The NCATE 2000 Standards refer to the involvement of the "Professional Community" in developing an assessment system for the teacher education program and in designing, delivering and evaluating field experiences and clinical practices. Additionally, college faculty are expected to be "actively involved with the professional world of practice in P-12 schools," as well as to collaborate "regularly and systematically with colleagues in P-12 settings" and other members of the broader professional community "to improve teaching, candidate learning and the preparation of educators (NCATE, 2000).

Institutions of higher education have utilized the "learning community" approach since approximately 1927, when the first documented "learning community" was established by Alexander Meiklejohn at the Experimental College at the University of Wisconsin (Kellogg, 1999). While this learning community existed solely on one campus and encompassed only higher education faculty and their college students, the concept of a learning environment that will promote coherence and create a sense of common purpose and community can be expanded to include community members off-campus as well (Kellogg, 1999).

Technology has enhanced the opportunities for interaction among the members of a professional education community through e-mail and the Internet (web pages, bulletin boards, chat rooms, and other opportunities). Research on preservice student use of technology has indicated that student teachers often use technology in on-campus classes; however, their use of technology during the student teaching internship drops off sharply (Beck & Wynn, 1998). Robert Morris College has seized this opportunity to bridge the physical space between College faculty, inservice teachers, preservice teachers, and others through the development of a "professional cyberspace community" website. The interaction fostered by this professional community has the potential to empower teachers to become self-reflecting individuals who are willing to take charge of their own professional development and to encourage the effective utilization of technology in order to enhance learning for all community members.

## Program Overview

At one time, much was written regarding the lack of hardware available to P-12 teachers, teacher education faculty, and preservice teachers. This is no longer a major concern as almost all schools and higher education institutions have numerous computers, internet access, and other multimedia resources. It is now possible to move beyond issues of acquisition to focus on the optimal usage of these resources for the enhancement of teacher preparation, P-12 faculty professional development, and higher education faculty professional development. The existing infrastructure provides the scaffolding for a professional cyberspace community. Robert Morris College has utilized existing resources to accomplish this goal. Using a web-based approach, it has been possible to develop an easily-accessible resource that provides general resource links for sites relating to these areas of interest to all members of the professional community: employment in education, lesson plans, national and state standards, professional organizations, on-line educational publications, and grant opportunities.

Utilization of the world wide web for this purpose is consistent with adult learning theory. In a learning environment in which technology is utilized, Imel (1998) has identified that adults want a place where learners can collect important ideas, express themselves, and feel some security that they are going in the right direction and to provide fast and productive access to help when it is needed. Similarly, the use of technology enhances adult learning because technology provides increased flexibility and access to expertise, and can reduce feelings of isolation often experienced by nontraditional learners (Imel, 1998).

In the Robert Morris project, the development of the professional cyberspace community has met established goals in the areas of teacher preparation program enhancement, professional development of preservice teachers, professional development of P-12 faculty, and professional development of higher education faculty.

### Enhancement of the Teacher Preparation Program and Curriculum and Professional Development of Preservice Teachers

In teacher education, effective supervision of student teachers has often been hindered by factors such as a lack of communication and collaboration (Kauffman, 1992) which make it difficult for higher education faculty and P-12 faculty to provide a coherent and organized professional development program for preservice teachers.

Moon, Niemeyer, & Simmons (cited in Kauffman, 1992) reported that, as a result of this lack of communication and collaboration, "cooperating teachers and university supervisors often misunderstand each other, lack unity in front of the student teacher, and continue to teach and supervise the way they always have instead of working as a supervisory team." Facilitating communication and collaboration among higher education faculty, student teachers, and P-12 inservice teachers can serve to build cooperative and collaborative teams that can more effectively meet the needs of all participants.

Through the Professional Cyberspace Community website, access to the education unit's conceptual framework, assessments, curricula, long-range plans, and other information is provided to everyone in the professional community. This information exists as a resource and guide for teacher education majors at all stages in their programs, student teachers in the field, P-12 faculty working with education majors doing field experiences and/or student teaching, parents, community members, and higher education faculty in both arts and sciences as well as education programs. All constituents can comment on this information at any time, thereby providing continual feedback about the teacher education curriculum and programs. Student teachers can post messages and/or e-mail their peers, mentor cooperating teachers, and college supervisors. Lesson plans can be posted for review and constructive feedback, and requests for assistance and information can be posted. Students may access course descriptions, class schedules, and other program information.

### P-12 Faculty Professional Development

According to Joyce, et al. (1990, p. 33-34): "Proposals both for the 'empowerment' of teachers and for an increase in the use of a knowledge base in education depend upon the realization of a radically revised workplace with very different relationships...and much greater attention to the application of professional

knowledge." It is precisely this shift in relationships that has become possible through the use of technology to provide a workplace that is "radically revised" due to the replacement of teachers' feelings of isolation with opportunities for professional connections with others in their field.

Articles related to mentoring, preservice teacher education, action research, and related topics are available on the professional cyberspace community website. Inservice faculty may also post requests for information, materials, ideas, or other educationally-related needs. Information on workshops and inservice credit courses of interest to inservice teachers is made available; teachers may also make requests for workshops or courses to meet their needs in particular areas. In Pennsylvania, all certified teachers are required to obtain a minimum of six credits or 180 hours of professional development every five years in order to maintain their certification. The professional cyberspace community website provides up-to-date information on these "Act 48" requirements, including links to appropriate state information and lists of available opportunities for inservice credit.

These aspects of the website also provide support for recent Robert Morris College graduates who are in their first few years of teaching, who may continue to utilize the services and interact with the other members of the professional cyberspace community. Support for this population is critical, as research has indicated that many first-year teachers "are frequently left in a 'sink or swim' position with little support from colleagues and few opportunities for professional development" (Darling-Hammond, 1997). First through third year teachers may voluntarily remain as part of the cyberspace community, continuing to receive support from higher education faculty and other inservice P-12 faculty. In addition, these novice professionals also provide support for the student teachers in the community, as they share their tips and suggestions for "surviving" the first few years of teaching. Research has indicated that those beginning teachers who are mentored are more effective teachers at the beginning of their careers, tend to focus more on student learning, and leave the profession at a lower rate than beginning teachers who are not mentored (National Commission on Teaching and America's Future, 1996).

**Higher Education Faculty Professional Development**

The learning community developed within this project can be viewed, in a sense, as a cyberspace professional development school--a "learner-centered environment....in which reflective practice and teacher decision-making are part of a school culture where new teachers are naturally expected to collaborate with more experienced university-and school-based colleagues" (Levine & Trachtman, 1997). Obviously, this approach holds benefits for the experienced veterans, who may also learn from the novice teachers.

According to Kellogg (1999), "faculty who teach in learning communities reveal that they become re-energized and feel empowered..." While the learning communities in Kellogg's report referred to those comprised of on-campus individuals, it is logical to assume that the expansion of the learning community to include those off-campus will have similar, if not enhanced, results.

In the professional cyberspace community, higher education faculty also access and utilize the bulletin boards, e-mail services, program information, and mentoring information available to other community members. In addition, College faculty use the resources and relationships developed through the on-line community to establish contacts for action research projects, locate sites for field experience placements, and to develop additional projects cooperatively with P-12 colleagues.

## Summary

The professional cyberspace community developed through this project supports a system of "co-mentoring," defined by Bona, et al. (cited in Mullen, 1999) as a name for "supportive assistance provided by several connected individuals. Placing the prefix 'co' before 'mentoring' reconstructs the relationship as non-hierarchial; 'co' makes mentoring 'reciprocal and mutual" (p. 119.) The public nature of the website allows co-mentoring to flourish; questions, ideas, and lesson plans become public and, therefore, open to constructive feedback from any and all members of the community.

According to Mullen (1999, p. 42), Synergistic co-mentoring groups require empowerment of the members, so that "each member feels that what s/he has to offer is important to the group and valuable." The professional cyberspace community allows everyone to participate on equal ground; the input and feedback provided by preservice teachers is valued as much as the input and feedback provided by others in the community. It may be that this feeling of empowerment will provide the basis for continued professional development of all members of the cyberspace community.

As a teacher preparation program working toward continuous assessment and improvement, enhanced P-12 student and teacher-candidate learning, and national accreditation, Robert Morris College has embraced technology as the infrastructure through which the scaffolding of our professional community can be strengthened and expanded. This is a model of an approach which can be replicated at any institution with a teacher preparation program.

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# How We Integrated Technology Throughout Our Education Program

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Abstract: In this paper, we describe the technology integration efforts at Albion College over the past four years, with the hope of providing a vision to programs that are both similar and dissimilar to us. Of particular interest is our successful integration into methods courses, and the way that we used our diverse strengths and worked as a team to accomplish it.

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## Introduction

In a given teacher education curriculum, it is not at all unusual to find a course in educational technology offered as a "stand-alone." Students either opt for or are required to take this course in order to learn the effective theory and practice of integrating technology into their teaching. While these classes can make a measurable impact in a student's preparation, the concept itself contradicts much of what we now believe about training teachers. We describe the importance of helping students build pedagogical content knowledge, but we deny them the opportunity to learn to use technology tools in parallel with their learning about content and its pedagogy. We value the notion of students dealing with ill-defined and complex problem spaces, but we stratify the study of educational technology and diminish its importance relative to study about content and its pedagogy. To wit, we do a disservice to pre-service teacher training when we separate classes in technology from classes in subject-specific methods or pedagogy.

There is probably a majority of education faculty who would agree that technology should be integrated into methods and pedagogy classes, even if this is not the case at their home institution. There are many reasons why integration is not possible, such as constraint by available personnel, by program review cycle, by facilities, or by the need for vision. It is in this latter area, vision, that our experience at Albion College may be of service and interest. Albion College is a liberal arts college for undergraduate education, with an Education program that accounts for over 10% of the total enrollment. Each year, approximately 30-35 elementary and secondary education students graduate from the program. Four years ago, the Ferguson Center for Technology-Aided Teaching was created with the involvement of a prominent member of the Board of Trustees, the President of the College, and the Chair of the Education Department. The primary goal of the Center was to help faculty in the Department to integrate technology across most or all courses

and to help students learn to effectively use technology in the service of teaching and learning (http://www.albion.edu/education/technology_integration.asp). In this paper, we describe the efforts of the past four years, with the hope of providing a vision to programs that are both similar and dissimilar to us.

## Courses

We will briefly describe our technology integration efforts across several different courses over the past four years, identifying course goals, software and hardware used, and course projects which were abetted by technology. The courses are laid out chronologically. At the heart of these efforts is the manner in which we coalesced our diverse strengths as faculty to produce an integrated curriculum. Almost all of the faculty saw themselves as average or below average in their personal or pedagogical technological ability. However, their expertise in diverse content areas and in teaching allowed us to have fruitful discussions about integration. As an example of this, the voice later in the paper that speaks about the course in Literacy Pedagogy differs from that used throughout the rest of the paper to convey the personal aspect of the collaboration. Some efforts resulting from these discussions were short-lived but important to the success of later ones. It was clear from the beginning that the responsibility for success did not rest on the shoulders of any one person; rather, our success depended upon our ability to be creative, to take risks, and to be honest about failures and triumphs.

### Effective Instruction and Effective Schools (Elementary)

Effective Instruction and Effective Schools is a general methods course that is set against a backdrop of teaching elementary science. The course has been team-taught more often than not, and has been a valuable training ground for helping faculty, who are unsure of their ability to incorporate technology, come up to speed. It meets two hours a week, twice weekly, and has a two hour per week practicum component alongside.

Students who take this course are sophomores, and are often unsure of their ability to either teach science or use technology. Technology integration occurs in four different ways. The most far ranging is pointed towards helping students develop skills and self-efficacy in their personal use of technology. The goal is to help them increase their information literacy, understand the process of investigating and writing a research paper on an unfamiliar subject, and think about how to write good hypertext. The details of this project are provided elsewhere (Rubio, Michell, Kondelik, Blackwell, & Albery, 2000).

For the practicum, students spend most of the semester actively involved in working with teacher and students; near the end of the semester, they team-teach a curriculum-appropriate science unit with a classmate. They use the PIViT software (http://www.umich.edu/~pbsgroup/PIViT.html), described in the section on the Pedagogy classes, to plan their teaching. This is their first opportunity to use technology to plan and manage teaching.

One of the course assignments is a software or Internet site assessment. The students propose to study a piece of software or an Internet site for its educational value in teaching elementary science. Their selection must be approved by the instructor to make sure that it has sufficient depth for a worthwhile investigation; since some sites are extremely large, sometimes students are asked to focus on a particular segment of the site. Once their selection is approved, they explore the site or software, and assess it along several dimensions. These include ease of use, requisite background knowledge, purported educational use, how well it supports a constructivist view of learning, and whether it has any bias or strength towards gender or ethnicity. They must also give some specific scenarios for how it could be used in a classroom setting. Finally, they write a recommendation, a paragraph which stands alone but would adequately convey their opinion about the educational value to a fellow teacher. In order to help students with this assessment, the instructor spends up to a full day in class looking at software and sites which have overall positive and negative value in teaching elementary science.

Students also participate in a local, electronic discussion forum with a web interface. Their experience here is similar to that described in the Secondary Methods class.

**Secondary Methods (Secondary)**

Secondary Methods is a general methods course which takes a special, in-depth look at multicultural education, particularly ethnicity. Otherwise, it resembles the Effective Instruction course, but without the emphasis on science. To date, we have experimented with several possible ways to integrate technology into this course, but have yet to settle on anything because a different instructor has taught it for three consecutive years. One early attempt involved having the students create interdisciplinary units utilizing PIViT, a piece of software designed specifically for unit or project planning. It was ultimately decided that this component should be moved to the subject-specific Pedagogy classes, to allow students to learn to do such planning in the context of their own subject area. PIViT will be described more fully later in this paper, in the section devoted to those courses.

Another attempt at technology integration parallels some of the efforts involved in the Effective Instruction course, namely a discussion forum. During this semester, the course met once a week for three hours, with the students committed to a structured service learning project for an extra hour per week. Throughout the semester, the students commented that the discussion forum was especially useful in helping build a classroom community. The forum centered upon a weekly requirement that the students post a journal entry and respond to the entries of two other students. There are no specific assessment criteria other than "done well" or "not done at all." However, the overall grade is analogous to a grade for participation, in that a student cannot receive a high grade without taking part. The discussion forum was managed with O'Reilly's WebBoard®. WebBoard is accessed through a student-generated id and password; the instructor then gives students access to a specific forum. WebBoard provides threaded, dated discussions. It automatically places forum participants on an email listserv. It allows the instructor to review the number of posts made by each student, but has no other capability for assessment. The instructor must manually search postings to determine whether any were made on a certain day. The College's Instructional Technology Division provides instruction on the use of WebBoard on an individual basis. Faculty at Albion who use the forums comprise the spectrum from neophytes to techies.

**Pedagogy of the Humanities, Social Sciences, and Natural Sciences (Secondary)**

As noted previously, the student experience of unit/lesson planning utilizing PIViT was ultimately placed in this class. PIViT (Project Integration and Visualization Tool) allows teachers to plan units or projects in any content domain. It consists of a project map which allows the teacher to visually organize in a manner similar to that afforded by Inspiration (http://www.inspiration.com) or other concept mapping software. It also has an integrated calendar, so that teachers can assign dates to different classroom activities, investigations, and assessments and readily view or change those dates. Finally, teachers may enter specific lesson plans from within the project map. Thus, students who use this tool may view their plans from three different representations: visual/conceptual, chronological, and textual/detailed. There is a practicum placement with this class that is similar but not quite as all-encompassing as with the Effective Instruction class; the lessons that students create with PIViT are taught during that practicum.

PIViT only runs effectively on Macintosh computers, meaning that the vast majority of our students have to familiarize themselves with a computer platform that is largely unsupported by the College. However, since a significant percentage of schools utilize Macs, it is in our students' best interests to "force" them to use these computers so that they are prepared for the realities of a dual-platform profession.

Students in these classes are also asked to do a software or Internet site assessment in their own subject area. The parameters of this assignment are similar to the one used in the Effective Instruction course. Some simple HTML editing has also been taught and utilized, on the same scope as that in Secondary Methods.

**Literacy Pedagogy (Elementary): An Implementation Story**

I teach the Literacy methods courses for our elementary students. When I started at Albion College a year ago, Reuben came to me and said he'd like to help develop a technology component in each of our classes. I was excited by this, although I had to strongly warn him that I was less technologically skilled than most of our students. For this reason, we began with a plan to first help me learn how to use HyperStudio (http://www.hyperstudio.com), and then we could teach my students together.

I began by doing the tutorial in the HyperStudio manual; I actually had my nine year old son do it with me! I found the manual very easy to follow and I also got many ideas as to how I could incorporate the technology into my already full course offering. Originally, Reuben and I had talked about just doing a board book, described to me as being like those children's books with the buttons down the side of the text you push in conjunction with the rebus picture in the text to get "exciting" sound effects as they read. But as I learned from the tutorial how to make cards into stacks, my mind switched from envisioning a board book to thinking of this as more of a teaching or reinforcing program my students could use in their classrooms when they did their student teaching.

The next step in our journey was to have the students repeat my own experience: begin by taking the tutorial, and then determine the skill or genre they wanted to teach or reinforce. As my model, I chose to reinforce my teaching of quotation marks, and made a sample storyboard of my stack. I then began to generate my cards, and this, more than anything, allowed me to acquire a realistic idea about the amount of time needed to create an effective stack. It also gave me the confidence to try to answer my students' questions during the two class work sessions (two hours each) in which we met in the computer lab for class.

On the day that the stacks were due, we asked the students present their programs to their peers. We had asked the students to self-evaluate their learning, as well as their product, before the presentations began. The students found the sharing very enlightening, and immediately asked to have their evaluations back so they could talk about the upgrades they wished they could make, now that they had seen what others had done. I found it helpful to hear from my students their explanations of the purpose of the stack and their intention for its use very helpful when we went back and individually evaluated each student's work. I was dismayed that it took me approximately one hour per stack to evaluate. We found many things that we wanted to hold the students accountable for, and other things we thought the students should consider before using their stack with students.

Based on our previous experiences, we revamped our rubric and I structured the assignments differently this year. I began by taking my students through the process slower. I made certain that all students had taken the tutorial prior to drafting their initial plans. I also had them create a well-developed, sequential lesson plan which structured the learning and the practice, to assure there was appropriate student support and levels of practice. I passed out a rubric which, I thought, better reflected my needs for the instruction and practice as well as Reuben's needs for effective use of technology. I did not have them create their initial storyboards until they had received back from me their lesson plans, complete with suggestions and considerations for thought. Once the storyboards were in place, we met together in the computer lab. As we expected from our experience last year, the first session was slow going, with most students only completing one or two cards. But during the second session in the lab, the students' questions were more advanced, and their level of anxiety was greatly decreased.

I think the benefits of doing the HyperStudio in this course are two-fold. I have seen the tremendous increase in confidence in my students, now that the first group are student teaching, when incorporating technology into their teaching and in their own presentations (such as in the Teaching of Science, Social Studies, and Mathematics, or the Student Teaching Seminar). But what I appreciate most, from the perspective of a methods instructor, is the quality of the direct interaction with curriculum design and implementation. My students now have discussions amongst themselves about effective methods for teaching or reinforcing skills, appropriate language use for children with limited experience and lexicons,

and open analysis of the level of skill required by specific forms of practice. I have never been able to obtain similar levels of discussion regarding "paper and pencil" unit design.

**Teaching of Science, Social Studies, and Mathematics (Secondary)**

Elementary education students in this class have the privilege of conducting a summer day camp for local elementary children at the College's Nature Center. For part of the day, class is in session for the students as they learn to teach in an interdisciplinary, multiage, field-based setting; for the remainder of the day, the students actually run the camp. Students plan all of the lessons using either PIViT or any other piece of software that allows them to show their plans in all of the three representations described previously; they also aggregate their individual design/project maps into one big class map.

Different children in the camp focus on plant and animal biology, geology, environmental science, or the history and culture of historical and contemporary peoples. The environmental group that studies water quality makes use of computer-based laboratory probes which interface with a computer and provide real-time data. They use digital probes to measure the conductivity, dissolved oxygen, and temperature of a large river at disparate locations, and then report their findings on the health of the river to the camp. The college students spend some class time learning to use the equipment, and work with the campers to make the measurements and distill the data.

Students in the class also use HyperStudio to create a hypermedia anthology or retrospective of the camp, drawing on their experience of creating stacks in the Literacy Pedagogy course. Each content area group (biology, geology, etc.) develops a set of stacks that portray the camp experience from their own perspective, utilizing source or scanned digital images, digital video, and personal artwork. The class is responsible for creating a gateway stack and agreeing on a consistent navigational structure so that the stacks may be aggregated. Students then present their anthology in an Institute-wide colloquium.

**Student Teaching Seminar (Elementary and Secondary)**

In the first years of our efforts, we noted that during the student teaching semester, students had a tendency to fall back upon what they considered their "tried and true" techniques and degree of comfort, which generally had little to do with technology. While this was appropriate for those first years, we realized that we would have to build something substantive into the curriculum in order to help the students see their technological knowledge as a strength. Beginning last year, we asked students to create a digital presentation portfolio. Beginning this year, we asked them to implement a technology project.

We explain to the student teachers that they will compile a digital portfolio in order to convey the essence of "what they are all about" to a prospective employer. It is partly a focused presentation of their professional knowledge, experiences, and artifacts, containing such things as a statement of philosophy, resume, lesson plans from student teaching or practicum experiences, examples of work that their students have done, classroom video, or samples of their own academic work. They may also put in extracurricular or personal information about themselves which helps paint a holistic picture of their potential as a teacher. The portfolio will ultimately reside on a CD-ROM that they can loan or give out. As such, the CD-ROM should be wholly self-supporting in that every application or file that is needed is already loaded. All of the specialty software and hardware tools that they need to create a digital portfolio are maintained in the Ferguson Center computer lab. They can also access Microsoft FrontPage, the College's officially supported HTML editing software, in any campus computer lab.

The technology project represents a substantive effort by the student teacher to utilize available computer technology at their school in order to accomplish teaching and/or learning that could not be accomplished otherwise. The project is grade- and curriculum-appropriate and spread out over 7-10 hours of classroom time. This time span was chosen with the hope that it would strike a proper balance away from either a superficial or onerous attempt. Each student teacher writes a project proposal early in the semester in order

to receive feedback and the assent of the seminar instructor. They must then carry out the project at a point in the semester of their choosing, and then document their efforts in the digital portfolio.

The seminar meets for two hours, once a week. During half or more seminar class meetings of the semester, basic information is presented or question and answer sessions are held for up to an hour. Either a student lab assistant or myself hold set lab hours throughout the semester to help students with individual problems. The lab has four computers, two scanners, a digital video workstation, a CD-RW/CD-R burner, a color printer, and software for creating and editing graphics, web pages, and audio or video.

#### Advanced/Directed Study (Elementary and Secondary)

This study course had its origins with a group of elementary students during the first year of the digital portfolio effort. They student taught during the fall semester, and wished to devote extra time to creating a more polished portfolio. One student from the group was particularly interested in applying for the Michigan Certificate for Outstanding Achievement in Teaching with Technology (see http://www.coatt.org). The course was beefed up to be worthy of academic credit, and initiated. The quality of the portfolios by these students was sufficiently high that we decided to continue to offer the study each semester to seniors who are anticipating student teaching or have just completed it. Apart from portfolio work, this elective course would allow students to extend a technology project or begin a new one. For example, in the fall semester a group of elementary student teachers used the study to prepare some HyperStudio stacks intended to provide their students with understanding of certain concepts that are perennially troublesome. The project resembles what was done in the Literacy Pedagogy, but is more wide-ranging because it involves research into how children learn math as well as beta testing of the software. In the spring semester, the students use the stacks in their teaching. This design experience is a more substantive utilization of technology than for someone who uses something "off the shelf," because they can understand and describe how multiple representations of difficult concepts can improve understanding.

## Areas of Future Growth

All of the prior and current Education faculty agree that having a resource like the Ferguson Center is crucial to the success of technology integration. A willingness by methods instructors to "own" the use of technology in their teaching rather than see it as someone else's domain is equally important. Ongoing and future efforts for our education program in technology-aided teaching and learning include the ongoing effective integration of technology into other education courses, support for the technology projects of practicing teachers within the local education community, and research into possible uses of Personal Digital Assistants by practicing teachers. Three education courses, Foundations of Education, Reading in the Content Area, and Exceptional Child, have yet to experience appropriate integration. Some discussions have pointed toward the use of software for concept mapping and speech-to-text recognition in the latter course. Teaching regarding the use of technology for assessment (e.g. spreadsheets and mail merge) also needs to be housed in some courses. Since Albion is a four-year undergraduate institution, it does not deal with in-service teachers in a graduate program. However, a College-wide impetus for collaboration with community institutions finds a ready application in ongoing work with local teachers to make better use of technology in their teaching.

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# Cyber Space Communities for Pre-service Teachers

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**Abstract:** Technology impacts our professional lives in many ways. Instead of a disconnected voice over the PA system, classrooms are now invaded by the sounds of "You've got mail." Teachers record attendance and grades "on line." We teach our students how to conduct Internet research. We send students on "virtual field trips" and plan simulations. Instead of asking for home addresses, we ask for e-mail addresses. We have begun, albeit slowly in many cases, to integrate technology into our classrooms and profession. As a profession, we are learning to use technology to build a sense of community among our members. At Robert Morris College, we plan to concentrate on the ways in which a virtual community can be build using technology, specifically e-mail and electronic bulletin boards, might be used as a way to keep student teachers connected to one another in addition to providing information on current issues as they complete their field work.

## Introduction

Technology impacts our professional lives in many ways. Instead of a disconnected voice over the PA system, our classrooms are now invaded by the sounds of "You've got mail." Teachers record attendance and grades "on line." We teach our students how to conduct Internet research and refer them to web sites. We send students on "virtual field trips" and plan simulations. Instead of asking students to supply home addresses, we ask for e-mail addresses. We have begun, albeit slowly in many cases, to integrate technology in our classrooms and in our profession. Professional organizations use technology to publicize conferences, list resources, and begin conversations about important issues. As a profession, we are learning to use technology to build a sense of community among our members.

Technology has expanded the resources available to pre-service teachers as well as inservice teachers. In teacher preparation institutions across the nation, pre-service teachers are given instruction and opportunities to integrate technology into daily lesson plans. They use technology to complete assignments, to present mini lessons, and to critique their own and others' tape-recorded performances. Using video conferencing technology, pre-service teachers are able to "look" into classrooms and see the interaction between real teachers and real students. Pre-service teachers can now log on and in a few minutes down load several different lesson plans on ways to teach a particular topic at a particular grade level. During content and methods courses, pre-service teachers are taught the importance of using technology as a teaching tool. Technology, however, can be much more than an instructional tool for our pre-service teachers. It can help pre-service teachers build their own community: their own support group.

There has been much research on the retention of teachers in the profession. The National Education Association (NEA) conducted a survey in 1982 and reported that less than 50% of the nation's teachers plan to stay in the profession. Wolfe and Smith (1996) discovered that of the 32,000+ teachers who begin teaching each year half will leave the profession within the first five years. One of the reasons for leaving the profession as cited in Zepeda and

Ponticell's (1996) study was the feelings of loneliness and isolation. The problems and concerns student teachers report has also been the subject of other research studies as well (Ball 1985, Grossman 1990, and Strickland 1987). All of these studies empathize the importance of maintaining a support system for student teachers and beginning teachers as they enter the profession.

At Robert Morris College, we plan to concentrate on the ways in which a virtual community can be build using technology, specifically e-mail and electronic bulletin boards, might be used as a way to keep student teachers connected to one another in addition to providing information on current issues as they complete their field work. We, therefore, are adding an additional requirement to the student teacher experience: our student teachers must read and respond to their e-mail messages and posted messages at least three times each week.

The familiarity our students have with technology, the availability of computers with Internet connections in the schools in which they are placed, and the ease of forming electronic groups through the college has led to the proposed implementation of this program requirement.

## Overview of the Program

When our pre-service teachers begin their fieldwork, they are assigned to several different schools; we do not often cluster student teachers. This adds to the feeling of isolation that our pre-service teachers report. Our students tell us that they need someone who understands their situation and is at the same professional level to share the successes and failures they have in their classrooms. The distance between schools and the college makes it difficult for many of them to return to campus for a weekly seminar; therefore, we decided that an alternative to a face-to-face return seminar might be beneficial for our students. We began by evaluating the technology that our students would have some degree of expertise and familiarity.

Pre-service teachers at Robert Morris College complete many of their content courses in classrooms that are equipped with various types of technology. These rooms have document cameras, video cameras with voice tracking capability, VCR recorders, CD players, Internet access, and computers. Our students, therefore, are comfortable with using technology in their mini lessons and integrating technology into their instructional units. Additionally, many of their instructors post assignments and other information on line. Many instructors require students to e-mail draft copies of assignments to them or to evaluate specific web sites. All instructors at Robert Morris College have the capability of creating class groups by clicking a button on the electronic roster. Our system is designed to allow instructors to e-mail the entire group, select specific members, or to post messages. Our pre-service teachers, therefore, are familiar with electronic communication. We decided to utilize this type of technology to help our students maintain a connection with one another and with the college.

## The Specifics of the Program

The first step in creating this component is to ensure that all pre-service teachers have current e-mail accounts. The next step is to explain the importance of building a community and operating within the community to all of our student teachers. In our program, all student teachers spend the first four weeks of the student teaching semester on campus. A portion of this time is spent in whole group seminars. Having the opportunity to explain the program to all the student teachers at the same time will ensure that all the student teachers have the same information. More importantly, bringing the student teachers together will allow us to begin to build the sense of community we want them to have as they are in the field.

required to visit. Then the conversations begin. After reading To ensure consistency in the program, each Monday education faculty will take turns posting a message about an educational issue or concern. For example, many of our student teachers have concerns about classroom management. One of the first messages they may receive is information about classroom management in general and two specific web sites that they will be the articles or evaluating the sites, student teachers are invited to share their reactions. We

require that they make at least one comment with specific references about the material. As student teachers log on and read each other's comments, they are encouraged to respond in positive ways to comments. Other topics for discussion include: using technology effectively with real students, teacher parent conferences, managing the paper load, grading, and effective assignments. We will also use this forum to give our student teachers current information on educational issues such as the state requirements for inclusion, no tolerance policies, and testing.

Student teachers are encouraged to post concerns or issues that they may be having in their classrooms. For example, if a student teacher has a parent conference scheduled, the student teacher might post a message asking for ideas from peers about procedures, what to say and what not to say, or what might be necessary in terms of documentation. Other student teachers respond with their ideas; thus, a conversation among the student teachers begins and the community continues to grow.

Another expected advantage of this component is that it will encourage student teachers to reflect on their teaching: specifically, lesson plans, content, and delivery. Often when asked to reflect, student teachers merely give a short, general comment. They are reluctant to elaborate or explain alternatives, successes, and failures in their reflection. We require that each student teacher post at least one reflection during the week. We encourage other students to comment on the reflection, ask questions, and suggest alternatives, or use the reflection as a springboard for new ideas.

## Program Assessment

Before implementing the program, it is necessary to decide how to assess its strengths and benefits. Initially, we have decided to post an issue or concern and then to monitor the conversations. As faculty, we do not intend on responding to our student teachers comments through e-mail. If a student teacher seems to be in danger of committing a serious error in judgment, we plan to intervene privately. Although, our student teachers know that we monitor and examine their individual responses, it is our belief that by remaining "silent" we will be able to blend into the background as many ethnographers do.

In essence, we plan to take turns posting a concern on Monday. Although any of the coordinators or the department chair might monitor the responses for any week, the coordinator responsible for posting the issue will be responsible for checking the responses during the week and making hard copies of the electronic responses for the others on the next Monday. Each of the content coordinators will be responsible for closely examining the responses from the student teachers in that discipline. To encourage student participation, coordinators will assign points to the student teachers for each contribution to the conversations that helps to move the conversation along. Comments like "I agree," will not receive points. Coordinators will be responsible for recording the points for student teachers in the coordinator's discipline. Although our intent is not to use the conversations as a way to evaluate student teachers as they practice, we believe that the transition from extrinsic to intrinsic motivation needs to be strengthen for our students. We also believe, based similar in class discussions, that once the discussion begins most of our student teachers will begin to "join in" without the extra motivation of "the grade" to do so.

In addition, coordinators will be responsible for noting trends in the conversations. At the monthly coordinators meetings, these trends will be discussed and plans for appropriate action will be made. By evaluating the comments for patterns of concerns and issues, we believe we can better service our students. The patterns that we discover in our students' conversations will enable us to engage in a continuous evaluation of our total program from the content and education courses to the field experiences. Thus, we believe this community of professionals will continue to grow and expand. We further believe that this sense of community will strengthen the profession by helping to retain teachers.

## Conclusion

It is hoped that requiring student teachers to stay connected to each other and to the college as they complete their fieldwork will instill a habit of sharing and learning together. By providing this type of support system, student teachers will be able to rely on peers rather than instructors as they make important curricular decisions. We are confident that helping them to establish a community will sustain them through student teaching and provide a model for them as they begin their careers in their classrooms.

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# Internet Use in Teacher Education: What Are the Foundations for Determining Learner Outcomes?

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**Abstract**: This descriptive case study explored both the implementation of an interactive web module in a teacher education course and the instruments used to assess the learner outcomes of that implementation. Data collection consisted of a pre-post critical thinking measurement, which was the foundation for the construct of higher order reasoning, an analysis of student-teacher discourse through electronic mail, and an interview with a student. The findings from this study have implied that: 1. an integrated approach of instructional technology must be carefully planned and implemented to reduce anxiety and increase the likelihood of student use; 2. there is a need for differentiating between the types of learning goals and outcomes in relationship to different instructional web module designs, and 3. there is a need for developing a blueprint of a variety of instruments that assess learner outcomes, both quantitative and qualitative in nature.

## Introduction

The details of the theoretical application and implementation of the web module used in this study, as an instructional tool in a teacher education course, can be found in previous studies (Hazari & Schnorr, 1998, 1999; Schnorr, Bracken, & Hazari, 1999). The aforementioned web module design includes McKenzie's (1995) considerations that it is essential for technology to be implemented through careful planning, and the necessity that learning theory be used as a foundation for technology's integration within course instruction. However, little is known about the effect of technology on learner outcomes as measured by higher order reasoning skills (McKenzie, 1995; Riel, 1994). Furthermore, Reid (1997) indicates that the demand is high but the supply is low for methods of assessing the teaching and learning experience in online education.

Therefore, this case study was conducted to solidify a plan for assessing the teaching and learning experience while using an interactive web module in an educational psychology teacher education course, ESEC 443, at California State University, San Bernardino (CSUSB). The course instruction is designed to embed practical applications, such as teaching strategies and learning tools, within a theoretical framework. In this course, the World Wide Web (WWW) is employed as an educational device where it provides a variety of sources, thereby significantly broadening the spectrum of practical applications. For example, it is a source for finding innovative lesson plans and current educational research and practices (Hazari & Schnorr, 1999).

This case study observes the applicability of the interactive web module within the classroom from the standpoint of the module's ability to be used in facilitating learner growth as defined by the construct of higher order reasoning.

**Theoretical Foundations**

The World Wide Web is ideal for teachers who wish to use interactive technology to enhance learning within their courses. Since the Web is a newer medium that requires its own presentation style, careful planning is required to building effective Web pages that use learning theory as their guide (McKenzie, 1995). Such learning theories include Constructivism, Cognitive Behaviorism, and Cognitive Social Learning. Bednar, Cunningham, Duffy, and Perry (1992) strongly recommend applying theories of instruction to learning. The Constructivist theory incorporates pedagogical goals for the process of constructing knowledge by providing appreciation for multiple perspectives, embedding learning in relevant contexts, encouraging ownership in the learning process, embedding learning in social experience, encouraging use of multiple modes of representation, and encouraging self-awareness of the knowledge construction process (Vygotsky, 1986; Bruner, 1990). By virtue of its interactive nature, the WWW is a complement for a Constructivist learning environment.

Additionally, Relan & Gillani (1997) define Web Based instruction as, "the application of a repertoire of cognitively oriented instructional strategies implemented within a constructivist and collaborative learning environment, utilizing the attributes and resources of the World Wide Web" (p. 43). Furthermore, effective Web Based Instruction promotes student centered cooperative learning (Johnson & Johnson, 1990), critical thinking (Beyer, 1988; Ennis, 1989), communication skills, reasoning power, in a non-discriminatory environment that takes into account student cognitive styles by offering a multi-sensory interface that supports interaction and contextual learning.

**The Study**

The participants in this study were thirty-two students in the Single Subject Credential Program (SSCP) in the College of Education at CSUSB. The focus of the SSCP is to prepare educators who will evaluate current school practices and imagine teaching and learning in new ways. This program is designed in three phases: foundations, pedagogy, and Praxis. The phases lead candidates through a process in which ideas, models, and skills are continually reexamined and expanded. The SSCP is based on the philosophy of education embodied in five intersecting themes: diversity, curriculum in social contexts, critical reflection, communication, and academic competence (Handbook for the Single Subject Credential Programs, 1999). CSUSB can be described as serving a diverse population with a significant ratio of minority students, specifically Latino and African-American. The students can also be described as a primarily commuter population. The average socioeconomic status of the surrounding community is lower to middle income. The majority of the participants of the study had little (less than 2 years) of teaching experience.

This case study observes students in an adolescent psychology class, which met once a week over ten weeks. The interactive web module was introduced in the first class, and each consecutive class involved integration and expansion upon the module's uses in the course. All instructions relating to the use of the web module were given during the first session by the instructor. Supplementary instructions were given over the time of the course on a one-to-one basis and as a reminder within the class instruction. In the first session, the students were asked to complete an on-line questionnaire and to pay particular attention to the following components of the instructor designed web module at http://soe.csusb.edu/schnorr: 1. Informal assessment/critical thinking questions, 2. On-line practice quiz, 3. Links within each chapter that would provide lecture notes and alternative WWW resources, 4. Examples of former students' projects.

The data collected in this study were 1. Student Interview, 2. Pre/Post test assessment: <u>Principles of Learning and Teaching: Grades 7-12</u>, 3. Summary of technology use as indicated by student/ teacher discourse, 4. Evaluation of the Cal Press rubric for the study's critical thinking assessment needs. The collection took place over the ten-week quarter period.

## Findings

### Student Interview

The student interview was chosen as a data source because of its ability to provide the descriptive self-report of any perceived influence of the web module application on the outcome of the learning process from an end-user perspective. This report includes affective and intellectualized descriptions of the experience. This data source was analyzed for underlying themes relating to the web module's use by the student. The interview was conducted through electronic mail after verbal acceptance for participation was obtained. The student chosen was female, Caucasian and in her mid-forties. She was chosen because of her stated lack of experience with Internet technology use before the class. The question asked was open-ended and was administered and analyzed by the research assistant. The interview consisted of the following open-ended question: "Tell, in your own words, about using the technology in class. Please be as complete as possible by describing the process from beginning to end. If possible, please include your feelings and thoughts as they occurred throughout the class." The interview response revealed several themes.

***Theme 1: Use of the web page as an instructional tool allows the class experience to become relevant to the student's personal life.***

The interviewee said, "Because Dr. Schnorr encouraged us to write our Learning Projects in an area where we felt strong in order to LEARN TECHNOLOGY, I now feel that I could move beyond this and use the same tools to learn about other topics and fields of study. One of the goals of learning is to keep learning outside of the classroom and continue to grow as a person in a more holistic approach to learning. In my Learning Project, I wanted to incorporate a broader base of cultural awareness as related to the arts. I did research and was able to connect to the Getty Museum discovering they had a vast amount of information on Cultural Context and Cooperative Learning among Students. I also became aware that I could research the art of many countries and museums all over the world."

***Theme 2: The interactive technology is seen as an unknown, which has negative implications for the user from the first day. The initial emotional reaction to the unknown was anxiety.***

The interviewee said, "I am an artist; therefore, abstraction is difficult for me at times. The computer itself seemed so foreign. I had been using the computer basically in the WORD program to type reports and to keep records. I had never been on-line, surfed the Internet or used E-mail. My first reaction to Dr. Schnorr's expectations of integrating technology into the classroom experience was anxiety."

***Theme 3: The teacher/educator, over time, provides a non-threatening environment where the student can overcome initial anxieties.***

The interviewee said, "She (Dr. Schnorr) had a web page with all other important information and went through it in class with us. This turned out to be very empowering. Dr. Schnorr was able to give us tremendous access to a rubric and exact requirements for each assignment. She also had several illustrations of other learning projects so that we could further understand what a successful project should look like. Dr. Schnorr was able to show us power point presentations on a large screen instead of using an overhead--modeling. I didn't even know what a Power Point presentation was! That isn't really even important--she exposed me to new information that became clearer later."

### Pre/Post Test Assessment

The pre/post test assessment instrument was used to observe if the web design had any influence on the students' critical thinking ability in relation to a standardized instrument. The instrument used was the *Praxis Series On Line- Professional Assessments for Beginning Teachers, The Principles of Learning and Teaching: Grades 7-12 (0524)[www.teachingandlearning.org/licnsure/praxis]*. This instrument assesses the student's knowledge of educational psychology principles. This test was designed to assess beginning teacher's knowledge of a variety of job-related criteria. The exam assesses knowledge on human growth and development, classroom management, instructional design and delivery techniques, evaluation and assessment. There are fifteen (15) total questions with thirteen (13) multiple choice questions and two (2)

essay. The pre-test and post-tests were given to all thirty-two (32) students in the first session of class. The results for the pre and post-test were analyzed both quantitatively and qualitatively. The essays were quantitatively scored using the rubric provided in the Test at a Glance booklet produced by the *Praxis*. The possible essay scores ranged from 0-3. The essays were then qualitatively scored using the guidelines from the booklet that had been modified to allow for the student's application of practical knowledge. The results of this analysis revealed that this instrument was not appropriate for the purposes of assessing critical thinking within a constructivist context. The standardized appropriate answers as outlined in the rubric did not account for the unique experiences that face the teachers in this sample.

**Summary of Technology Use**

The electronic mail represents the discourse between the instructor and students. This discourse took place over the ten-week course span. The analysis consisted of reading for and finding common themes that existed within the messages. The instructor noted that throughout the course, the same students seemed to be taking advantage of such features as the informal assessment templates and e-mail use.

**Rubric Suitability**

The Holistic Critical Thinking Rubric was the device chosen to measure the student's level of critical thinking employed in the pre/post test and on the students' learning project. The Holistic Critical Thinking Rubric is constructed by the Cal Press and can be found at http://www.calpress.org./ The rubric was found limited in its ability to score the level of applied critical and creative thinking skills of the student. This instrument requires the learner to analyze, among other cognitive skills, opposing arguments without bias. The Learning project reflects some level of creative thinking. The student has the potential to take from the educational psychology theories presented in class what is necessary and develop an applicable product to the student's own experience and, in doing so, that type of learning does not fit within the guidelines of this critical thinking rubric.

**Conclusions**

The objective of this study was: (a) to explore the role of technology as it relates to learner goals and learner outcomes as determined by the researcher's theoretical foundations for instruction, such as Constructivism and Cognitive Social Learning theories; and (b) to validate the choice of rubrics for quantifying learner outcomes in relation to higher order reasoning. The outcomes of this study can be described as falling within two categories: 1. necessary procedural modifications for the subsequent experimental research study (i.e. independent variable or treatment issues) and 2. modifications of the researcher's learning theory construct and ideals about use of the web-based technology in relation to higher order reasoning (i.e. dependent variable or measuring issues).

**Treatment Issues**

The data that resulted from student online correspondence with the instructor (e.g. e-mails, on line questions, and etc.) and the student interview, lead to the realization that procedural changes were needed for introducing and reinforcing the use of the internet within the course. The analysis of the online correspondence said that the use was minimal and, in fact, isolated to a minority number of students with definite trends within the correspondence (e.g. lack of understanding about an assignment, or request for additional information.). The only time that there was a guaranteed use of the technology was if it was required, as in the case of the Learning Project Contract. To compound this issue, the interview revealed that initial levels of anxiety are produced when being introduced to technology while also being introduced to another educational context such as educational psychology. There is inherently a level of anxiety that is attached to learning something new- educational psychology, and that anxiety could be increased with the introduction of technology. This led to the identification of procedural issues for the ensuing study that would need to be addressed.

The following question emerges from these results: "How can the instructor reduce anxieties toward

technology in the beginning of the course while increasing the likelihood that it is being used effectively?" First, the technology must be accessible. The researcher could not count on ongoing use outside of the classroom setting, therefore the class would be held in a computer laboratory or near one where the whole class could be transferred. Through integrating the technology more as an in-class activity, its use would be convenient and students' learning curve could be increased. The most promising aspect of the in-class use is the scaffolding that could be provided by both the instructor and the peers; this would encourage the technology use, specifically in required assignments such as the Interdisciplinary Group projects.

Secondly, a non-threatening task must be given in the first class that enables the instructor to diagnose the technology-related weaknesses and strengths of the students. After the first class, the instructor can give an outside class activity using the web module so that during the next class such problems as interface issues can be assessed.

**Measuring Issues**

The need for modifying the researcher's construct on learning theory foundations in relation to the web-based technology came from two different sources, one being the analysis of the scores from The PRAXIS Series: Principles of Learning and Teaching: Grades 7-12 Sample Exam used as the pre and post-test. During the attempts to score the tests as prescribed by the scoring guide given with the sample exam, a discrepancy was determined in what was believed to reflect higher-order answers for the essay questions yet would not have been considered as such by the instrument's scoring guidelines. According to the scoring guidelines, what could be expected to be a "correct" answer was a standardized answer based upon discrete theoretical origin to the exclusion of answers that include, and value, personal experience within the context asked. This led to the findings that the use of the Sample Test for the purposes of this study was an invalid assessment of what the researcher believed was the effect of the web-based module on critical thinking skills. This study also had an impact on questioning the suitability of the Cal Press rubric for assessment of the thinking levels that emerged from the learning project assignment within this research study which appeared to be more *creative* in nature. These findings also lead to the realization that clarification was needed between the constructs of critical thinking and creative thinking. Critical thinking is considered evaluative thinking that is logical and creative thinking is defined as the ability to deal with a problem in an original way (Wakefield, 1996).

Finally, the researcher discovered that in the same way that various instructional strategies and assignments within a course target varying levels of reasoning and cognition, so do varying elements of instructional Internet designs. Whereas this researcher thought that some of the Internet scaffolding techniques produced higher order reasoning, the questions and feedback from the instructor with student use of the on-line critical thinking template, in some cases, narrowed the students' thinking more closely to the instructor's desired response. In line with all of the findings outlined above, the researcher's construct of what constituted higher order reasoning skills (critical and creative thinking) was determined as requiring realignment, and in fact, a more solid definition. The following question emerges from these results: Are there valid quantitative measures for critical and creative thinking given the qualitative nature of these constructs? Secondly, how does the interplay between the expected outcomes of the assignment itself and the use of the Internet in relation to that assignment affect learner outcomes? Thirdly, do unique components within the instructional Internet design target differential learner outcomes?

**Recommendations**

The results from this study have provided us with a solid framework from which to approach the subsequent quasi-experimental and qualitative research design that is outlined at http://soe.csusb.edu/schnorr/matrix.htm. The most pragmatic result was the determination that the ideology of the expected learner outcomes based upon Constructivist and Cognitive Behavioralist constructs required redefinition and realignment and how the web module design effects those outcomes. This result has led to the creation of a checklist (http://soe.csusb.edu/schnorr/matrix.htm) that can be used to evaluate the following ideals in concert: 1. the learning theory that provides the purpose for the web module design, 2. the relationship between the learning theory and the web module design components that align with that theory, 3. learner outcome assessment tools that align with the goal of the web module design.

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# Student Teacher Educational Technology Use

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**Abstract:** This paper deals with the use of instructional technology by student teachers. According to the results of three years of surveys, student teachers at our university are reporting limited use of instructional technology during this experience. Data from the surveys illustrate the restricted use of instructional technology, which technologies are being utilized, and some of the causes for concern.

## Introduction

While working with colleagues in the Chemistry Department at Northern Kentucky University to develop a chemistry class for pre-education majors, I arrived at the idea of surveying our student teachers to see if the course had any impact on their use of educational technology. The following paper discusses the results of the survey, some implications, and direction for further research.

## The Study and Findings

The following data were gathered over a three year period in which student teachers from Northern Kentucky University in the Elementary and Middle Grades Education Programs were surveyed concerning their use of educational technology. Surveys were distributed each Spring Semester. One hundred three surveys were returned out of just over three hundred. The overwhelming majority of respondents were female (93.2%). Most (68.9%) were seeking elementary certification.

Only 60.2% reported that they used educational technology while student teaching. Mathematics was the subject area that rated the most use of educational technology (14.1%). English and other subjects each accounted for 7.7%, while science and social studies each rated 6.4%. Many respondents reported that they used technology for a combination of subject areas (57.7%).

The most frequently used hardware was the CD ROM (48.5%). Second was LCD projectors (18%). That was followed by laser disc players (15.6%) and computer interfaced probes (1.7%). Results were consistent for the use of software with CD ROM's being the most used form of software (54%). Floppy discs were second with 37.7%. Laser discs were used by 21.8% of the respondents and 11.3% reported using simulations. Just over half (51.5%) of the student teachers stated that they or their students used Internet resources.

Student teachers were asked to rate the impact two courses that were specifically designed to promote and model educational technology usage had on their use of technology. The first course was CHE 105: Chemistry and Society. The second course was EDU 313: Computer Applications for Teachers. CHE 105 was rated by 23.1% of the respondents as having impact or the highest impact on their use of educational technology. 48.1% rated EDU 313 as having impact or the highest impact on their use of technology

while student teaching. Several student teachers rated other courses as having greater impact, but these were courses that few in the program had taken.

Respondents were also asked to answer essay type questions to explain some of their responses to the other questions. The first essay asked, "Why haven't you used educational technology for instructional use?" The following are quotes from the student teachers:
"Because they were not readily available to me."
"During the first eight weeks of student teaching I was told what and how to teach.
During the second eight weeks, we have been covering materials to prepare for [state] testing."
"Technology was not readily available."
"In my classroom, technology is not available. I would like to use it if it would come available."
"The classroom has a few computers but are not set up to teach a whole class. In addition, I don't feel ready to use this technology to teach yet- maybe when I have more experience in the classroom."
"Would love to use computers if available and current teacher supervisors in the school district felt confident with them."

## Recommendations

These responses indicate a direction the university and cooperating schools must take to improve the use of instructional technology by student teachers. Professors must model the use of technology in teacher preparation programs, especially those teaching courses in the content areas. University supervisors must encourage and support cooperating teachers to obtain and use educational technology.

## Further Research

Interviews and focus groups will be conducted in the spring of 2001 to explore further the data resulting form the surveys and to identify ways universities and cooperating schools can improve student teacher use of educational technology.

The following is a quote from a student teacher you wanted to write his/her own essay:
"I feel like my education I received here at NKU prepared me for my career somewhat. I do not feel as if my computer knowledge or use of technology was enhanced at all. With our growing and changing society NKU should have smothered me with computer work and technological advances."

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# Project Sun: Teacher Preparation at Brevard Community College

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**Abstract:** Brevard Community College (BCC), in partnership with the Florida Solar Energy Center (FSEC), the School District of Brevard County, the Astronauts Memorial Foundation (AMF), and the University of Central Florida (UCF), has submitted a proposal to the National Science Foundation, Advanced Technological Education Program called *Project Sun* to provide pre-service (BCC teacher education students) and in-service (Brevard County certified) teachers an exciting array of curriculum opportunities and technical experiences to enhance their scientific and technical instructional skills. *Project Sun* is a comprehensive plan that addresses an ATE project in the Technical Experiences program track with objectives that will provide 1) technical experiences for pre-service (PS) and in-service (IS) teachers, 2) a thematic approach to science instruction, 3) a method of scientific investigation, scientific practice, and thought, 4) exposure to working scientists and educators, 5) recruitment and articulation activities between all institutions involved, and 6) business partnership connections.

## Introduction

The educational community does not fully realize and recognize the essential role of two-year colleges in teacher preparation. Nationwide, more than 40 percent of teachers complete a portion of their science and mathematics course work at two-year colleges, with most of the elementary and middle school teachers completing all of their college-level work at these institutions (NSF, 1998). Thus, for most public colleges, opting out of providing teacher education, especially in science, mathematics, and technology, is not a choice. Pursuing a concentrated effort to improve teacher education is both practical and moral (Gonzalez 1999). According to an industry task force, many teachers are teaching "rain forest mathematics" curricula that are light on the tools tomorrow's high-tech workers will need (Leopold 2000).

The solar curriculum and experiments will give impetus for teachers, both PS and IS, to expand their personal and academic capabilities in science, mathematics, and technology education. The four Solar Energy curriculum units ("Solar Matters," "Alternative Fuel Matters," "Solar Wonders," "Building Performance Matters") provide an exciting thematic approach to scientific and mathematic study through a myriad of topics, experiments, and activities. Each of the curriculum units and activities are adaptable and versatile, allowing them to be adjusted up or down to fit any academic level. Common materials and supplies are used in the experiments and activities so that they can be conducted in or outside the classroom. Most importantly, they use a renewable and readily available energy source - the Sun.

The project outcomes will enable educators to integrate creative and intriguing science and mathematic activities into their daily instruction, provide "hands-on" experiences to increase the PS and the IS teachers' scientific and technologic capacities and skills, increase their interest in teaching science and math, connect mentoring teachers with students, and engage educators, scientists, and industry in supporting teacher preparation. In addition, PS teachers will gain a clearer understanding of the career opportunities, roles of responsibility, and challenges of the teaching occupation. They will also be better prepared to continue their

teacher preparation at the university level and be aware of occupations using science, mathematics, and technology skills. The dissemination activities, video, and the community forum will heighten the community's awareness and sense of stewardship of renewable energy, the importance of quality teacher preparation, and the role of the community in the education efforts.

## The Project

The content focus of *Project Sun* are the solar energy curriculum units developed by the Florida Solar Energy Center, a nationally recognized research institute of the University of Central Florida. The curriculum units are aligned to the national science standards and the Florida Sunshine State Standards.

Summer Sun Academy, a five-day workshop for 25 PS and 25 IS teachers, will be conducted. Subsequent mentorships will be created at this time, which will continue throughout the year as PS teachers complete their field experiences, internships, and curriculum projects. All participants will receive support from each other.

The *Project Sun* partnership was formed among BCC, UCF, FSEC, AMF and Brevard Public Schools so that each entity would provide resources toward the success of the project. Objectives regarding teacher preparation, enrollment, and articulation are focused on students at Brevard Community College. Founded in 1960, BCC is a comprehensive, public two-year community college in east central Florida, home of the nation's space program. In 1999, BCC enrolled over 14,000 students in degree and vocational courses. In 1997, Forbes Magazine listed BCC as one of America's top 20 "CyberU's"—the only community college to receive the distinction. In addition, The Association of Community College Trustees has recognized BCC as one of the two most outstanding community colleges in America in terms of equal opportunities for women and minorities.

The primary target population for the project participants is BCC students who have completed or intend to soon enroll for an education course. The secondary target population is in-service elementary school teachers in Brevard County, particularly those from schools with the highest percentages of children from low-income families. Participants should already have introductory computer skills. Before Sun Academy, participants will complete a technology self-evaluation rubric; they will also be encouraged to visit Web sites such as Computers for Lunch as a learning-readiness activity.

Designed for future and current elementary teachers, *Project Sun*'s content of instruction focuses on the top three most requested training needs: Internet, PowerPoint, and Web design. This training will not duplicate existing training already provided by BCC or Brevard Public Schools, but rather complement and support other technology training. *Project Sun* consists of a summer workshop and school year activities. Project activities directly address the project objectives.

a. Sun Academy. The Sun Academy is an intensive, five-day workshop for 25 in-service and 25 pre-service teachers per year with a dual purpose of increasing technological literacy and science/math preparation. Sun Academy was developed in direct response to surveys which documented needs of elementary school teachers in Brevard County for integration of technology into the curriculum and specific technology applications. Pre-service teachers will choose to receive either a stipend or a fourth credit hour to the EME 2040 Teaching with Technology course; in-service teachers will receive 35 in-service points and a stipend. This Academy will unleash the technical potential of the participants, giving them practical experience in using the tools of technology, expose them to a thematic curriculum approach, and give them confidence in their own potential for teaching science, math, and technology. Participants receive a *Project Sun* notebook and are encouraged to keep a journal of their progress.

The *Project Sun*'s PI and Co-PI will supervise. During Sun Academy, activities are performed in teams that contain both in-service and pre-service teachers in order to build group problem-solving skills and develop mentoring relationships. The following is a schedule of activities for Year 1. Years 2 and 3 are similar except that 1) previous Project Sun participants will make presentations at Sun Academy about their experience, and 2) instruction will change according to what is most suitable and requested in the yearly survey of technology training needs in Brevard County.

## Activities

The project activities during the academic year will directly address the objectives for technical experiences, preparation of teachers, recruitment, and partnerships. Providing experiential and hands-on activities with technologies and applications to PS teachers is a primary objective. PS teachers enrolled (approximately 300) in the BCC "Technology for Educators" course will learn to use and understand technology tools of the classroom teachers by engaging in the improvement of the existing solar energy posted on the FSEC website (www.fsec.ucf/edu/ed/teachers). Under the instruction of key faculty, students will develop, create, and integrate interactive components, a FAQ section, animation, video, and other activities for the text-based curriculum, making them livelier, real, and more interesting to teachers and students.

DAYS 1 – 2: Instruction for Sun Academy will be delivered by BCC technology and education faculty and Florida Solar Energy Center (FSEC) staff on Days 1 to 4. Participants will work in teams to evaluate "Solar Matters," a solar energy curriculum unit that includes 25 inquiry-based, cooperative learning projects for upper elementary school/early middle school students. Currently posted on the FSEC Teacher Web site (www.fsec.ucf.edu/ed/teachers), "Solar Matters" is one of four Solar Energy curriculum units developed by FSEC, a nationally recognized center of UCF. "Solar Matters" is aligned to the national science standards from the National Research Council, and the Florida State Sunshine Standards for science and math in Grades 4-8.

Currently, "Solar Matters" is pages of static text; participants will develop ways to improve the curriculum, based on current research they have just reviewed on effective educational technology strategies. Teams will develop, create, and integrate interactive components, a Frequently Asked Question (FAQ) section, word problems, and activities to the text-based curriculum to make it more learner-centered, interesting, and user-friendly for teachers and students. Participants will also learn how to make Web sites accessible for all students, such as creating audio files for blind students, or ensuring that all cultures are represented in graphics of students and teachers.

Participants will learn how to use software programs such as QuizPlease or Hot Potatoes, which are user-friendly ways to add interactive quizzes to the Web sites. They will be instructed in using presentation software (such as PowerPoint and Kid Pix) which allows you to draw and animate models, and to add slides to Web sites. They will also gain experience in searching the Web for the many freeware/shareware resources available to enhance Web sites (such as clip art graphics, sign-in guest books, counters, puzzles, chat areas, bulletin boards, and more).

In addition to advancing their knowledge of technology and science, participants will increase their math skills as they create original math word problems for "Solar Matters" which includes integrated curriculum that aligns with state math standards. They will also perform math while working with "Solar Matters" activities that require calculations of time, temperature, angles, and population demographics.

DAY 3: Participants will develop a Sun Kids Web site, appealing to all levels from elementary to secondary. Participants will learn to use Microsoft FrontPage or Publisher for Web site creation, which are ideal for beginning Web authors. (They are also the two Web design programs that come with versions of Microsoft Office 2000, which was one of the top programs Brevard elementary schools requested training in). Web site highlights will include a Guest Scientist section, FAQ's, Learning Centers, a Discussion Forum for students to exchange ideas with others around the world, an Ask Professor Soleil column, solar experiments, and activities for home or school use.

DAY 4: This instruction is at The Astronauts Memorial Foundation. Participants will choose a solar energy activity/experiment from "Solar Matters" to perform. Having participants perform the experiments they will teach their students is crucial to their development as teachers. One study notes that 19% of third graders never perform experiments in science class; that many pre-service elementary teachers have misconceptions about science; and that many elementary are reluctant to teach science due to an inadequate science background (Sutton). Teachers who model scientific inquiry and technology use are more effective in the classroom.

Participants will rehearse and then videotape each other's presentations using digitized video cameras, or they will take a series of still photographs with Mavica digital cameras. (98% of elementary schools in Brevard County have digital cameras and/or video editing equipment).

DAY 5: At AMF, participants edit their videos on iMac computers (Macintosh computers outnumber PC computers at Brevard elementary schools 2 to 1). Participants will use iMovies digital editing software, which turns the series of digital still photographs into a motion picture. Final presentations will have participants exhibit their movie and then burn it onto a CD for use in a resource library. At the end of Day 5, there will be a "graduation" ceremony where participants receive a Certificate of Completion and a Sun Academy T-shirt. Each school represented at the Academy will receive a curriculum unit and a "Solar Matters"

Kit composed of enough materials and supplies to recreate Academy experiments.

b. Follow-Up Activities During the School Year. Learning is more meaningful when placed in a context with practical applications; learning technology is no exception. Once participants have completed the summer academy, they are Sun Academy graduates. It is expected that 90% of graduates will continue with follow-up activities throughout the following school year; several will continue to be involved with *Project Sun* for the full three years of the project. They will remain involved in *Project Sun* due to a comprehensive plan of project retention, which includes academic support, mentoring relationships, electronic conferencing, and workshop opportunities. The project expects to compensate for the estimated 10% of Sun Academy graduates (five) a year who choose not to follow up. Five pre- and in-service teachers a year who are interested in participating in some of the school-year activities may do so with a colleague who attended Sun Academy; they will be recruited for the next Sun Academy.

All education, math, science, and technology faculty at BCC will be involved in helping Sun Academy graduates who are BCC students to build on the knowledge gained at Sun Academy. Education students at BCC take the core courses Introduction to Education, Teaching Diverse Populations, Teaching with Technology, and Introduction to Special Education—all of which are available as distance education online as well as in a traditional classroom. Particularly in the EME 2040 Teaching with Technology course, students will reinforce the technology skills learned at Sun Academy. Specifically, they have assignments that require them to make PowerPoint presentations, practice with digital cameras and digital video cameras, use the Internet extensively, and evaluate educational Web sites.

Participants are encouraged during Sun Academy to find a mentor and also be one themselves throughout the school year. Mentoring relationships do not necessarily have an in-service teacher as mentor and pre-service teacher as protégé. A pre-service teacher needs an in-service teacher as a role model for pedagogy, but may be more technologically literate and can act as a mentor as well. A national study found that teachers with three or fewer years of experience were more likely to feel well-prepared to use computers than teachers with 20 or more years of experience (Rowand 1999).

BCC education students are required to go into the schools for classroom observations. In the past, this has been simply observing pedagogy. *Project Sun* participants, with the cooperation of the supervisor teacher, will do their observations in classrooms supervised by in-service teachers who allow the student take a more active role. During their in-school time, participants will use technology to support innovative assessment of students, as described by Sheingold and Frederiksen (91-108). Participants will use An Educator's Guide to Evaluating Use of Technology in Schools and Classrooms (Quiñones et al. 1998), which describes benchmarks, indicators, and methods of collecting information with nine worksheets that cover topics such as "Why am I evaluating?" "What questions should I ask?" and "How do I communicate my results?" Participants will fill out these worksheets as they observe students going through Solar Matters and Sun Kids. To develop reflection on their progress, participants will add to the journals they began at Sun Academy. Participants can decide to keep the journal private, submit it to project directors, or post it on the Web site.

To promote awareness of technologies and the teaching career, participants will create an Inquiry Group among themselves, with support from project directors and education faculty. The Glenn Commission recommends Inquiry Groups because "however well they may have been prepared to teach, and whatever knowledge they may have gained in Summer Institutes, all teachers need continuing, collegial contact, peer reinforcement, and input from experts to sharpen their skills and deepen their subject knowledge." Participants will make a field trip to the Instructional Technology Resource Center at UCF in Orlando to increase their knowledge of current teaching technologies. They will also visit FSEC to learn about the origins of the solar energy curriculum, and to meet scientists who are conducting research on renewable energy for commercial and non-commercial use globally.

The Inquiry Group will set up an electronic discussion group (also known as a listserv), develop their mentoring relationships by E-mail, arrange real-time chat sessions to discuss a variety of topics, take electronic field trips, and post lessons (in-service teachers) or notes from their observations (pre-service teachers) on the Web site. The listserv and chat sessions will help participants organize a Renewable Energy Community Forum featuring a variety of guest speakers. This will be an opportunity for *Project Sun* participants to gain experience organizing and disseminating results of an educational forum, increase their knowledge of solar energy, and meet working scientists, government representatives, business and industry leaders, and other educators.

c. Increasing Enrollment and Diversity. Increasing the number and diversity of prospective K-12 teachers at BCC is a key concern of *Project Sun* (Objective 3). It is crucial to the future of teaching to be more inclusive,

and teachers should reflect the diversity of the students they teach. While minorities comprise only 13% of our teachers, almost 30% of our students are from minority populations (NCTAF, 1996). The *Project Sun* Director (Principal Investigator), Dr. Krupp, will create recruitment materials that explain the AA degree and how to make a smooth transition to UCF. Other materials will be created for BCC students in math, engineering, science, and technology classes, encouraging them to consider a career in teaching. This effort is aided by a new incentive by Brevard Public Schools to give teachers in math, science, and special education $1,000 sign-on bonuses. Participants from Sun Academy who want to expand their experience producing and editing video will make a video of Brevard Public School teachers describing the rewards of a teaching career, and current BCC and UCF education students talking about how much they enjoy their major.

In addition, the PI will work with BCC Minority Recruitment and Retention and the Office for Students with Disabilities to create materials to encourage the enrollment of those traditionally under-represented in elementary education, such as males (only one out of ten elementary school majors is male), and those from minority, low-income, and disabled populations. As role models are an important factor in deciding a college major, BCC elementary education students who are from an under-represented population will be available at career fairs and on the video discussing their background and why they chose to pursue a teaching career. This effort will work hand-in-hand with Brevard Public School's recent efforts to increase minority teaching candidates. The Project Director will also work closely with the local One-Stop Center to develop materials to specifically target career changers. Materials will show, among other information, that the Brevard average teacher's salary is above the Florida average (Gonzalez, 2000).

The *Project Sun* PI will also visit high schools to talk about the education major, to promote *Project Sun*, and to encourage seniors to attend Sun Academy when they graduate. At Rockledge High School, students are enrolled in a new "Exploratory Education" course where they get training and then teach children at Hoover Middle School with reading. The 30 students in the program will be the focus of recruiting efforts. Retention of current students in the BCC education program will be improved by *Project Sun* as well as by the establishment of a Future Teachers of America chapter at BCC.

Pre-service teachers will be tracked through the duration of the project to determine their progress toward graduation, certification, employment, and preparation. Project directors will cooperate with longitudinal studies to track students beyond the grant period, in order to follow them through their first year of teaching (which may be five years after entering the project) and see that they demonstrate successful performance in the classroom.

d. Articulation Partnerships. Currently in Florida, students who are awarded an Associate of Arts degree are guaranteed complete acceptance of the community college credits toward their Bachelor's degree. Articulation agreements exist between BCC and UCF on the prerequisites necessary for a teacher education degree program. The Articulation Committee, consisting of administrators and instructors from BCC and UCF, will be responsible for reviewing the current articulation agreements and course requirements to determine what modifications are necessary to ensure that: 1) courses are aligned with state and national requirements; and 2) students have a smooth transition into an upper-division teacher education program. The Committee will survey UCF students who transferred from BCC to determine their satisfaction with the information, academic counseling, and services received during their transfer. The survey will elicit suggestions for improvement from students, and use the results to improve the transfer process.

## Conclusion

*Project Sun* intends to be a statewide and nationwide model for improving teacher preparation. The results of the project will advance knowledge in the fields of technological literacy for teachers, theme-based science teaching, alternative energy education, mentor relationships between pre-service and in-service teachers, and the transfer process from a two-year college to a four-year university.

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# Educational Technology at the University of Florida

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**Abstract:** The expansion of educational technologies in the College of Education at the University of Florida has resulted in three interrelated phenomena: (1) the development of educational technology support throughout the College, (2) the integration of technology within our teacher education program and other programs throughout the College, and (3) the expansion and revision of our Educational Technology degree program. This paper explores these three interrelated phenomena in detail.

## Introduction

A metamorphosis has been occurring in the College of Education at the University of Florida in recent years. In increasing numbers, faculty and students alike are using technology to create and provide meaningful and engaging learning environments. The expansion of educational technologies in the College of Education has resulted in three interrelated phenomena: (1) the development of educational technology support throughout the College, (2) the integration of technology within our teacher education program (ProTeach) and other programs throughout the College (i.e. educational technology for non-majors) and (3) the expansion and revision of our Educational Technology degree program. Figure 1 illustrates these three interrelated phenomena and the rest of this paper further explains each in detail. Please see our web page for more information: http://www.coe.ufl.edu/Courses/EdTech/ET.html

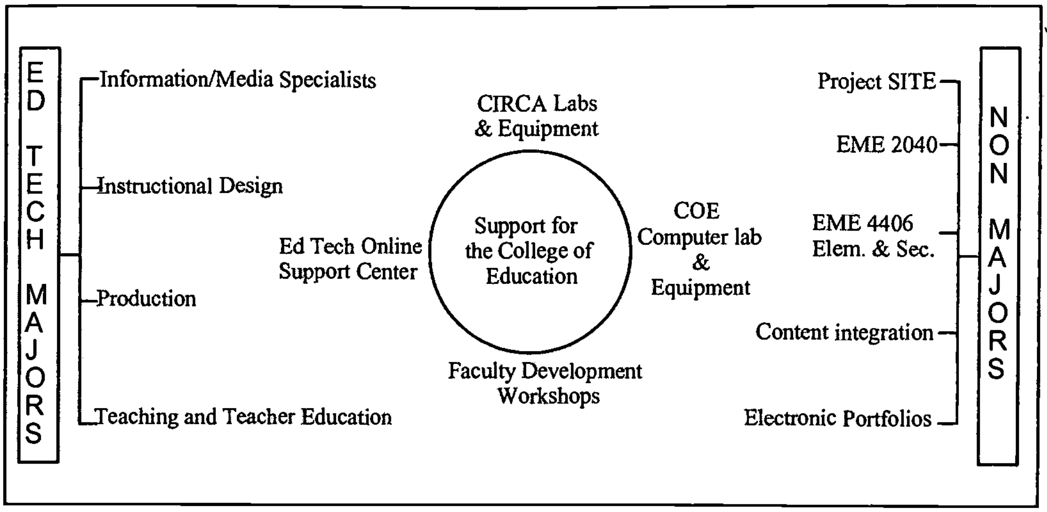


Figure 1: Educational Technology at the University of Florida

## Support Structure

The importance of having a support structure for students and faculty cannot be overlooked when infusing educational technologies into the College of Education. Without a robust and changing support system, many, if not all, of the technologies will be underutilized in this learning environment. It is critical that all members of the College of Education community learn not only fundamental skills for using educational technologies but also to develop strategies for seamlessly integrating these educational technologies into the daily learning environment. Currently, the College of Education has four areas of support dealing with access, skill acquisition, and professional development.

### CIRCA labs and Equipment

Students have access to the university supported computing labs (CIRCA labs). Located within the College of Education are two labs of 25 G4 Macintosh computers. These lab provide students access to scanners, printers, and numerous specialized application packages. In addition, there is at least one computer consultant on duty in the College of Education labs.

### College of Education computer lab and Equipment

The College of Education computer lab is primarily used by the Educational Technology program and for college-wide faculty development. This lab has 15 G4 Macintosh computers, digital video cameras, scanners, video acquisition machines, video editing software, high-level production packages, laser disc players, and a CD ROM burner. Students work in the lab on class projects when the lab is not being used for classes. With the abundance of classes and the popularity of the lab, it is rare to find a time when the G518 lab is not being used. This lab allows students to have access to equipment and also provides a place for skill acquisition and professional development. Educational technology faculty offices are located within this lab so there are always graduate students and faculty around the lab to provide assistance.

### Faculty Development Workshops

The Office of Educational Technology, an academic computing group of staff and graduate students, has recently been established in the College of Education to support faculty in the integration of technology into all curricular areas. New faculty meet with the Director of the Office of Educational Technology to determine technological fluency and to provide suggestions for integrating technology into the classroom

and work environment. Faculty new to using technology are building skills in workshops and gaining insight on strategies for using technology in their courses. In addition, graduate students serve as mentors/coaches for new faculty members. More experienced computer-using faculty receive instruction in advanced computer applications as well as learning strategies for effectively using technology in the curriculum.

### Educational Technology Online Support Center

In 1994, we decided that many of the support documents we were creating for our courses transcended an individual course. As a result, the web-based Educational Technology Support Center was developed. It has undergone several transformations as different groups of students worked on its evolution. We now offer support to new students, school children, teachers, and those interested in developing technological skills. The existence of the support center has had an impact on K-12 schools, where students often use our reference pages to learn how to build web pages, and on our own courses, where we no longer teach web page development directly. Although the Educational Technology web suite is now extensive, we envision a time when institutional resources will be directed at our web presence, allowing us to build a more robust virtual "knowledge community". Since our students are both producers and consumers of information, our web suite should become an interface between the global infosphere and our particular corner of it.

## Non-majors in the Educational Technology program

The faculty, staff, and students in the College of Education recognize the need for technological fluency for success in the 21st century classroom. Teachers at all levels must be able to appropriately utilize educational technologies in their learning environments. This thrust in the College of Education has prompted the development of several courses and an alternative certification program. Described below are only a few of the courses and programs available for different audiences within the College of Education.

### EME 2040: Introduction to Educational Technology

EME 2040 is an introductory technology course mandated by the state for all declared education majors. With the organizational structure of the teacher education program, this class primarily contains elementary education students. (Secondary education students obtain a baccalaureate degree in their field and declare majors in their area of specialization.) This course is designed to introduce students to current and emerging educational technologies, and frameworks for critical assessment of the changing nature of humankind's relationship to information and knowledge. By examining the influence of specific technologies on education, society, culture, economics, politics and history, the course analyzes human to human communication and our expanding knowledge base. By comparing and contrasting research and instructional models the course addresses innovation diffusion, paradigm shift, and the nature of change at a local, regional, and global level. Simultaneously, students are required to engage in laboratory activities designed to expand their personal horizons with respect to technology. Further information can be found at http://www.coe.ufl.edu/courses/EME2040/2040.htm.

### EME 4406: Integrating Technology into the Curriculum (Secondary Sections)

EME 4406 is one of the required courses in the education minor for students in the College of Liberal Arts and Sciences. This is frequently the first computing course that students encounter in their educational experiences. Integrating Technology into the Curriculum is a hands-on and discussion/lecture/group-based course designed to give students experience with the infusion of computers into curricula. Students engage in activities that are based on the idea that a learning concept involves viewing it from multiple perspectives to accommodate different types of learners. Students also gain first hand experience in creating activities that span academic disciplines and address a wide variety of learners. Additional information can be found at http://www.coe.ufl.edu/Courses/EME4406Sec/4406.htm.

**EME 4406: Integrating Technology into the Curriculum (Elementary Sections)**

EME 4406 is designed to help students think about how technology may be used to enhance and extend elementary teaching. While students learn many technology skills during the semester, the primary emphasis of this class is on teaching and learning in the elementary school. Two very basic questions about how and when to use technology guide the class (Harris, 1998): (1) Will the technology enable us to do things we couldn't do before? (2) Will the technology enable us to do things better than we could before? Other fundamental principles that guide the class include the use of technology to promote content area learning and constructivist teaching principles, alternative assessment strategies, reflection and integration of state-mandated standards. More details are available on the class website: http://www.coe.ufl.edu/Courses/EME4406elem/home.htm.

**Content Integration Course for Secondary ProTeach**

Students in Secondary ProTeach have classes to learn strategies of using technology in their area of specialization (mathematics, science, and social studies). In this setting, students gain experience in using specialized software for their field and in creating technology-rich learning environments. For example, mathematics students learn methods for using software packages such as Cabri Geometry and the Geometer's Sketchpad as well as various Internet sites to enhance student learning opportunities. Students in the science and social studies classes also learn to use specialized software packages and technology integration strategies for their field.

**Electronic Portfolios**

In the fall semester of 1999 the Proteach students at the University of Florida began creating electronic portfolios as a way to demonstrate proficiency in the state of Florida's 12 accomplished practices. These are process portfolios which evolve throughout the student's education in the College of Education. Through the development of electronic portfolios students will understand and operationalize an evolving relationship with the accomplished practices. All students in teacher education certification programs create and maintain an electronic portfolio. An extensive support system is currently being created to assist students and faculty in this endeavor. Additional information can be found at http://www.coe.ufl.edu/school/portfolio/index.htm.

**Project SITE**

Project SITE (Site-based Implementation of Teacher Education) allows students to earn a Master of Education degree in Elementary Education and be eligible for certification. This project is offered jointly by the University of Florida's College of Education and the School Board of Alachua County. The site-based program is an intense 4-semester sequence that includes 48 credit hours of study and classroom teaching under excellent supervision.

This alternative to traditional teacher preparation provides a learning environment in which the graduate student's previous careers and volunteer experiences supplement their classroom instruction. This results in new teachers whose rich experiential backgrounds enable them to relate well to a wide variety of students.

Formal course work is taught at both the University of Florida's College of Education and the Alachua County Schools. Instructional strategies and methods are taught by practicing classroom teachers, administrators, and University of Florida faculty. The theory learned in course work is applied through daily classroom apprenticeship, with the intern working under the guidance of a mentor teacher.

## Educational Technology Majors

The Educational Technology program accommodates students with a wide variety of interests and career goals. Although most of our students find positions in K-16 educational settings, some are employed in the private sector as instructional designers, multimedia developers, and content providers. In order to meet the particular needs of our students, we have developed four areas of study or *tracks*. The delineation of the program areas helps students decide which courses are appropriate for their career goals. The four program areas are Information/Media Specialists, Instructional Design, Production, and Teaching and Teacher Education. Following their interests, students often take courses outside of their specified track. Descriptions of the areas of study follow:

### Information/Media Specialists

The information/media specialist track is intended to prepare students for service in preK-12 school media centers. Successful completion of courses in this track leads to qualification for Florida certification as a school media specialist. Students in this track take core library/media courses as well as courses in communication theory, video production, and computer applications.

### Instructional Design

Students in the instructional design track desire to become instructional developers in various settings including government, business, health, industry, and post-secondary environments. Students focus on topics such as the various perspectives of instructional design and message design.

### Production

Students enrolled in the production track investigate the dovetail between theory and practice in instructional technology. They develop a theoretical framework which includes conceptualizations of interactivity, graphical design, animation, video communication, audio communication and new media. While developing software, they gain production and programming skills in a collaborative, situated learning environment. Recent projects may be found at http://www.coe.ufl.edu/webtech/index.htm

### Teaching and Teacher Education

Students in this track are interested in ways technology can advance student learning in K-12 and/or post-secondary environments. These students desire to become K-12 teachers, K-12 school technology administrators, K-12 computer resource teachers or teacher educators. Most importantly, teaching and teacher education students are preparing to become educational technology leaders in their respective educational environment. Students enrolled in the teaching and teacher education track focus on topics such as designing technology rich curriculum, communicating using the Internet, and distance teaching and learning.

## Conclusion

In conclusion, the College of Education at the University of Florida continues to change and development with respect to the use of educational technologies. This metamorphosis can be seen in all areas of the College: students, faculty and staff, and the support structures. Students and faculty alike are benefiting from the infusion of educational technologies into our learning and working environment. These changes are also allowing students majoring in Educational Technology to gain more breadth and depth in our areas

of specialization. We encourage you to watch us as we grow and change to meet the various changes needed in education for the 21st century.

# Work-in-progress project aiming at assessing the Faculty Attitudes Toward Information Technology of Universidade Paulista (UNIP) Post Graduation Course in Brazil

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**Abstract:** This small paper is a report of the work-in-progress project aiming at assessing the Faculty Attitudes Toward Information Technology of Universidade Paulista – Post Graduation Course in Brazil leading to taylor-made training suggestion at identified areas in order to promote inquiry-based learning and effectively integrate the use of technology into existing curriculum thus increasing teacher - student learning and achievements. Assessment will follow Project for the Longitudinal Assessment of New Information Technologies in Education coordinated by Professors Gerald Knezek and Rhonda Christensen of University of Texas- TECET translated into Portuguese.

## Introduction

Universidade Paulista is the biggest private university of Brazil, with over 50,000 undergraduate students nationwide and 3,000 on post graduation courses. Being a private school, the vast majority of their campy possess technology infrastructure although other than for the specific courses in which it is integrated into the curriculum, such as Engineering and Computer Sciences, there is little use of technology in class related activities. The Master in Communications course has plans to implement and increase the use of technology in their courses mostly because one of the areas of concentration of the course is on New Technologies and Education. Nonetheless, there is still no formal body responsible for the dissemination of technical assistance nor a milestone plan to be implemented towards this dissemination and relatively few educators know how to use technology in their classes. The level of current faculty is equivalent to those of the best universities worldwide, all 10 teachers are PhDs, over 50% with Post PHD qualifications (Livre Docencia) and awarded several prizes for their academic production.

## The Study

The importance of technological literacy is acknowledged by the teachers and is encouraged through students and social pressures. Technological advances are viewed as powerful agents of change and these educators were used to being agents of change themselves. Not so long ago they knew, each in their specific field of expertise, what was the state-of-the-art in terms of teaching and learning. They are now faced with the challenge of reevaluating their modus-operandi and access the implications of using and recommending technology. However beneficial and cost-effective new technologies may be, they are also viewed a potential threat to universities and faculties, once these so called "new technologies" makes the dispersal of universities students possible (Young, 2000).

In accessing these faculty attitudes toward Information technology and computers in general, we aim at gathering all the necessary data in identified areas of need and in compiling these enable a pre-service and in-

service taylor made course to effectively integrate the use of technology into existing curriculum and increase teacher - student learning and achievements (Knezek et ali,1998).

**Project Goals and Aims**

1. Assess trends in faculty attitudes toward information technology in UNIP SP – Masters in Communication Course , using FAIT (TECET, 99) as the assessment instrument
2. Suggest taylor-made pre-service and in-service training for in-house faculty
3. Enable effective use of technology in the classroom
4. Enhancement of learning and teaching through research, communication, and productivity strategies
5. Emphasis on hands-on approaches in alignment with local and international standards
6. Encouragement of teamwork, problem-solving, and peer review
7. Provide the grounds for an in-service and post-service training assessment of faculty and students

**Plan of Operation**

1. Baseline data will be gathered in Brazil from faculty between 2000 and 2001
2. Post status reports and findings will be placed on our local web site.
3. Plan to present a joint project summary report at WCCE '2001 in Copenhagen with PLANIT Panel (Project for Longitudinal Assessment of New Information Technology Attitudes in Education) from the Texas Center for Educational Technology Telecommunications and Informatics Laboratory .

**Recommended Instrument**

For College/University Faculty: FAIT - 5-point Likert questionnaire (Knezek et ali,1998) courteously authorized for use in this study by Texas Center for Educational Technology .

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# A Collaborative Approach to Integrating Technology and Information Literacy in Preservice Teacher Education

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**Abstract:** The current focus on technology and Information Literacy (IL) represents an important shift in preservice teacher education from basic skills, which are necessary but not sufficient for students today, toward evaluation, analysis, synthesis, and production. The National Council for Accreditation of Teacher Education (NCATE) recommends infusing IL requirements into undergraduate and graduate programs in teacher education. The NCATE 2000 standards specify that candidates preparing to work in schools must be able to integrate technology appropriately and effectively with IL to support student learning and recognize the importance of using research in teaching. The intent of this study is to observe the complexity of preservice IL processes as they occur in one teacher education program and to describe how one education resource librarian and two professors of education collaborated to provide IL instruction to preservice educators that went beyond the traditional bibliographic instruction lecture format, using active learning methods and constructivist principles to encourage lifelong information literacy.

## Introduction

The current focus on technology and Information Literacy (IL) represents an important shift in preservice teacher education. The American Library Association (ALA) defines Information Literacy as the ability to recognize when information is needed and to identify, evaluate, and use information effectively (ALA, 1989; 1998). New knowledge about teaching and learning supports the idea that even though basic skills are necessary, they are no longer sufficient for students today. Schools are now being asked to prepare students who can demonstrate understanding as well as knowledge and skill (Lieberman & Miller, 2000). Because Information Literacy can be transferred across subject areas, improve research, writing, and critical thinking, it helps students interpret and understand the world (Souchek & Meir, 1997).

National education associations are recognizing the need to educate students for lifelong learning in a time of exponential growth of information. In January 2000, the Association of College and Research Libraries (ACRL) adopted new standards for college libraries specifying that librarians collaborate frequently with classroom faculty to integrate Information Literacy into appropriate courses. The National Education Association (NEA) recently introduced Information Literacy into the Teacher Education Initiative Program. The American Association for Higher Education (AAHE) created an action committee to incorporate Information Literacy into their programming. The National Association of Secondary School Principals (NASSP) devoted the March 1998 issue of the NAASP Bulletin to a discussion of Information Literacy.

When reporting on the progress of modifying teacher education to include Information Literacy in March 1998, the American Library Association Presidential Committee on Information Literacy reported that no progress had been made (Progress Report on Information Literacy, March 1998). Their recommendations included developing plans for working with teacher education programs and the National Council for Accreditation of Teacher Education (NCATE) "to infuse information literacy requirements into undergraduate and graduate programs in teacher education." Newly revised NCATE standards reflect this recommendation specifying that candidates preparing to work in schools must be "able to appropriately and effectively integrate technology and information literacy in instruction to support student learning" and "understand the importance of using research in teaching...." (NCATE 2000 Standards).

The Ohio Library Report recommends that library and information literacy instruction be included in the revision of teacher education curricula in order to "ensure that school teachers have the skills needed for effective incorporation of information literacy instruction into the elementary and secondary curriculum" (Jacobsen, 1988, p. 52). In her U.S. Department of Education brochure, Barbara Humes (1999), sites a 1995 study conducted by Rader, listing the following factors as necessary for successful integration into the academic curriculum:

$ The institution has a strong commitment to excellent educational outcomes for the students in the areas of critical thinking, problem solving, and information skills;
$ Library administrators have long-term commitments to integrate library instruction into the curriculum and;
$ Faculty and librarians work together on curriculum development

## Purpose

The intent of this study is to observe the complexity of preservice Information Literacy (IL) processes as they occur in one teacher education program. The study describes how one education resource librarian and two professors of education collaborated to provide information literacy instruction to preservice educators that went beyond the traditional bibliographic instruction lecture format, employing active learning methods and constructivist principles (Brooks and Brooks, 1999) to encourage lifelong information literacy skills.

## Theoretical Framework

A review of the IL literature provides the theoretical foundation for the study. The areas to be described are IL roles and definitions and critical thinking skill development. Scriven and Paul (1992), define critical thinking as "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered...as a guide to belief and action." Rasool, et al. (1996), point out that an essential element of critical thinking is creative thinking. Learning is an active process in which learners construct new ideas or concepts based on their past knowledge and construct cognitive structures (i.e., schema, mental models) that provide meaning and organization to experiences and allow the individual to "go beyond the information given" (Bruner, 1973). Bloom's Taxonomy (1956) identifies a hierarchy of levels of thinking that increasingly challenge the student to higher order thinking skills.

This study goes beyond the conventional definitions of IL to point out the influence of contemporary learning theory on IL when engaging student teachers in an authentic learning environment. In contemporary learning theory the student is seen as an actively engaged information user, underscoring the importance of developing information expertise. Learning is defined as the active knowledge building through dynamic interaction with information and experience. The information search process mirrors this description of the learning process when students "actively seek to construct meaning from the sources they encounter and to create products that shape and communicate that meaning effectively" (ALA, 1998).

Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. In a constructivist learning environment, students are encouraged to refine or revise their understanding. Five overarching principles are evident in constructivist classrooms: (1) teachers seek and value their students' point of view; (2) classroom activities challenge students' suppositions; (3) teachers pose problems of emerging relevance; (4) teachers build lessons around primary concept and "big" ideas; (5) teachers assess student learning in the context of daily teaching (Brooks & Brooks, 1999).

## Modes of Inquiry

A case study research design (Merriam, 1998), based on the qualitative paradigm is used. Through surveys, stories, and an examination of documents, researchers examined the nature of the preservice IL process with an in-depth look at preservice IL during prepractium methods courses within one teacher education program. Using qualitative methodology, elements found within this case study contributed to the development of an active learning model of IL at the preservice level. The main questions that guide this inquiry are:

$ How does the Information Literacy (IL) program contribute to education courses of one teacher education program?
$ What do student teachers identify as the key influences of IL in the teacher education program?
$ What are the attitudes and expectations of education faculty toward student IL competency?

The participants are two preservice teacher educators, one education resource librarian, and 200 students enrolled in required education courses over a period of two academic years. Contrary to current practice as noted by Collis (1994), that "much computer related teacher education is stimulated and delivered by persons without an academic background in teacher education," the education resource librarian has tenure and is a former classroom teacher. The setting is a state college of 4000 students in the northeast region of the United States, one of nine in the state college system. The Education Resource Center is housed on the mezzanine floor of the college library directly above the main library reference and circulation areas. A collection of over 12,000 items includes children's literature, curriculum guides, textbooks, tests, children's software, compact disks, magazines, kits, posters, games and other multimedia resources. A viewing room for previewing videos and CDs is located at one end of the Education Resource Center. At the opposite end of the Education Resource Center is an electronic instruction classroom used for library instruction classes. Computers on one side of the mezzanine area provide access to the Internet and over 350 electronic databases. Located on the adjacent wall are workstations with children's educational software programs. A number of institutions of higher education maintain similar curriculum libraries to support teacher education programs. *The Directory of Curriculum Materials Centers,* Fourth Edition, edited by Beth Anderson (1996), describes our center along with 277 other curriculum materials centers in the United States and Canada.

## Data Sources

Faculty and student survey data, syllabi, reflective journals, prepracticum field experience manuals, integrated thematic units, reflections on the unitary process and cooperating teacher evaluations were all used to examine the nature of the IL process. These extracted materials are the basis for categories and themes drawn from the data.

## Preservice Information Literacy Model

The Preservice Information Literacy Model provides opportunities for students to develop critical thinking skills in the context of active research connecting course work and student practicum experiences with hands-on information literacy exercises. The collaborative nature of the model with on-going consultation between faculty and librarian ensures that IL objectives are consistent with course assignments and requirements of the student practicum experience.

After initial discussion and demonstrations of Internet web sites and search techniques in an electronic classroom, students are given opportunities to explore and evaluate resources that are directly connected to their required course work and field work. Information is gathered, analyzed, synthesized, and evaluated and combined in new ways and eventually applied in the prepracticum teaching site by the student in consultation with the cooperating teacher. Lesson plans designed and implemented by students are assessed by the cooperating teacher and teacher educators.

Outreach into the community to facilitate Information Literacy skills for kindergarten through college has been one of the long term goals of this collaborative project. In the spring of 1998, the Education Resource Librarian conducted a series of three (3) full day workshops for twenty-two (22) librarians from the public schools of a nearby large urban district. In September 2000, workshops were offered at elementary school libraries in the local professional development school network for all the public school librarians. The workshops focused on

guidelines for library media facilities and personnel, current research on effective use of the Internet, and strategies for assisting student teachers with school-based library resources for lesson plans and integrated unit preparation.

## Results/Conclusions

A total of 34 survey forms, based on a questionnaire developed by O'Hanlon (1988), were distributed to education faculty and 21 were returned for a 62% rate of return. Eighty-five per cent of the faculty responding to the survey required their students to conduct research for one or more assigned projects. Lesson plans were the most frequently assigned research project, closely followed by research papers and then book or journal article reviews. Interdisciplinary curriculum units and literature reviews constituted the next most frequently ranked categories. Over half of the education faculty responding to the survey listed the first priority of the teacher education curriculum to be *teach students life-long or independent learning skills* as opposed to teaching specific facts, concepts, and methods. When asked which research skills were essential for future teachers, the ability to synthesize information gathered from many sources received unanimous support. There was consensus that students will need to be prepared to teach Information Literacy in Pre K-12 classrooms and that instruction be shared between the classroom teacher and the librarian. Nearly all faculty surveyed agreed that elementary and secondary teachers are in a better position to help their students become information literate when they receive formal instruction themselves during their teacher education program.

Analysis of the preservice students' course documents and prepracticum field experience manuals revealed that the preservice student teachers had successfully integrated many of the objectives of the IL instructional process. The individually designed and implemented interdisciplinary curriculum units provided a rich source of data demonstrating the effectiveness of library research and technology skills as a result of the active learning Information Literacy model. Some students utilized resources available in the Education Resource Center to a greater extent than others. Students enrolled in methods classes used children's literature, curriculum guides, and electronic databases that could be directly linked to the materials and technology available in the Education Resource Center. The quality of these units created by students who utilized various types of media and technology available in the Education Resource Center was judged to be superior by the education professor and the cooperating teachers. Internet sites identified by students in their bibliographies could be traced to their active learning experiences in the IL program. The cooperating teacher evaluations highlighted the research aspect of the preservice student's work.

## Educational Importance of the Study

*A Nation at Risk* (U.S. National Commission on Excellence in Education, 1983), emphasizes the need to develop critical thinking skills to evaluate the plethora of data produced by the information explosion. Since then, learning how to locate, access, and evaluate information in a variety of formats has become an even greater challenge. The Education Resource Center environment helps students and faculty move beyond the textbook to support critical thinking and inquiry-based learning. Education faculty collaborate with the librarian to ensure access to primary sources and developmentally appropriate materials. The library becomes a research center for students engaged in project- and inquiry-based learning.

The flexible Preservice Information Literacy Model provides opportunities for students to develop critical thinking skills in the context of active research connecting course work and student practicum experiences with hands-on information literacy exercises. The collaborative nature of the model with on-going consultation between faculty and librarian ensures that IL objectives are consistent with course assignments and requirements of the student practicum experience.

The qualitative paradigm further provides the latitude needed to study IL from the participants' perspectives within the context in which this takes place. Information Literacy Programs help to bridge the gap between theory and practice (Furlong & Roberts, 1998). Teacher educators could benefit from this study because there are universal elements which contribute to a systematic integrated model of IL at the preservice level.

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# Implementing Technology into Preservice Teacher Courses: PT3 First Year Accomplishments

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## Introduction

More than 20 preservice methods courses are currently taught in the College of Education at the University of North Texas. Prior to 1999, fewer than half of these courses made extensive use of information technology, and fewer than one-fourth involved active modeling technology-infusion teaching and learning techniques. Utilizing Funding from a Department of Education, Preparing Tomorrow's Teachers to Use Technology (PT3), the College of Education at the University of North Texas is producing technology enhanced teachers for the 21st century. The preservice teacher initiatives of the PT3 grant have provided:

Technology mentoring programs for senior faculty members
An opportunity for credentialing of technology competent paraprofessionals
An infusion of technology enriched experiences within the preservice teacher education curriculum
The current paper seeks to outline four of the activities sponsored by the PT3 program.

## Infusing Technology into Reading/Language Arts Teacher Preparation Programs

Technology is often taught as a separate subject in order for students to learn the basic use of computers. However, preservice teachers' knowledge of technology use should not end with their own achievement of computer literacy (Vannatta & Reinhart, 1999). Even after reaching the point of literacy in technology, students often do not transfer what they have learned to other situations or subject areas (Kinzer and Leu, 1997). In order for preservice teachers to become effective integrators of technology and language arts, it is essential that its uses be modeled for them (Vannatta & Reinhart, 1999) and they must be provided with opportunities to practice what they have learned, as well as develop their own ideas for weaving technology into the language arts curriculum.

In the spring of 1999, two doctoral candidates majoring in reading education worked collaboratively to integrate the use of technology into two reading methods courses for preservice teachers. Planning for the spring semester began in the fall of 1999 with searches for meaningful activities that could be easily implemented to enrich the reading courses. A web site was constructed for each reading course that consisted of the course syllabus, schedule and resources for preservice teachers (see http://www.people.unt.edu/~mlm0012 and http://courseweb.tac.unt.edu/dana). These resources included links to World Wide Web sites pertaining to language arts such as book award sites, professional organizations, lesson plans, government agencies and reading initiatives, ERIC Online, online language arts journals, web publishing for children, web sites belonging to authors of children's books, and a site that created puzzles that could be used in vocabulary activities.

Modeling the use of PowerPoint presentations required hardware in the form of computers and LCD panels for whole class viewing. While these items were routinely used in computer education courses, they were not used at that time for courses in the department of teacher education. Faculty members from the future Institute of the Integration of Technology into Teaching and Learning (IITTL) loaned laptops and LCD panels to the reading instructors for use in the

presentations throughout the semester, as well as provided space on a server that enabled the instructors to post materials related to the courses and student work on the World Wide Web.

The curriculum for the reading courses was already in place. No assignments or expectations were changed due to the addition of the technology component. The instructors were in agreement with Niess (1990), who believed that computers must be fitted to the curriculum rather than the curriculum to computers. The intent of the instructors was not to change the reading courses to accommodate the technology, but to infuse technology into the courses to enhance the preservice teachers' experiences and to help them become aware of the exciting possibilities for technology use in the area of language arts.

The technology infused course was an introductory reading course that is required of all students in the college of education at the university. It covers a variety of topics that include knowledge of the reading process, stages of reading and writing development, techniques for teaching reading skills, an overview of reading assessment, and an introduction to various types of reading programs currently in use today. This course was taught on campus at the university, where the students had easy access to computer laboratories and the class was able to meet in a computer education classroom on several occasions. The technology infused course is a prerequisite to the technology enhanced course involved in this study.

Two sections of another reading course, one of which was technology enhanced, participated in this study. It is required for all preservice teachers specializing in elementary education. This course is designed to teach students how to perform reading assessments, conduct evaluations, and provide remedial assistance for elementary level students. Students are required to perform assessments and tutor one child throughout the semester.

The amount of technology present in the three courses varied. Preservice teachers in the technology infused class had a course web site where they could access the syllabus, course schedule, PowerPoints from previous lectures, and many resources. PowerPoint presentations were modeled for them throughout the course. Toward the end of the semester, the students created their own presentations using PowerPoint and presented them to their classmates. They received instruction in web searching early in the semester. Some students indicated an interest in learning to design their web pages as an addition to the required course project. The instructor met with them several times out of class and the students spent many hours on their own time developing the web pages. The preservice teachers in this course participated in an email exchange that focused on reading assessment with students in the technology enhanced course.

Due to the limitations in availability of on-site technology equipment for the students in the technology enhanced course, those preservice teachers were unable to participate in all the activities experienced by the students in the technology infused course. A course web site was provided, the instructor modeled PowerPoint usage each week, and they engaged in an email exchange with the preservice teachers in the technology infused course.

The technology teaching tools offered to the students enrolled in the traditional methods course were limited to an overhead projector and transparencies. No course web site or PowerPoint presentations were provided and they did not participate in the email exchange.

The preservice teachers enrolled in the three courses were surveyed on the first and last day of class. According to survey results, students in the technology infused reading methods course believed they were better prepared ($P < .01$) to integrate technology into the language arts curriculum in their future classroom than did students in the traditional methods class. Students in the technology enhanced course rated their capabilities as somewhere in between those of students enrolled in the technology enhanced class and the traditional class.

## Technology Integration Mentoring

CECS 4800, Technology Integration Mentoring was a new course introduced as part of the PT3 Capacity Building plan, during the spring of 2000. The course was designed to allow students who had completed CECS 4100, Computers in the Classroom, to continue to advance in their technology integration abilities. The purpose of this course was to provide an extension of CECS 4100 which would enable preservice educators to focus on technology integration in an authentic classroom environments.

### Course Description

Students met together three times during the semester but communicated frequently via a class listserv. The remainder of the class time was spent in a working classroom where they were paired with a classroom teacher. The students were also required to submit assignments such as answering weekly questions via the listserv, finding and turning in the Acceptable Use Policy for the school in which they were working, filling out a technology survey (which required them to find out what hardware and software were available to them in the school/classroom), as well as writing and implementing a plan of action. The students were observed onsite by their instructor, Rhonda Christensen and her team teacher, Theresa Overall.

The Plan of Action differed according to the needs of the classroom teacher, but all of the plans were required to have certain components such as Texas Essential Knowledge and Skills (TEKS) and International Society for Technology in Education (ISTE) technology standards, a rubric for evaluating their plan, and other standard components of an effective unit or lesson.

Distribution of materials for the course was carried out at the first class meeting. These included a handbook for the cooperating classroom teacher, examples of technology integrated units, rubrics and other resources. A class website was developed with links to other technology and curriculum resources. Students' digital pictures were taken and placed on the course website so that when they were communicating with each other via the listserv, they could view the photos to recall the faces of fellow classmates.

Students had the option of selecting their own teacher or being placed in a classroom arranged by the instructor. This resulted in a wide geographic distribution for the students in the course. Two 4800 students were placed in the same school in special instances. This seemed to be very helpful to the students for peer support.

The second face-to-face meeting included a follow up of placement, as well as interaction on how things were going for the students in the course. A model activity of collaborative learning using technology, in which the 4800 students were participants, also took place at the second face to face meeting.

The final face-to-face meeting focused on presentations of student plans of action. This was an impressive display of wonderful work with classrooms of students and their teachers.

Assessment/Evaluation

An anonymous course evaluation was given to the students at the end of the semester. On a scale from 1 to 5 (awful to excellent), all students rated it as a 5.

Open-ended questions included: Please list two stars and a wish. What was the best aspect of the course (two stars) and I *wish* the following would have been different. There was also a place for additional comments.

The cooperating teachers also filled out a more extensive evaluation of both the student and the program. Overall the comments were wonderful. The teachers seemed to think this was a useful course that benefited both the university students and the classroom teachers.

Observation/Discussion

One nice benefit of this type of course is the two-way mentoring that occurs. The undergraduate students were the "technology integration experts" to help the classroom teachers. However these preservice students learned a great deal from these "expert classroom teachers" about classroom management and curriculum.

While there is currently much emphasis on the preservice teacher education technology integration in colleges of education, there isn't a precise plan for how to best improve preservice students' technology integration. In this course, placing preservice students in a real teaching environment was a rich and rewarding experience for both the students as well as the cooperating classroom teachers.

Infusing Technology in Preservice Teacher Preparation in Special Education

The State of Texas lists Special Education as an area with a critical teacher shortage. Interestingly enough, there is not a shortage of Special Education teachers in Texas. Basically, a large number of certified teachers choose not to teach or have left the teaching field for other occupations. The "burn-out" rate for a Special Education teacher in the field is typically four years (Cunningham, 1989). Two of the most common reasons for leaving the field involve discipline problems and the abundance of paperwork required of Special Education teachers. The paperwork problem is often more pronounced for Special Education teachers in testing and administrative position such as the Educational Diagnostician. Although a number of initiatives and incentives have been implemented to attract and keep more teachers in the field of Special Education the critical shortage of teachers remains. It is most important to alleviate areas that contribute to "burn-out." The College of Education at the University of North Texas has attempted to provide strategies to assist teachers with their paperwork and discipline problems through the use of technology. Instructors in the Special Education Program have developed a plan to infuse appropriate technology into teacher preparation courses. Instructors model the use of technology through class lectures and assignments. Instructors also develop a fluency with the aspects of technology which can help teachers reduce paperwork in the field. Instructors expose students to time saving technology such as:

Computer Generated Individual Educational Plans
Interactive CD's depicting students with special needs
Test Scoring Programs
Report Writing Programs
Grade Books
Effective Remedial Software
Computer Generated Behavioral Plans

The goal of the Special Education Program is to not merely produce teachers, but to produce teachers who have the technology skills to facilitate their timely and successful completion of job requirements. Surveys indicate that teachers completing the Special Education preservice sequence of courses improve their technology skills as they progress through the undergraduate sequence of courses. It will be important to monitor these technology proficient special educators to determine if technology training plays a role in classroom success.

## Web Based 2 +2 Articulation

During 1999, Dr. Jeff Allen created a web-based 2 + 2 articulation web page for students transferring from six North Texas community colleges AAS programs to the University of North Texas BAAS program. This site can be accessed at: (http://www.attd.unt.edu/Articulation/Index.html).

The State of Texas has a strong community college system that is willing and able to prepare students in their first two years of college. Community college students are representative of their local community populations (urban, rural, religion, race, national origin, gender, age, and disabilities). Eighty-five percent of students in the Bachelors of Applied Arts and Science (BAAS) program at the University of North Texas (UNT) have transferred from a community college Associate of Applied Arts and Science (AAS) program, thus allowing the BAAS program to better represent community populations Central and North Texas.

Utilizing funding provided by the Department of Education, UNT developed computerized (web-based) degree plan templates for *all* of the AAS programs offered at the following six community colleges:

Collin County Community College, Dallas County Community College, Grayson County Community College, McLennan County Community College, Navarro Community College, North Central Texas College, and Tarrant County College.

| *Community College* | *Number of Articulation Agreements* |
|---|---|
| Collin County Community College | 45 |
| Dallas County Community College | 79 |
| Grayson County Community College | 20 |
| Navarro Community College | 32 |
| North Central Texas College | 13 |
| Tarrant County College | 44 |
| Total | 233 |

Dallas County Community College, the largest of these districts, pilot tested the pages during the Spring 2000 semester. This web site was fully published during summer 2000 for the remaining districts. In addition, during Fall 2000, Hill College, McLennan Community College, Texas State Technical College and Weatherford Community College will be added to the web-based articulation/advising program. These 11 community college districts serve rural and urban populations in approximately twenty-nine counties of Central and North Texas.

The web-based Program articulation is a difficult and time-consuming effort involving many levels of cooperation and discussions. This web-based articulation/advising program provides greater opportunities for community college counselors and faculty to advise their students of UNT technology-based program. Through this local advising process, UNT faculty and staff can act in a resource and support role rather than a marketer for students exploring degree plan pathways options from community college programs. This program provides students a two-tier support/advising system to finish their four year degree program at the University of North Texas.

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# It's a Small University After All - Reducing Distances Between Colleges Via Web CT

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Abstract

This paper describes a Web-CT based project between foreign language education majors in the College of Education and foreign language students in the College of Arts and Sciences at a large metropolitan university. Thousand-level Spanish and French students responded weekly in the target language to instructors' queries posted on Web CT class accounts. Foreign language education majors, as a form of formative assessment, provided constructive feedback to these students by means of comments posted to them on WebCT. At the end of the semester, student reactions to this project were obtained via surveys. Education majors responded favorably to the assignment. Reactions of the language students, however, were mixed. Many of these students, most of whom were taking the course to simply fulfill a graduation requirement and were resentful of this requirement, expressed negativity toward the WebCT assignment. Others appreciated being able to correspond with a peer.

At a large metropolitan Central Florida university, the Foreign Language Department and the Foreign Language Education Program are housed in different colleges. The Foreign Language Department is contained within the College of Arts and Sciences, while the Foreign Language Education Program is part of the College of Education. As interdisciplinary projects are growing in prominence nationally, colleges are seeking ways by which to integrate curricula cross-college.

Last year, a collaborative relationship was established between the Foreign Language Department and the Foreign Language Education Program by means of a WebCT assignment. The author, Coordinator of the Foreign Language Education Program, had recently developed a course entitled "Technology in the Foreign Language Classroom" and sought a way by which to tie in course requirements with those in foreign language classes. During course development, the author participated in a summer faculty institute in which additional stipends were awarded for interdisciplinary project development and implementation. It was during this institute that foreign language faculty and the author met frequently to share syllabi and brainstorm ways to integrate assignments in their respective courses.

Foreign language faculty decided to begin cross-college collaboration within the context of their 1000-level Spanish and French classes since those classes already had a WebCT assignment in place. Students in these classes were required to respond on a weekly basis to questions posed by their instructor on WebCT. The questions necessitated student response in the target language and provided the students with additional practice in reading comprehension and writing. Questions typically asked the students to elaborate on topics that had been discussed in class, thus providing further reinforcement of the material as well as additional communicative opportunities. An example of a question is the following: "Tell me about yourself. What is your name? How old are you? Where do you live?" Instructors then commented on the students' responses by providing linguistic extensions, contributing constructive grammatical feedback, and/or continuing the conversation in a natural way. Given the large number of students in these introductory level classes, which are a requirement for graduation, provision of this feedback became very time-consuming.

Students in Technology in the Foreign Language Classroom were education majors who needed as much exposure as possible to the different areas of competency required in the field of education. One such competency is in the area of assessment. Upon comparing course syllabi for the entry level foreign language courses and Technology in the Foreign Language Classroom, faculty found a natural fit between the need for the provision of feedback to the language students' written productions and the need for practice in different modes of assessment for the foreign language education students. Thus a collaborative relationship was formed between both sets of students and their respective faculty. Thousand-level students would continue to respond to queries posed by their instructors. However, instead of the foreign language instructors addressing the written productions, students in Technology in the Foreign Language Classroom

replied to them weekly. This afforded a number of different opportunities: language students communicated with peers in another class and received prompt feedback, education students received practical experience in a very different mode of assessment, and instructors were relieved of the time constraints of responding to their large numbers of students. In order to monitor their students and the education students' continuance of their respective roles in this assignment, faculty from both programs accessed the Website weekly to determine the frequency and quality of the students' writings and feedback.

This assignment ran the course of the entire semester. At the end of the semester, both sets of students completed surveys that were geared toward their particular group. In other words, education majors were provided with a survey that addressed their observations/concerns from an educator's standpoint. The survey administered to the language students queried them from a student viewpoint. Overall, education majors' responses were overwhelmingly positive, although they did express a desire to have some face-to-face interaction with the language students. They found the unique mode of assessment to be challenging, yet intriguing. They also appreciated being given the opportunity to become familiar with the typical types of errors they will encounter in second language learners progressing through the natural stages of language acquisition.

To the contrary, language students' reactions to the collaborative assignment were very mixed. A number of the foreign language students appreciated feedback from a peer. However, several students expressed the preference for one-on-one interaction rather than asynchronous written communication. A number of students resented the entire university foreign language requirement; the overall negative evaluation they accorded the assignment may have been a generalization of this resentment.

Faculty in the Foreign Language Department and the Foreign Language Education Program at the University of Central Florida plan to further analyze the responses of the two groups of students to determine means by which to enhance the experience so that both groups realize equal benefits from the collaborative assignment. They also intend to develop other intercollegiate projects that will strengthen the growing relationship between the respective faculties and students.

# Technology and Problem-Based Learning: Connecting Students, Teachers, and Student Teachers

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**Abstract:** The investigation reported in this paper strives to bring technology and problem-based learning into the student teaching experience through an integrated, collaborative mathematics task. The project presented is based in data collection and analysis. It supports the National Educational Technology Standards (International Society for Technology in Education [ISTE], 2000) and the latest standards for school mathematics (National Council of Teachers of Mathematics [NCTM], 2000). Students from several schools collected and analyzed data for a task on an 2000 Summer Olympic project. Technology was vital to data collection, data sharing among schools, and data analysis. This project served as a stimulus and prototype for projects for the 2002 Winter Olympics. Presenters

## Introduction

Tom Carroll of the United States Department of Education states that technology has the potential to be a tool in the re-invention of education (1999). If this re-invention is to occur in ways that are meaningful to students, preservice teachers need to experience innovative uses of technology in their instructions. Integrating technology into teaching can be enhanced when problem-based learning is used (Albion 1999). Hannum (1999) describes the ways in which technology can be implemented into the *Seven Principles of Good Practice in Undergraduate Education* (Chickering & Gamso, 1991). The technology Hannum recommends includes but is not limited to listserves as a tools for communication between several students and the instructor, email for student-to-student collaboration, websites as a source for data, and hyperlinks for students to access webdata efficiently. The investigation reported in this paper strives to bring technology into the student teaching experience in innovative ways through a problem-based learning task. This task helps student teachers understand and attend to relevant technology and mathematics standards as they plan and implement lessons. The lessons support the National Educational Technology Standards (International Society for Technology in Education [ISTE], 2000) and the latest standards for school mathematics (National Council of Teachers of Mathematics [NCTM], 2000).

## The Olympic Task

This investigation has as its context an event that is both rich in content and likely to be of high interest to elementary, middle, and high school students—the 2002 Olympic Games. During the 2000

Summer Olympics several teachers were invited to begin a 2-year problem-based project that would continue through the 2002 Winter Olympics in Utah. They defined several problems or questions that would require students to gather data before, during, and after the games. They set up listserves to share data among schools. Their students used Internet sites to explore both the 2000 and the 2002 Olympic Games. They gathered data about medals, participants, viewers' preferences, and TV scheduling. They used spreadsheets to analyze their data. They created WebPages at their schools to display their data analyses. Student teachers participated in these projects and reported their experiences in their electronic portfolios.

The first activity completed during the 2000 Games was to plan a schedule for prime time Olympic coverage for the 2002 games. Students posed relevant questions regarding scheduling, then engage in collecting, organizing, representing, and interpreting data from the 2000 games to build their 2002 schedules. They plan to compare their completed schedules with the schedules actually followed by major channels during the Olympics 2002 games. The following is an outline of the first problem-based task presented to the students:

**Student Assignment**

Plan a schedule for prime time Olympic coverage during the 2002 Games. Discuss **population, sample**, and **sampling methods.** Discuss data collection procedures, e.g., **surveys.** Generate questions that you might need to investigate to complete the task.

- What kinds of coverage do most people like to watch?
- What age levels watch the Olympics the most?
- How are the 2000 games covered by the TV networks?
- What other kinds of information will be needed?

**Data organization**

What will your categories of information be? How many categories will you need? Will you need to design a chart or some other recording device to organize the information you collect?

**Data representation**

What ways of summarizing and representing your data will help you make sense of your information? Possible strategy: Using a spreadsheet program such as Excel, students compile the data collected by their class. They represent the data with percentages and a circle graph.

**Data interpretation**

What do the data show regarding the most popular events? Based on the data, how much time each evening should be devoted to each event? Possible product: Students generate a prime time television schedule for a week of the Olympics using the data they have studied.

## Technology Standards

The International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) (2000) defined technology competencies for teachers and students. The standards for teachers include (1) operations and concepts, (2) planning and designing learning environments and experiences, (3) teaching, learning, and the curriculum, (4) assessment and evaluation, (5) productivity and professional practice, and (6) social, ethical, legal, and human issues. Standards for students include (1)

basic operations and concepts, (2) social, ethical and human issues, (3) technology productivity tools, (4) technology communication tools, (5) technology research tools, and (6) technology problem-solving and decision making tools.

These standards support the development of new learning environments for students. Classrooms using technology appropriately are less teacher-centered and more student-centered. Instruction moves from single sense stimulation to multi-sensory stimulation. Students progress through multiple paths rather than single paths to the completion of their learning goal. Instruction utilizes multimedia not single media. Students work collaboratively, not in isolation. Students and teachers engage in information exchange, not just information delivery by the teacher. Learning is more active, exploratory, and inquiry-based, less passive. Students do not learn facts through literal thinking. They use critical thinking to make informed decisions. Their work is authentic based in real world context.

## Content Area Standards

The National Council of Teachers of Mathematics (NCTM) has defined several principles and standards for the teaching of mathematics (2000). The principles are equity, curriculum, learning, teaching, assessment, and technology. The technology principle states that "technology is essential in teaching and learning" and that "technology influences the mathematics that is taught and enhances students' learning" (p.24). The project described in this paper requires data collection and analysis that would not be feasible without the use of technology. Student learning was enhanced through use of real world data collection that led to an authentic understanding of graphing, charting, and decision making.

The NCTM standards include both content and process standards. The content standards are (1) number and operations, (2) algebra, (3) geometry, (4) measurement, and (5) data analysis and probability. The process standards include (1) problem solving, (2) reasoning and proof, (3) communication, (4) connections, and (5) representation. This project addresses content standard (5) data analysis and probability and all five of the process standards. The project involves problem solving and reasoning by asking students to develop and use a variety of strategies in their mathematical thinking. Students are asked to communicate their analysis of data with other students. The project requires students to make connections among several mathematical concepts and learn about mathematics from real-world contexts. Finally the Olympic project requires students to create representations of data collected, primarily in the form of charts and graphs.

## Student Work

Students, teachers, and student teachers from across the state participated in this project. They collected data on the television coverage of the Sydney Summer Games for information to help them create the schedule for the Salt Lake City Winter Games. Data was entered into a spreadsheet. Students at different schools represented their data in various ways. As they shared their data and analyses with each other, their range of strategies for creating a TV schedule increased. Table 1 shows the data collection sheet and sample data summaries. Figure 1 and Figure 2 show two different data representation, one as a bar chart and the other as a pie chart. Figure 3 shows a minute-by-minute summary of the events during one hour of TV coverage. This was used as a model of minute-by minute coverage for the TV schedule for the Winter Games.

| Minute | Day | Time | Sport Event | Athlete Story | Athlete Interview | Story about Australia | Commercial | Other |
|---|---|---|---|---|---|---|---|---|
| 1 | Mon | 6-7 | 1 | | | | | |
| 2 | Mon | 6-7 | 1 | | | | | |
| 3 | Mon | 6-7 | | 1 | | | | |
| 4 | Mon | 6-7 | | 1 | | | | |
| 5 | Mon | 6-7 | | | | | 1 | |
| | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mon | 6-7 | 32 | 10 | 2 | 0 | 14 | 2 |
| | Mon | 8-9 | 26 | 13 | 1 | 0 | 20 | 0 |
| | Sun | 8-9 | 34 | 12 | 0 | 0 | 14 | 0 |
| | **Total** | | **92** | **35** | **3** | **0** | **48** | **2** |

**Table 1**: Summary data from survey of Summer Olympic TV coverage.

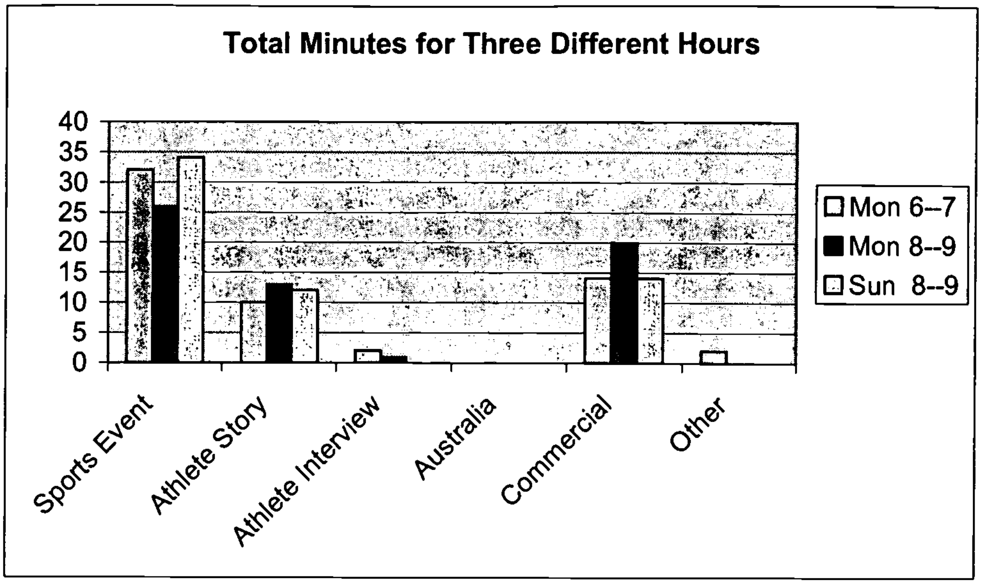


**Figure 1:** Data Representation of total minutes for three different TV hours.

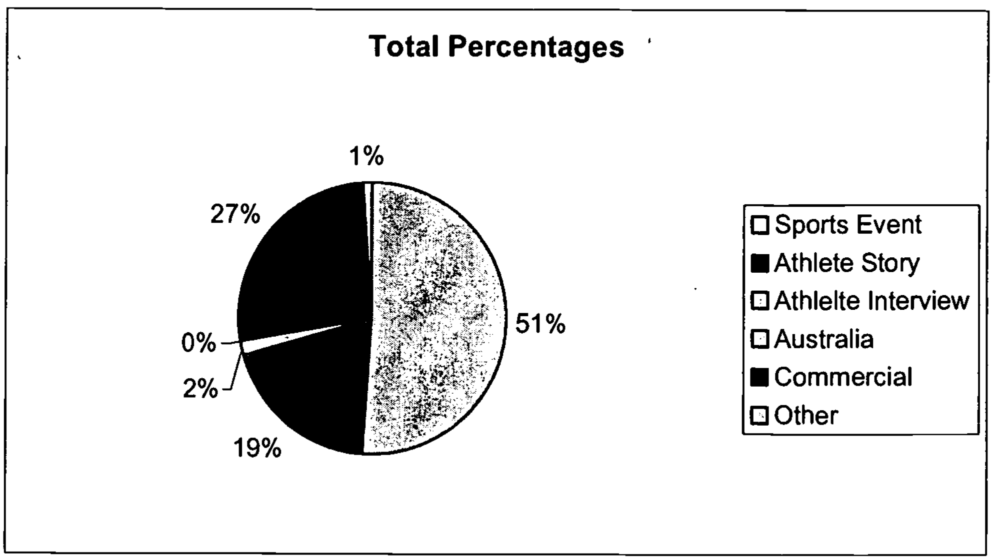


**Figure 2:** Data representation of the percent totals for all TV coverage.

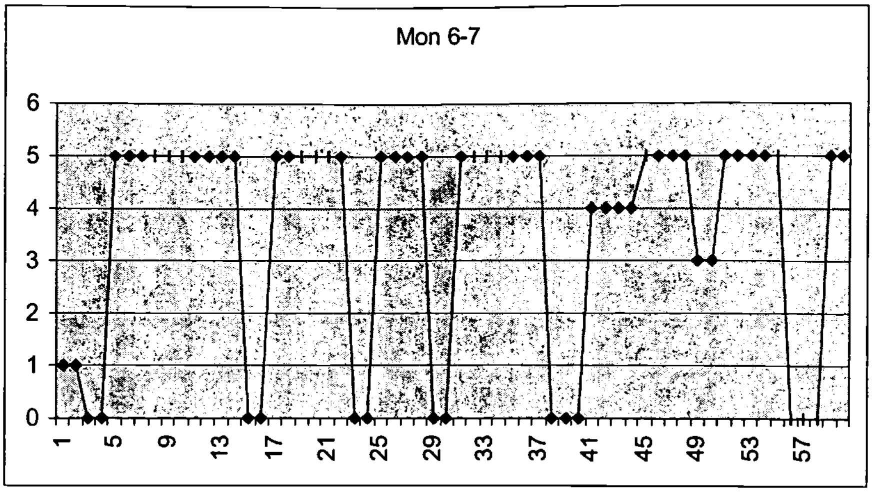


**Figure 3:** Data representation of minute-by-minute TV coverage.

Data from Figure 3 allowed students to think about how to plan TV coverage for the 2002 Winter Games. Students visited the www.saltlake2002.org/sloc/event_schedule/index.htm Internet site to choose a day to schedule. The students were directed to have some coverage of every event, but to strive to have the most time allocated for the most popular events. They wrote a survey asking classmates to indicate which event from the assigned day they would be interested in viewing. The survey results were used to determine how much time each event should be given during 4 hours of prime time TV coverage. The scheduled amount of time for each event matched the percents of popularity from the student survey. Table 2 is a summary of one survey for a day of the 2002 Winter Games. Students were asked if they were VERY LIKELY (3), SOMEWHAT LIKELY (2), or UNLIKELY (1) to watch the event on TV. The tallies were averaged to determine how much time to schedule for each event during the prime time TV coverage. As of the date of this paper submission, the students were still building their final TV coverage.

| Curling | Luge | Downhill Skiing | Snowboarding | Biathlon | Speed Skating | Ice Hockey | Figure Skating |
|---|---|---|---|---|---|---|---|
| 2 | 3 | 2 | 2 | 2 | 3 | 1 | 3 |
| 1 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 2 | 3 | 2 | 3 | 3 | 1 | 3 |
| 1 | 3 | 3 | 3 | 1 | 2 | 3 | 3 |
| 1 | 2 | 3 | 1 | 2 | 2 | 2 | 3 |
| 1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| 1 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| 1 | 3 | 3 | 2 | 3 | 3 | 1 | 3 |
| 1 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| 1 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| 1 | 2 | 3 | 3 | 1 | 3 | 3 | 3 |
| 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| 1 | 2 | 3 | 1 | 1 | 3 | 3 | 3 |
| 2 | 3 | 3 | 2 | 1 | 3 | 2 | 3 |
| 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 1 | 2 | 1 | 3 |
| 1 | 2 | 2 | 3 | 1 | 3 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 1 | 2 | 2 | 2 | 2 | 2 | 3 | 1 |
| 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| 1.458333 | 2.625 | 2.833333 | 2.291667 | 2.083333 | 2.75 | 2.416667 | 2.916667 |

**Table 2: Likelihood of Winter Olympic Event to be watched on TV**

## Future Work

Preservice teachers who will be student teaching during the 2002 Winter Games are preparing learning activities in current methods courses. Teachers from across the state are planning additional problems for the months before, during, and after the 2002 Winter Games. These problems include a study of restaurant prices during the games, cost of planning a trip to the games from several places around the world, housing and food costs for the athletes while at the games, transportation issues to and from venue sites, etc. Participating schools are working to design the projects and share information electronically with each other. Comparisons will be made of results in different areas based on distance from venue sites. We are hoping to invite schools from across the country to have electronic pen pals with students in venue sites. Student teachers from this year's project will be teachers around the country next year and can continue in the project with their students.

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# Collaboration and Integration: Technology in a Pre-Service Elementary Education Foundations Course


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**Abstract:** Changes in State regulations and National Standards have resulted in Colleges of Education redesigning their teacher preparation programs. During this redesign, many programs are eliminating their "technology course" in favor of integrating technology throughout all teacher preparation courses. This redesign has often resulted in concerns that many teacher education faculty are not well prepared to provide teacher candidates with the technology skills and knowledge needed to insure the effective integration of technology into K-12 curriculum. This paper focuses on one teacher preparation program's efforts to address this concern. Faculty members at George Mason University in the Elementary and Instructional Technology Programs paired up and team-taught an Introductory to Elementary Curriculum course, providing students with the needed foundational knowledge and technology skills.


## Overview and Background

The inclusion of technology into elementary teacher preparation programs has become a necessary and important component in most, if not all, teacher education programs. In the past five years the integration of technology into teaching methods courses has been suggested as an effective model for helping teacher education candidates develop a vision of the role of computers in an integrated curriculum (Willis, 1997). Typical models for integrating technology into teacher preparation courses include the use of e-mail, on-line databases, WebQuests, software, spreadsheets, and word processing (Maeers & Brown, 1999; Willis, 1997). Other technology uses typically found in coursework include the incorporation of electronic portfolios and the creation of video presentations with film clips from CD-ROM encyclopedias (Kovalchik, 1997; Willis, 1997). Specific barriers to successful integration of technology into teacher preparation courses have also been identified in the literature. These barriers include limited access to technology resources, technical problems, and time to experiment and learn (Falba et al., 1999). In addition, Roberts and Ferris (1994) indicate that faculty who teach the courses may not see technology as important, may believe that there are too many course changes required at one time, may be unfamiliar with available hardware and software or find that it is hard to take risks using technology. Robert and Ferris (1994) recommend that a team teaching model be used to successfully integrate technology into teacher preparation courses.

The purpose of this paper is to describe teacher education faculty efforts to develop and implement an introductory and foundations course in elementary education that integrates technology into the course content. During the 1998-99 academic year, George Mason University redesigned its teacher preparation programs in response to changes in State Licensure requirements. During this redesign, the

Elementary Program faculty decided to eliminate the Introduction to Educational Technology course, the only course in the teacher education program that focused on technology, and integrate technology throughout all courses. The faculty expressed the belief that technology should be infused into the program and were committed to modeling the effective use of technology to support teaching and learning. To help the faculty accomplish this goal a member of the Instructional Technology Program (Dr. S) accepted an affiliation with the Elementary Program. Dr. S had expertise in integrating technology in the K-12 curriculum and was responsible for the Introduction to Educational Technology course that was being eliminated.

An immediate concern the faculty faced was to ensure that the Introduction to Elementary Curriculum course (the first course in the program sequence) provided students with the technology skills needed to complete assignments across the other teaching methods courses. The faculty spent time examining each of the methods courses and determined that the preservice teacher candidates would need to learn the following technology skills: how to use e-mail, how to evaluate websites, how to conduct Internet and ERIC searches, how to use the university's threaded discussions tool (TownHall), and how to use Microsoft's PowerPoint software for presentations. In addition, students needed to understand the basic tenets of elementary curriculum and a variety of instructional strategies and related topics (i.e. direct instruction, cooperative learning, authentic assessment, and inclusion). Students also needed to develop an understanding of historical influences and school laws in elementary schools.

The merging of introductory technology skills and a foundational knowledge base presented a challenge for the Elementary Program faculty. Two sections of this course were to be taught in the spring of 2000 for the first time. It became apparent that none of the faculty members had expertise in both of these areas. It was decided that the best way to handle this was for the technology faculty member (Dr. S) and the foundation faculty member (Dr. W) to team-teach the two sections together. To accomplish this the two sections were scheduled to meet at the same time in two adjacent computer labs.

## Preparing the Course

During the semester prior to the spring 2000 semester, Dr. S and Dr. W met weekly to co-design the course. The two faculty members collaborated on choosing the textbooks and materials and on developing the class assignments. As the course was developed Dr. S spent time determining the best way to integrate the technology skills into the course. For example, when students were ready to begin working on their research paper, they needed to learn how to conduct an ERIC Search and develop search strategies for finding resources on the Internet. The use of e-mail and TownHall should be presented the first and second week of classes.

Several issues and questions related to course design and scheduling emerged. It became apparent that the integration of some of the technology skills required creative thinking and problem solving. For example, while learning foundation topics, should students learn how to evaluate websites and also perform Internet searches? Trying to cover three topics at once could be too much for the students. Teaching PowerPoint should be included when students were required to do a presentation, but what were they going to present? To solve these problems, it was decided that Dr. S would create a WebQuest as a way to integrate content about U.S. laws and how they influence elementary teachers in schools (see http://mason.gmu.edu/~dspragu1/lawquest.html). The WebQuest would include the evaluation of websites and result in the students preparing a presentation using PowerPoint software.

Several other topics addressed in the course allowed the introduction of software programs not typically included in an introductory elementary education foundations course. For example, when the class discussed direct instruction, students could spend time previewing some drill-and-practice programs. When the class discussed cooperative learning, students could spend time using one of Tom Snyder's Decisions, Decisions programs. Exposing students to software popular in K-6 classrooms provided an opportunity for meaningful integration of technology into course content. The course syllabus can be found at htttp://mason.gmu.edu/~dspragu1/educ542.html.

The other major decision that had to be made was how the team-teaching would be accomplished. Since the two sections were scheduled at the same time and were in adjoining rooms, it

was possible for Dr. S and Dr. W to move back and forth between the classes. It was also possible for the students in the two sections to collaborate with each other on assignments. It was determined that Dr. S and Dr. W would switch mid-way through each class session. Dr. S would ensure the students had the technology skills needed for the methods courses while Dr. W would provide students with the content knowledge. Students would be provided with opportunities to collaborate on the completion of the WebQuest and the resulting presentations.

## Implementing the Course

During the first few weeks of the course the instructors became aware of four issues that needed to be addressed. These four issues were time, communication, consistency, and instructor expertise. In terms of time, the instructors realized that switching mid-way through each class session took additional time and it was often difficult to coordinate the timing of the activities each instructor was responsible for. For example, when the lesson on PowerPoint took longer than predicted, Dr. W had to extend a discussion on significant individuals in educational history with the group he was teaching. Consequently, the second part of the class session was shorter for both instructors when they had to modify the planned experiences for their second group.

In the team teaching model used, each instructor was responsible for evaluating and assigning grades for a particular group of students. Consequently, communication between instructors and between students and instructors emerged as an issue. Students from one group would periodically ask the instructor of the other group questions about an assignment he or she had not originally explained. For example, Dr. W had to discuss and clarify particular details of the WebQuest assignment with Dr. S so that he then could discuss it with students in both groups. Similarly, the importance of consistency in communication between the two instructors emerged as a critical issue. The teacher education students in both groups frequently discussed assignments and expectations with each other. If any inconsistencies in expectations or grading criteria were apparent to the students, they would ask both of the instructors for clarification.

The two instructors met weekly to review and discuss the content to be taught in the next class session. These meetings served as an opportunity for the instructors to "mentor" each other on specific aspects of the content that was to be taught. For example, since Dr. S was more of an expert in technology, she explained the concepts and procedures involved in the WebQuest so that Dr. W could address any questions that students might have while working on that assignment. Similarly, in an activity on instructional strategies, Dr W assumed responsibility for explaining how to conduct a cooperative learning strategy used to teach concepts underlying Direct Instruction.

Student comments in a formative evaluation conducted in the middle of the semester reflected the issues identified by the instructors. Students indicated through their comments that 1) they felt certain activities were rushed because there was not enough time, 2) one class may get more information on a particular topic than the other class, and 3) at times the classes seemed to be disorganized. The student feedback also indicated that students had varying comfort levels with technology. For example, one student stated, "I don't always feel comfortable with the technology section of the class. Many times I find myself behind the rest of the class". In contrast, another student stated, "too much time was spent on PowerPoint, I already knew how to use it." After reviewing the student feedback in the middle of the semester the instructors decided to change the way they moved back and forth between the two classes. Rather than move back and forth during each class session, the instructors tried to work with one group for an entire class period as much as possible. In addition, both instructors worked on communicating the same expectations for the remaining assignments.

## Course Evaluation and Conclusions

The formative evaluation administered at the end of the course and shared reflections by both instructors served as the basis for course evaluation. The student feedback indicated that the change in the organization of each class session (one instructor teaching one group for an entire session) was more effective than constantly switching back and forth. Student feedback indicated that most students

perceived the course to be a "little disorganized at the beginning." In addition, student feedback indicated that: 1) the students would like more discussion on technology; 2) there were specific technology activities that were valued while others were not (for example a specific videotape on the uses of technology was not valued); and 3) there was not enough time to cover all of the material (the foundations content as well as technology applications).

Instructor reflections focused on how to effectively integrate technology into the foundations content in practical ways while still including the key content components of the course. The instructors have also worked on how to accommodate students with varying levels of previous experience with technology. The instructors decided to continue to work together in planning and preparing specific activities. However, for the next course implementation in 2001 both instructors will teach all of the content. That is, each instructor will be responsible for the technology and elementary foundations content. This change will require more mentoring for Dr. W who is not an expert with technology. Since the elementary program is currently involved in a Preparing Tomorrow's Teachers for Technology (PT3) grant, Dr. W will be working with both Dr. S and a mentor from the public schools who is considered to be an expert in technology use in elementary classrooms (Sprague and White, 2001).

Based on our experiences with integrating technology into an elementary education introductory/foundations course we pose the following recommendations: 1) organize each class session so that there is enough time for the technology experiences; 2) infuse technology into the program gradually and incorporate technology into assignments that are relevant to realistic education settings (Siegel, Good, & Morre, 1996); 3) seek student feedback through formative and summative evaluations as well as weekly reflections on both the class experiences and understanding of the technology applications and related course content; and 4) emphasize how technology can be used in every day classroom settings .

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# Effectiveness of an Exemption Exam for an Introductory Educational Technology Course

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**Abstract:** The need for teachers who are proficient in the use of technology in the classroom has increased dramatically over the past few years. Professional and regulatory organizations with direct and indirect influence on teacher education programs have issued reports, recommendations, standards, and accreditation criteria all aimed at increasing the technology competencies of beginning teachers. The College of Education at the State University of West Georgia established an introductory technology course for all teacher education majors to meet this demand. This survey course provides students with a background in various instructional technologies as well as classroom integration strategies. At the time the course was created, many of the faculty involved believed that many students entering the program would be sufficiently competent in technology to enable them to exempt the course. Those exempting the course would be able to take an additional class in their content area. This presentation will provide an overview on how the exemption exam was created and implemented, as well as a measure of its effectiveness in identifying technology competent students. Additionally, the results of the exam will be viewed in relation to the students beginning the course perceived level of technology expertise.

## Introduction

The need for teachers who are proficient in the use of technology in the classroom has increased dramatically over the past few years. Professional and regulatory organizations with direct and indirect influence on teacher education programs have issued reports, recommendations, and standards all aimed at increasing the technology competencies of beginning teachers (CEO Forum on Education & Technology, 2000; ISTE, 2000; Solomon, 1998).

The College of Education at the State University of West Georgia established an introductory technology course for all teacher education majors to meet this demand. This survey course provides students with a background in various instructional technologies as well as classroom integration strategies.

At the time the course was created, many of the faculty involved believed that many students entering the program would be sufficiently competent in technology to enable them to exempt the course. Those exempting the course would be able to take an additional class in their content area. This presentation will provide an overview on how the exemption exam was created and implemented, as well as a measure of its effectiveness in identifying technology competent students. Additionally, the results of the exam will be viewed in relation to the students beginning the course perceived level of technology expertise.

## Why the Exam Was Created

The College of Education at the State University of West Georgia had felt the pressure, as many institutions have, to both reduce the total number of semester credit hours to 120 while also being required by the Board of Regents to increase the number of content courses in its various programs. The Introduction to

Instructional Technology course was developed by merging two existing courses in an attempt to reduce the total credit hour load.

Although deemed a very necessary component of the curriculum, many faculty believed that students entering the college would possess many of the technology skills covered in the course. It was decided to create an exam that would evaluate a student's technology competencies. If the students met the basic criterion of the test, they would be exempted from taking the course. However, they would not be given the credit hours so that they could be required to take a different course in its place. The faculty wanted to utilize the opened space in the program created when the technology course requirements were satisfied.

## How the Exam Was Developed

Media and instructional technology faculty teaching the technology courses were asked to develop the new introductory course and the exemption test. Meetings were held to review the new course objectives and content based on the ISTE technology standards. It was agreed that the knowledge, skills, and attitudes to be conveyed in such a course were not only to help the students to succeed in their future profession, but also to provide support in their other courses in their teacher training program. This would be particularly important since it would provide a base level of understanding that would enhance the ability of the students to understand the integration of technology infused in their advanced content and methods courses. The test, consisting primarily of performance and some written test items, would evaluate the students' mastery of the objectives set by the course.

The test covered the same topic areas as the course. These are operating systems, email, list servers, on-line resources, word processing, data base development, spreadsheets, presentation software, and technology integration. Test items are designed to emulate projects assigned in the course that require the students to create a product (e.g. newsletter, budget, presentation, etc). The final draft of the exemption test was reviewed by the dean of the College of Education, selected CoE chairs and faculty, adjunct instructors teaching the course, and a business education professor to insure face validly.

## How the Exam is Administered

The exam is offered twice a semester during the Fall, Spring, and once in the Summer terms. The selection of the dates corresponds with advisement periods to allow students to use the results in planning their schedules. It is always given on a Saturday to avoid conflicts with students' classes and courses that use the college's computer lab. The exam is widely publicized by posted flyers, recommended by student's advisors and announced in classrooms. In addition, criteria for each section of the test is made available to potential test takers in the college's resource library.

Students are given four hours to complete the exam to allow enough time to complete the various projects. All necessary materials are provided including two disks on which to save the exam's projects. One disk is used while working on the exam and the second is used to create a final back-up, a requirement under the operating system section.

Since the exam is entirely performance based, the number of students who can sit for the exam is limed by the number of computer stations in the lab. To insure that all examinees will have a workstation, students are required to register for the test with the Media & Instructional Technology department. Contact information is used to remind prospective test takers of the date, time, and location of the exam.

## How the Exam is Graded

The exam was designed to follow as closely as possible the projects assigned in the course. Each section is evaluated as a separate project and assigned a grade based on the number of correct responses and/or actions. Because each individual project must be evaluated on its own merits, each exam requires approximately 20 to 30 minutes to grade. Although this requires a large investment in time, it is deemed

necessary to effectively evaluate the student's capabilities in using the technology. The section grades are then averaged to establish a final grade.

A measure of reliability has not been established primarily due to the four hour length of the test. Since the exam is not in multiple choice format, common statistical methods for calculating reliability are not appropriate. A test-retest or multiple forms method would suffice but the small number of participants as well as the length of the test has prevented their use.

The passing score for the exam was originally set at 85%. The rationale for this decision was that students needed more than a minimal score to show enough competence to exempt the course. After administering the exam twice, this minimal score was lowered to 80% to better reflect the passing rate of students in the course.

## Outcomes

At the outset, it was anticipated that a large number of students would take advantage of exempting the course. However, this has been far from the case. Although the test is well publicized, few sign up to sit for it, and of those that do, only a small percentage actually show up.

Feedback from those who failed to participate revealed that some, after reviewing the published criteria, decided that they did not have the necessary knowledge to pass the test. This is supported by the results of a survey given to 259 students enrolled in the introductory course on the first day of class. The students had a high to moderate perceived knowledge level of the Windows operating system, word processing, web searching, email and the GALILEO online library catalogue system. However, perceived knowledge level of spreadsheets, data base development, presentation and multimedia software, and technology integration was dramatically lower (see Table 1). Results of a similar study at Appalachian State University were consistent with these findings (Green & Zimmerman, 1999).

**Response to Perceived Level of Technology Knowledge (%)**

| | Low 0 | 1 | 2 | 3 | 4 | High 5 |
|---|---|---|---|---|---|---|
| Windows OS | 4.6 | 15.4 | 22.4 | 32.0 | 20.1 | 5.4 |
| Mac OS | 52.1 | 23.9 | 13.1 | 8.5 | 1.9 | 0.4 |
| Microsoft Word | 8.5 | 10.4 | 16.2 | 27.8 | 24.3 | 12.7 |
| Web Searching | 6.2 | 10.8 | 23.9 | 27.0 | 23.6 | 8.5 |
| GALILEO | 13.9 | 18.1 | 23.2 | 24.3 | 14.7 | 5.8 |
| Email | 10.0 | 14.3 | 13.5 | 21.6 | 28.6 | 12.0 |
| Microsoft Excel | 52.5 | 18.5 | 15.1 | 9.7 | 3.1 | 1.2 |
| Microsoft Access | 62.2 | 18.5 | 10.0 | 6.6 | 2.7 | 0.0 |
| Microsoft PowerPoint | 62.5 | 17.8 | 8.5 | 5.4 | 3.9 | 1.9 |
| HyperStudio | 90.3 | 4.6 | 3.5 | 1.2 | 0.4 | 0.0 |
| Technology Integration | 49.0 | 18.5 | 17.4 | 12.4 | 1.5 | 1.2 |

**Table 1:** Response to a survey on perceived level of technology knowledge at the beginning of the course. Shaded areas illustrate the higher percentage of responses.

Another important factor seems to be the requirement that the students take an additional course to replace the credit. They feel that knowledge of technology will be beneficial and if they have to take a course anyway, it should probably be in instructional technology.

To date, 33 students have taken the exam, twenty undergraduate and thirteen graduate. The overall passing rate is 48% with 55% of the undergraduates passing and only 38% of the graduates. An examination of the passing rates by topic shows results similar to the perceived ability level of the students enrolled in the course. Scores are higher on operating systems, word processing, on-line resources, and email and lower on spreadsheets and data base development (see Table 2).

| Exemption Exam Results by Program Level & Technology Area | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Examinees | Operating Systems | On-Line Resources | Spread-sheets | Word Processing | Email, Listserves, & Integration | Data Base | Power Point | Number Passing |
| Total Tested | 33 | 21 | 16 | 12 | 21 | 19 | 13 | 22 | 16 |
| Undergrad. Tested | 20 | 15 | 11 | 10 | 12 | 14 | 8 | 14 | 11 |
| Graduate Tested | 13 | 6 | 5 | 2 | 9 | 5 | 5 | 8 | 5 |
| Undergrad. Passing | | 75% | 55% | 50% | 60% | 70% | 40% | 70% | 55% |
| Graduate Passing | | 46% | 38% | 15% | 69% | 38% | 38% | 62% | 38% |
| Total Passing | | 64% | 48% | 36% | 64% | 58% | 39% | 67% | 48% |

**Table 2:** Exam results by program level and technology area.

## Conclusions

At the time the course and exam was created it was anticipated that a large number of students would attempt to exempt the course. To date, 942 students have enrolled in the course since its inception in the Fall of 1998, while only 33 have taken the exam. This low participation rate (3.5%) can be attributed primarily to the requirement that students who pass the exam must still make up the credit hours by taking an additional course. If students have fundamental skills in technology, it is a more attractive option to take a course in which they have some knowledge than one that would require additional effort and a possible lower grade. The exam is not providing the anticipated option for students to open their class schedule to take additional subject area courses.

The review of the perceived level of technology knowledge from the students beginning the course does show that many have an introductory skill level in the basic use of computers and associated communication software (e.g. email and word processing.) They do not have knowledge of the more advanced analysis, presentation, or multimedia software. Although this knowledge level may have prevented them from passing the test, there is an apparent sufficient level of knowledge that there should have been a greater number attempting the exam.

The 48% overall passing rate indicates that the exam is sufficiently difficult to insure that those passing have an understanding of the subject matter and skills covered in the course. Inspection of the passing rate by technology area supports the data on the perceived level of technology knowledge of students beginning the course. The passing rate is higher for use of the operating system and communication technologies and lower for the more advanced programs. The only exception to this is the passing rate for presentation software (e.g. PowerPoint) which is higher than word processing at the undergraduate level but was rated low for students beginning the course.

The higher passing rate for undergraduate students over graduates tends to support the perception that students entering college are beginning to bring in a higher level of technology skills. Information on the number of years since the graduate students had been awarded their undergraduate degrees was not available so that it is difficult to conclude that the lower passing rate is related to them not having access to

technology while they were in secondary and post-secondary programs. However, graduate students are only required to enroll in the introductory course if there is no indication that they have completed a technology course in their undergraduate studies.

The data also tends to support those advocating the continued use of an introductory course in the curriculum. Although education programs are quickly moving toward the incorporation of technology into content and methods courses it is questionable whether it is a best use of time in these courses to teach technology fundamentals. For the immediate future, it would be more expedient to provide students with a strong technology base so that content and methods courses could focus on integration strategies and not the upgrading of basic skills.

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# Tomorrow's Teachers and Tomorrow's Technology—The T4 Project

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Abstract: Educators in northeastern Oklahoma have collaborated on a special three-year project entitled "Tomorrow's Teachers and Tomorrow's Technology (T4) Project". The focus of the project will be to deliver a three-year comprehensive professional preparation program for prospective teachers from the northeastern region of Oklahoma for the purpose of empowering these future educators with the technological skills necessary for effectively teaching in twenty-first century schools. The purpose of this paper is to document the goals and objectives of the T4 Project, the elements involved in Phase I, and detail the benefits of this project to Langston University / Tulsa elementary education majors.

Educators in northeastern Oklahoma have collaborated on a special three-year project entitled "Tomorrow's Teachers and Tomorrow's Technology (T4)" Project. The focus of the project will be to deliver a three-year comprehensive professional preparation program for prospective teachers from the northeastern region of Oklahoma for the purpose of empowering these future educators with the technological skills necessary for effectively teaching in twenty-first century schools. Funding was provided by the United States Office of Education. The purpose of this paper is to document the goals and objectives of the T4 Project, the elements involved in Phase I, and detail the benefits of this project to Langston University / Tulsa elementary education majors.

The overall goals and objectives to support the full-scale implementation of a comprehensive program to development technology-proficient prospective teachers includes the following:

(1) implement a comprehensive professional development program in the use of technology for prospective pre-service teachers;
(2) implement a sustained service learning component for prospective teachers that focuses on technology connections and applications;
(3) implement a coherent professional development program focuses on the use of technology for higher education and teacher education faculty who will be active in the preparation of prospective teachers; and
(4) implement a rigorous evaluation plan for assessing program effectiveness and technology-proficiency levels of pre-service educators.
(5) implement a comprehensive professional development program in the use of technology for prospective pre-service teachers.
(6) implement a sustained service learning component for prospective teachers that focuses on technology connections and applications.
(7) implement a sustained service learning component for prospective teachers that focuses on technology connections and applications.
(8) implement a coherent professional development program focuses on the use of technology for higher education and teacher education faculty who will be active in the preparation of prospective teachers.
(9) implement a rigorous evaluation plan for assessing program effectiveness and technology-proficiency levels of pre-service educators.
(10) implement a follow-up consultative support network and listserve for pre-service educators to access as a resource in sustaining their professional technology-proficient careers.

The primary prohibitive factor for the full development of technology-rich instructional environments in American schools is the lack of teachers prepared in the use of technology. The need for technology-proficient educators entering the teaching profession is paramount. Employable teachers for the 21st century will be those graduates who display technology-proficient portfolios. The T4 Project

attends to this need by incorporating specific tools and strategies in the preparation of prospective teachers via technology-rich portfolios, presentations, and lesson plans.

Members of this partnership consortium include Tulsa Community College, Langston University / Tulsa, Tulsa Public Schools, the Tulsa Chamber of Commerce, Oklahoma State Department of Education; Tulsa area school districts, and local businesses in the Tulsa, Oklahoma area. This project is an alliance, which includes a wide variety of interest groups all focusing on common goals to help benefit future teachers.

Tulsa Community College (TCC) and Langston University / Tulsa are the primary institutions involved in the T4 Project. TCC is a "feeder" college, transferring students on to Langston University / Tulsa to receive a Bachelor's Degree in Elementary Education. Just as TCC is the "feeder" institution, Langston University / Tulsa is the "receiving" institution. Many of the students at Langston University / Tulsa take courses at both LU / Tulsa and TCC concurrently in order to complete general requirements.

In Oklahoma almost two-thirds of the education majors begin their study at community colleges. TCC (Tulsa Community College) is the largest two-year college in Oklahoma and the second largest college in the state with an enrollment in excess of 20,000 students located on five campus sites within Tulsa County. TCC serves over 1,000 pre-service education majors each semester.

Langston University / Tulsa serves only upper division undergraduate education majors and has been the primary receiving institution of TCC education associate degree students for the past ten years. The commitment of Langston University / Tulsa to the development of a seamless program for the technology preparation of prospective teachers is evidenced in the willingness of LU / Tulsa to utilize the TCC campus sites, to request professional development programs for LU / Tulsa teacher education faculty via TCC course offerings and faculty expertise, and by the LU / Tulsa expressed need for education majors to have more extensive experiences with technology before entering teacher education programs.

The three-year project has been divided into the following components: (1) Phase I: Participant Recruitment and Curriculum Restructuring; (2) Phase II: Implementation and Evaluation; and (3) Phase III: Follow-up and Consultative Support. Phase I project milestones included the following: (a) conduct participant recruitment activities, (b) provide incentives for education majors, (c) provide incentives for increased enrollments in technology education courses, and (d) provide incentives for higher education faculty professional development, (e) upgrade and modify existing general education curriculum, (f) upgrade and modify existing teacher education curriculum, (g) restructure education curricula to include a greater focus on technology, and (h) select sample pre-service education students for evaluation focus.
Teacher Education faculty at Langston University / Tulsa have participated in the areas of recruitment, higher education faculty professional development, upgrading the teacher education curriculum to include technology use for both the students and the professor. Teacher Education faculty also have been able to participate in a Faculty Grants for Technology Innovation program. Two Langston University / Tulsa faculty members have received grant funding for the Spring semester of 2000.

In conclusion, educators in northeastern Oklahoma have collaborated on a special project benefiting prospective teachers from the region. The purpose is to empower these future educators with the technological skills necessary for effectively teaching in the twenty-first century schools.

# The Computer Endorsement Program: Examining Expectations as a Catalyst for Change

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**Abstract:** This paper examines attitudes and perceptions associated with instructional technology programs offered by the School of Education at Indiana University South Bend. I chose to examine instructional technology programs offered by the School of Education. The School of Education currently offers a computer endorsement, which may be added to an initial area of certification. It is expected that teachers holding this endorsement will be sufficiently competent to incorporate computers into instruction in various contexts. It was therefore my intent to determine the level to which our students are meeting school expectations. An appropriate instrument was developed to investigate prevailing attitudes and expectations, and the survey was conducted. While technological skill expectations of the School of Education and P-12 schools were similar, disparity was observed in two areas. The results of this survey will be used as a catalyst for change in the School of Education's instructional technology programs.

## Introduction

Changing state and national standards as well as the changing needs of schools served by the School of Education at Indiana University South Bend (IUSB), have made it necessary to examine the instructional technology programs offered by the School of Education. The School of Education at IUSB currently offers a computer endorsement, which may be added to an initial area of certification. It is expected that teachers holding this endorsement will be sufficiently competent to incorporate computers into instruction in a variety of contexts. The IUSB computer endorsement program has been in existence for six (6) years, and has produced approximately twelve (12) graduates with a computer endorsement. There are currently a number of students pursuing this endorsement as well. As these graduates enter the workforce they hope that the endorsement will qualify them for a broader range of positions than they would have been qualified for without the endorsement. Through discussions with these graduates it has come to our attention that human resource personnel and school administrators may be uncertain about the computer endorsement, and its implications. While the number of computer endorsees is not large, it was decided that this matter warranted further investigation. It was therefore my intent to conduct a survey of school corporations in the IUSB service area to determine the level to which our students are meeting school expectations.

### Context

Created in 1820 by an Act of the General Assembly, Indiana University is one of the oldest state universities in the Midwest, and with more than 97,000 students on eight campuses, one of the largest institutions of higher education in the United States. The campus of Indiana University South Bend (IUSB) serves the greater Michiana area (northwest Indiana southwest lower Michigan.) IUSB strives to meet the needs of local employers by educating potential future employees in the region. The social environment of the School of Education at IUSB consists of one thousand three hundred seventy-eight (1378) students. This number includes undergraduate, graduate, certification and degree seeking students. Traditional and non-traditional students are represented in equal proportions. The School of Education places approximately two hundred (200) student teachers in area school corporations each year. In addition to student teachers IUSB's School of Education assigns two hundred fifty five (255) students in field experience placements in area schools as well. The relationship between the IUSB School of Education and area schools continues to be one of shared responsibility and respect.

School corporations in the IUSB service area were surveyed to discover attitudes and expectations relating to instructional technology in general, and the School of Education's Computer endorsement specifically. Schools participating in the survey represent a wide range of size, settings, socioeconomic status and financial resources. All school corporations represent P-12 schools. An appropriate instrument was developed to investigate prevailing attitudes and expectations.

## The Survey

Forty-one (41) school corporations were contacted for the survey. Forty-six percent (46%) of school corporations contacted answered the survey. The survey was administered in two formats. All school corporations served by IUSB were placed on a contact list. All school corporations on the contact list were initially contacted by telephone. Some of these contacts resulted in telephone interviews. In school corporations where the appropriate contact person was unavailable, surveys were mailed. Respondents include superintendents, technology coordinators, principals and human resource personnel. The survey was conducted in early August of 2000, with mailed responses arriving intermittently through the early fall. The survey is comprised of six open-ended questions. The open-ended format provides respondents freedom in answering the questions as well as allowing for a varied depth of response.

The first area addressed was skills and abilities in instructional technology. School corporations in the IUSB service area vary greatly in the degree to which technology is utilized, and technological expertise is expected of teachers. Some schools in the IUSB service area include a technological skill component as part of the hiring process. This survey item addressed educational technology expectations for any beginning teacher. Respondents were to address four categories: general, software, peripherals, and platform. In the general category respondents indicated that the use of the Internet and integrating technology into the curriculum were key issues. The Internet has emerged as an invaluable source of information for classroom teachers as well as an essential research tool for students and teachers alike. Knowledge of Internet technology and proficiency in its use are crucial for the classroom teacher. Proficiency with basic applications such as personal productivity software was stressed by survey participants. Expertise with productivity applications enables the teacher to be more efficient in the management of data related to students as well as the planning and implementation of learning opportunities. When asked about peripherals, respondents indicated that scanners, digital cameras and printers were the essential items with which beginning teachers needed to be familiar. Respondents also indicated that familiarity with Zip® drives and the use of video projectors was an asset for a beginning teacher. The reduced cost and widespread availability of a variety of peripherals, enables schools and teachers to access a greater amount of technology. This provides an increased application of technology across the curriculum.

When asked which platform our students and beginning teachers should be comfortable in, the majority indicated that their computer applications operated in the Windows platform. The remaining respondents said that it would be beneficial for beginning teachers to be equally comfortable in the Mac and Windows platform. Elementary schools in the IUSB service area operate mainly on the Mac platform, while high schools operate in Windows. Middle schools in the area however, typically use both platforms. IUSB School of Education students interested in middle school teaching are encouraged to become familiar with both platforms. All students in the School of Education at IUSB are required to take a course that serves as an introduction to microcomputers in education. This course addresses all software, peripheral and platform issues considered essential by respondents, with the exception of digital imaging and the use of video projectors.

While the debate concerning the standards movement is ongoing, standards are currently a reality that many teacher preparation programs must face. Technology standards have been set at national and state levels for P-12 education. These new standards create a need for teacher education programs to provide students with skills that will allow them to integrate technology throughout the classroom curriculum. The Indiana University South Bend School of Education is accredited by the National Council for Accreditation of Teacher Education (NCATE). NCATE standards now expect accredited schools of education to provide adequate access to computers and other technologies, and expect faculty and students to be able to use it successfully. Programs offered by the School of Education must also meet the standards developed by the Interstate New Teacher Assessment and Support Consortium (INTASC), as these standards have been adopted by the state of Indiana. According to the Indiana Academic Standards for P-12 schools each student who participates in technology education will acquire an understanding of technology as a component of the global context. Teachers must be prepared to provide students with instruction that will accomplish this goal. Survey participants were asked to address future directions for instructional technology delivered by the IUSB School of Education in light of changing standards. Participants indicated that the IUSB School of Education should offer instruction in the use

of technology as a tool for curriculum integration to all education students in the future. It was suggested that this offering begin as soon as possible. The integration of technology into and across the curriculum is vital. Many teachers feel unprepared to face the challenges this integration presents. Participants strongly felt that the School of Education should offer instruction in routine cleaning, maintenance and repair (Fig.1). While some schools employ individuals whose central responsibility is to maintain, clean and repair technological equipment, often these responsibilities fall upon school personnel who are ill prepared for the task. Providing basic instruction in these areas would be beneficial. It was also suggested that the ability to communicate technological knowledge and act as staff developers be encouraged in our students. In addition, instruction in the use of the Internet as a research tool was stressed. Aligning curriculum, instruction and assessment with the use of technology was stressed as well; as was the use of technology to align school curricula with various standards. Alignment of curriculum, instruction and assessment helps to ensure equal access to an educational experience of high standards for all students. This process is also a crucial step in fulfilling requirements of various state and national standards.

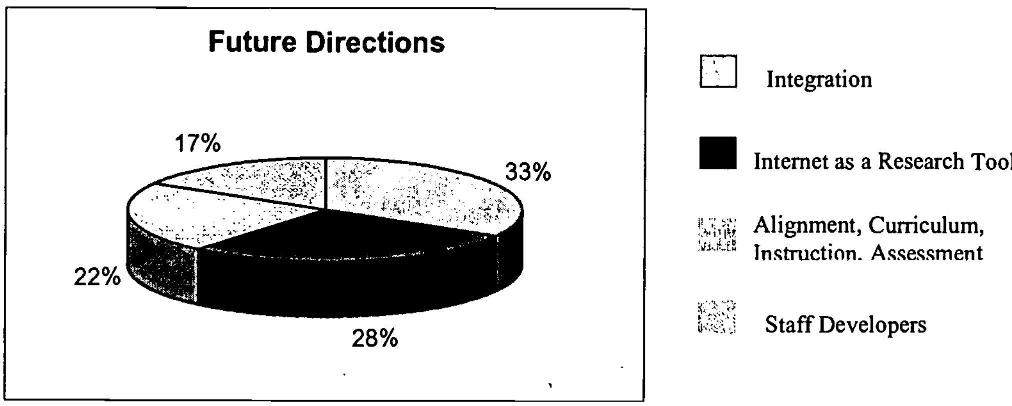


**Figure 1**: Future Directions for School of Education Instructional Technology

In an effort to examine existing notions, survey participants were asked to describe their expectations of potential employees who have a computer endorsement. Respondents expressed the expectation that students with a computer endorsement should be prepared to assume a leadership role in technology. It was also expected that these individuals would lead staff development sessions on the use of technology in educational settings. It was further revealed that the ability to integrate technology into the classroom and teach others to do so was expected of individuals holding a computer endorsement. In the area of technological skills, expectations of the School of Education and P-12 schools were quite similar. Disparity was found to exist between the expectations of P-12 schools and the IUSB School of Education in two areas. One area of disparity is that some respondents have expectations that an individual with a computer endorsement should be able to maintain and repair computer equipment. At the present time this is not an element in either the School of Education's instructional technology course, or the computer endorsement program. Changes are underway that would incorporate more hands-on experience in this area into existing courses. Another area of inconsistency is the issue of computer endorsement holders as staff developers. The intended purpose of providing a computer endorsement option is to provide added levels of knowledge and experience with educational applications of technology to enhance a teacher's performance in the classroom. School of Education students are given instruction in, and opportunities to practice, the teaching of computer applications but emphasis has not been placed on large-scale staff development.

As the instructional technology offerings of the School of Education were examined, respondents proposed possible additions to existing course offerings. It was again suggested that there should be instruction on routine maintenance cleaning and repair of common hardware. This issue has been raised throughout the course of this study. Respondents suggested that instruction in web page design be included in required technology courses for IUSB School of Education students. The introduction to microcomputers course mentioned earlier does not contain a web page design component, while the computer endorsement program includes web page design. Respondents also stressed that the average teacher should possess the ability to

troubleshoot classroom technology and common software applications. While troubleshooting has been included in the introductory course, it has not been emphasized. It was again stressed that students should be provided instruction in the integration of technology into the curriculum. Some respondents indicated that instruction in networking be a priority.

To conclude, survey participants were asked if there were any other issues that needed to be addressed. Most respondents replied that there were not. One issue that did arise was concern on the part of schools concerning teachers who have been in the classroom for a number of years. School administrators are searching for ways to get more experienced teachers to become enthusiastic about technology. The possibilities technology presents for teachers are limitless. Sadly, either lack of knowledge or fear of technology causes many teachers to avoid using the valuable resources available. Many teachers lack confidence in their ability to teach their students how to use technology, or to use it themselves.

Christopher Moersch has constructed a conceptual framework that measures the level of technology implementation or LoTi™. Moersch asserts that there are "seven discrete implementation levels teachers can demonstrate, ranging from nonuse (Level0) to refinement (Level 6). As teachers move from one level to the next, a series of changes to the instructional curriculum are observed" (Moersch, 1995, p41.) The challenge faced by schools is to move teachers from the level of nonuse along the continuum towards refinement. In an effort to bring this about, many schools have attempted to provide technological training with limited success. Many staff development programs are based on the assumption that participants in such sessions are easily able to make the connections between the technology available and their instructional curricula; as well as the assumption that the individuals are ready and willing to initiate changes in their instructional practices. Frequently neither assumption is valid, and staff development sessions result in nonuse or low levels of technology use by classroom teachers (Moersch, 1994). "The use of technology does not guarantee a fundamental change in the teaching-learning process and consequently in learning outcomes" (Dwyer, 1991). In order for schools to successfully move reluctant teachers along the technological continuum, emphasis must be placed on linking technological gains with long-term instructional objectives.

## Conclusions and Implications

In keeping with the School of Education's commitment to continuous program improvement, the IUSB School of Education has initiated the process of changing the instructional technology program, and the computer endorsement program to more accurately address the needs of the P-12 schools in our service area. It is intended that more hands-on opportunities be available to our students, to learn routine maintenance and repair procedures. The process of change presents many challenges. One such challenge is formulating a plan to add requirements to a program that is already very rigorous. Some School of Education students at IUSB, depending on the specifics of their program of study, require five years to obtain a bachelors degree. Another challenge is the time factor. IUSB is one campus in a very large university system. Even though the changes are to be made only on the South Bend campus, certain changes will require not only campus-wide but perhaps system-wide approval. This requires more time. Currently in the Indiana University system, it takes one to two years to change requirements for an existing program of study on a single campus.

The issue of computer endorsement holders as staff development leaders will be examined in further detail. Although there are some components of staff development in the computer endorsement program , at this time, it is not intended to provide P-12 schools with staff developers, but rather teachers with an above average level of technological expertise. Efforts will be concentrated at this time to ensure that instructional technology offerings by the Indiana University South Bend School of Education are as effective as possible in meeting the needs of the P-12 schools, which we serve.

It is the intent of the Indiana University South Bend School of Education to prepare students to serve as effective teachers. It is our belief that the effective teacher must master both a significant body of content knowledge, as well as demonstrate myriad effective teaching skills, one of which is proficiency with instructional technology. Instructional technology goes beyond any single media, or device, the classroom computer for example. It is a systematic way of planning, implementing and evaluating the entire teaching-learning process. It is a way of combining human and non human resources to bring about more effective instruction. In order to ensure that the instructional technology offerings of the IUSB School of Education meet the needs of students who will in turn meet the personnel needs of area schools; it is necessary to periodically examine those needs as well as prevailing attitudes and expectations and make appropriate changes.

The results of this study will be used as a valuable source of data as well as a catalyst for change in the School of Education's required instructional technology courses, as well as the computer endorsement program. It is possible to bring about change in existing courses with relative ease, in a short amount of time; changes such as incorporating experiences in routine maintenance for example. Program changes, however, require more time. This process may be expedited by the fact that precedent exists in the Indiana University system to support the proposed changes to be made on the South Bend campus. Bringing about change in a program, which is part of a large university system requires time and documentation. The need for change as well as the potential benefits of such a change must be carefully and thoroughly examined. Only through periodic examination and evaluation of changing needs, can the Indiana University South Bend School of Education continue its proud tradition of excellence in teacher preparation.

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**Computer Endorsement Needs Assessment Survey**

| **Interviewee** | Date |
|---|---|
| | |
| **Affiliation** | **Position** |
| **1.** What skills and abilities in instructional technology do you expect a beginning teacher to possess? | |
| **General** | **Peripherals** |
| **Platform** | **Software** |
| **2.** (for HR people) When an applicant comes to you with a computer endorsement, what positions do you consider them qualified for? | |
| 3. **Given the changing standards, where do you feel we need to be taking our students 3 or 4 years from now?** | |
| **4.** When an IUSB graduate comes to you with a computer endorsement, what does that mean to you? What skills and abilities do you expect that student to possess? | |
| 5. **What do we need to offer in the area of instructional technology?** | |
| 6. **Is there a question that we should have asked, but did not?** | |

# Learning to teach with technology – From Integration to Actualization.

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**Abstract:** The purpose of this paper is to highlight technology infusion within a unique professional development school (PDS) context. Emphasis is placed on teaching interns (preservice elementary teachers in their final year of preparation) who were introduced to applications of technology through their university coursework. Opportunities to explore technology use in the classroom were afforded through a year-long and school based internship. These preservice teachers experienced multiple ways integrate a wide range of technologies that were designed to enhance and support student learning. The following aspects are highlighted in this paper: program context, approach to technology integration in university coursework, five case studies of technology infusion in the context of elementary classrooms, and implications for learning to teach with technology. The case studies include: Grade 1 – Prehistoric Life with the Dinosaurs using Kid Pix; Grade 2 – Exploring the Seasons; Grade 3 – Where do Insects go during the Winter? Grade 4 – Representing Nutritional Information through Electronic Graphing; and last, Grade 5 – How can the Internet be used effectively to enhance Human Body instruction for Fifth Grade Students?

In their review of literature on information technology and teacher education, Willis and Mehlinger (1996) purport that, "most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology" (p. 978). This is not surprising given the United States Office of Technology Assessment (U.S. Congress, 1995) report that found technology was not a central component of teacher preparation programs in most colleges of education. A summary of the key findings states, "Most technology instruction in colleges of education is teaching about technology as a separate subject, not teaching with technology across the curriculum. Seldom are students asked to create lessons using technologies or practice teaching with technological tools" (p. 165). Clearly there is a need to integrate technology into teacher preparation.

Attention to technology integration alone, however, may be insufficient for assisting preservice teachers in learning how to effectively infuse technology into their classroom teaching practice. A common problem reported in the literature is the decontextualization of elements of teacher education (Zeichner, 1992). In light of the potential to provide unique opportunities to integrate university coursework and field experiences (Darling-Hammond, 1994, Levine & Trachtman, 1997), professional development schools (PDSs) offer a possible means of addressing this issue. Some of the underlying elements of PDSs include developing collaborative relationships between members of the school-university partnership, engaging in authentic problem-solving in light of a shared vision, and nurturing a common vocabulary and knowledge base (Rosaen & Hoekwater, 1990). School-university partnerships foster contexts in which school-wide and classroom-based environments offer preservice teachers multiple opportunities to develop skills and understandings to effectively use instructional technology. Technology infusion in such settings stands to be a powerful approach to fostering changes with respect to instructional technology in preservice teacher preparation.

The purpose of this paper is to highlight technology infusion in the context of a particular PDS, the school-university partnership between The Pennsylvania State University and the State College Area School District (PSU-SCASD PDS program).

## Program Context

Based on the definition and historical development of the PDS movement nationwide, the State College Area School District and The Pennsylvania State University joined in partnership to create four Professional Development Schools. These four schools are a result of a six-year effort to collaboratively plan and open Professional Development Schools that achieve three goals. The first goal is to enhance the educational experiences of all children. The second goal focuses on ensuring high quality field experiences for prospective teachers. The third and final goal is to engage in furthering the professional growth of school and university based teachers and teacher educators (Dana, Silva, & Colangelo, 1999).

Today, Penn State students are selected to complete the yearlong internship program through an extensive application and interview process in which mentor teachers play a major role. The students begin the experience during the second week in August with an intensive two-week campus-based preparation experience, termed "Jump Start." Interns then join their mentors for orientation, classroom preparation for the school year, and district meetings. At this point, interns abandon the university calendar to teach alongside their mentors.

Through seminar and teaching alongside a mentor each day of the school year, interns earn 30 credits, the equivalent of the Penn State's Elementary Education Discipline Inquiry Block Courses (three credits each in math methods, science methods, social studies methods, classroom management, and clinical experience) and Student Teaching. Teams constituted by mentor teachers and Penn State teacher educators structure the experience to ensure that course objectives are met, within the rich context of spending a full school year in the field.

## Technology infusion in university coursework and the PDS classroom

Identified as a goal of the PSU-SCASD PDS program is to find ways to support the development of interns' skills and understandings of ways to effectively use technology to enhance and support children's learning. To achieve this goal, interns are given initial experiences that are supported by the university method instructors. During the first phase, interns experience activities that are designed to help them explore and make sense of teaching with technology. Individually, interns are asked to reflect on these experiences. Class and on-line discussions (using CourseInfo through the website www.blackboard.com) focus on the students' emerging ideas about teaching with technology.

In the second phase, the interns engage in additional scientific investigations using the technology tool. As some of the instructor support is removed, interns experience setting up the technological tool. For example, they explore how to use individually selected software such as Tom Snyder's Graph Club, Claris Home-page for designing web pages, and Kid Pix for presentations. Interns practice with such technological equipment as heart monitors, and electronic microscopes. While they 'played' with digital cameras, scanners, and video equipment for recording and digitizing, interns explored technological tools that were available for teacher use in their schools. In conjunction with their mentor teachers, interns figured ways to have the hardware available for daily use in their classrooms. They negotiated some of the practical dilemmas that arise when trying to make technology effectively usable in a classroom.

During the third phase, PDS interns examine and modify existing exemplary curricula to effectively infuse technological tools. Interns consider in-depth the plausibility of using a particular piece/s of technology. Mentor teachers, interns, and university faculty are involved in discussions that help the intern to conceptualize what the process of technology infusion might look like in the classroom. The goal is to integrate technology into planning classroom activities that support and enhance children's learning, rather than designing and implementing some 'cute' motivational activity. Consequently, the children's experiences with technology fosters further learning experiences that are open-ended.

In the last phase of the technology infusion process, interns move from the role of learner about technology to that of teacher with technology. Interns write and enact technology-enhanced lesson plans. Lesson may be co-planned and co-taught with other interns and mentor teachers, and the process is supported by university faculty. The interns reflect on these individually, and are asked to post their lesson plans and reflections on their web pages. The latter two phases emphasize the planning and teaching aspects of learning to teach with technology. Further, central to this process, is the building of interns' confidence as they learn about technology and how to use it, and how to be a teacher who can effectively infuse technological tools to enhance the curriculum and support student learning.

## Case Studies in the Elementary PDS classrooms

Five case studies are described as examples of technological infusion in the context of PDS elementary classrooms.

### Grade 1 – Prehistoric Life with the Dinosaurs using Kid Pix Studio

In designing a culmination activity for a first grade science unit, Prehistoric Life, a team of two interns and two mentor teachers brainstormed ideas that integrated technology. They sought ways to construct a report-writing task as the final activity. Such a task would allow children an opportunity to present gathered information in a way that was supported by technology. Creating a slide show using Kid Pix Studio to highlight the children's experiences with discovering their mystery dinosaurs was the agree upon task for each group of children. Support was offered by university faculty members in the PDS community to facilitate this process in conjunction with the teachers, parent helpers, and the first graders.

A planning time was organized to familiarize the children with Kid Pix Studio. Digital photographs were taken throughout the unit as the children engaged in activities that sought to identify their mystery dinosaurs. Each child selected the background for at least one slide, the transition from slide to slide, and the appropriate photograph. In order to access enough computers to allow 46 children to work in groups to construct a slide show, five computers were relocated into one of the first grade rooms for one day. Teams of children, each facilitated by an adult, worked over a four-hour period to complete the slide shows. Every child wrote and recorded (using a microphone device) reflections underneath the photograph on the slide.

Parents were invited to attend the Slide Show presentations on the final day of the unit. Teachers, university faculty, parents, and other audience members were very impressed with the children's explanations that highlighted how they designed their slide shows. Shared comments from the witnessing adults expressed surprise that first grades were capable of using such technology to create slide shows.

### Grade 2 – Exploring the Seasons at Acorn Pond

The software program, Sammy's Science House was integrated into a second grade science unit that facilitated student understanding of the weather characteristics of the four seasons. The objectives of the unit focused on how students identified the four seasons, and explained the effects of each season on people, plants, and animals. The instructional plan was framed.

Before: The station area was arranged to accommodate a computer work area. The computer software Sammy's Science House was installed. Construction paper was prepared for students' drawings.

During: The computer software Sammy's Science House was explained and demonstrated to the children. The children were instructed to go to Acorn Pond. In this area the children rotated through the seasons at Acorn Pond. First, they folded their paper into four sections. In each section, they drew and labeled each scene at Acorn Pond. Second, they explained what was occurring to the plants and animals at Acorn Pond. They included in their picture what happened to the pond, the tree, and the animals each season. Third, the children included the temperature at Acorn Pond during each season. Last, they clicked on the animals and

listened to what the animal was doing to prepare for life at Acorn Pond. This interactive activity focused the children's learning on this ecosystem and its inhabitants throughout each season.
After: The children discussed what they saw occurring at Acorn Pond. Ask volunteers described their drawings. Questions were pondered: What happened to the tree, the animals, and the pond during each season? What were some of the animals you learned about during each season?
Closure: The children identified how they relate to each season. How do they change throughout the seasons? What in their lives changes? What are some real life problems that they encounter within each season?
Assessment: The assessment for each child's work was based on the drawing completed and the explanations given about Acorn Pond's adaptations for each season. The children included the changes occurring to the tree, pond, and animals at Acorn Pond; the temperature averages at Acorn Pond; an explanation about the weather characteristics of each season; and labeling of each season.
Reflection: The children depicted through drawings and text the effects of the seasons on plants and animals. They also learned the attributes of each season. The computer program was very effective in helping the children understand the concepts. The students were excited about the computer software. The students arrived at the station in groups of 4 to 5. They cooperatively shared two computers with their partners. Conversation and discussions were held around the computers about the animals and scenes at Acorn Pond. The children liked the interaction of the computer. This allowed the children the freedom to converse and make decisions on their own about what they wanted to depict in their illustrations of each season. Throughout the lesson the children verbalized their findings to the adults and their peers.

**Grade 3 – Where do Insects go during the Winter?**

In Andrea's third grade classroom, there were a number of students who demonstrated an interest in the outdoors. Considering the constraints of curriculum and the interests of these students, Andrea lead a small group of children into the woods for a science investigation. She chose to use a guided type of inquiry and framed the investigation with the question: Where do insects go during the winter?

As she searched for books on insects in the school library, and browsed the net for sites (Topics in insect ecology, and Insects Winter) on insect galls and over-wintering, Andrea realized how important it is for a teacher to have a good understanding of content before trying to teach it to children.
After venturing into the woods the previous day, Andrea led a class discussion that focused on what the students had observed on their field trip. She asked the students why they had not found any insects in the woods. One suggested 'it was too cold.' Some students indicated that the insects were buried deep under the ground, and 'we didn't dig far enough.'

At this point the intern stopped the discussion and introduced a plant gall that her mentor teacher had brought in. Andrea let them look at it with microscopes and make conjectures as to what it could be. Some students thought it might be a cocoon that hardened on a seed pod from a tree. At this point, Andrea divided the group in half. Three children found a seat around a computer with her, and the other half of the group wrote further question down in their journals. Books on insects were available for the students to browse after they finished writing. This part of my lesson was aimed at showing the students sources of information about insects in particular, and science in general.

Andrea shared a series of web sites (Insect Galls, Butterfly Farm, and Ants) that included pictures of galls, information about various insects, and pictures of the insects in their many habitats. The students analyzed the detailed images of the galls. They identified galls that they had seen in their yards or on pine trees as well as maple and oak trees.

This intern concluded that finding ways to infuse technology with scientific inquiry is an important process for supporting children's learning. In particular, guided researching of the Internet provides information that children can use to expand their knowledge and generate further questions for scientific inquiry.

**Grade 4 – Representing Nutritional Information through Electronic Graphing**

In his efforts to familiarize students with constructing graphs using technology and connect these with the Pennsylvania Science Standards, an intern facilitated fourth graders exploration of foods on the

basis of protein content. In searching for a developmentally appropriate task, students were given opportunities to explore and implement the Graph Club software, designed by Tom Snyder. Initially, the workings of the Graph Club were explained to groups of students. Time was given for these groups to investigate the software and explore its capabilities. The task was outlined to each group, and roles were set for each member of the team. Two students spent some time exploring the program, while the other two identified information from the labels of the two foods to be compared, and recorded this onto a worksheet. The information was used to construct the graphs.

The task was designed to provide the four students with a job each: one at the keyboard, one at the mouse, one providing the information from the worksheet, and one student to serve as a "proofreader"- assessing the groups progress, making sure that the information was assigned correctly to the graph's columns. The roles of the students were exchanged. In this context, student learning was assessed as they constructed the graphs. Focus questions were provided by the intern to guide the students in a comparison of the content of two different foods. For example, How are the axes to be labeled?

Questions were asked that promoted student involvement in predicting and comparing. For example, In what ways are these foods different? How do you know? Students were asked to make predictions, using their current experiences with their knowledge about their foods and the graphs they designed. For example, If we graphed information using Graph Club, what foods are similar in content? Students asked insightful questions. For example, How can two apple sauces contain such different amounts of sodium? Printed graphs indicated the graph's accuracy in comparison to the recorded information on the worksheet, and each group's progress with the task.

**Grade 5 – How can the Internet be used effectively to enhance Human Body Instruction for Fifth Grade Students?**

As she became more responsible for planning lessons, an intern explored ways she could use technology to support instruction in her fifth grade classroom. With all the information allowed by the Internet, this intern felt that there must be useful ways to incorporate this technology into more of the instruction, particularly to give students access to artifacts and images that they would not normally have the opportunity to see firsthand.

As they embarked on the science, unit, The Human Body, Sara figured ways she could present an explanation of the human cell. She contemplated an in-depth analysis of a cell model, showing different organelles to the students and explaining the functions of each. As she did not feel particularly comfortable using a photocopied image of a cell, Sara searched the Internet for a suitable website. As part of an introductory lesson, Sara used the site: http://www.cellsalive.com that featured many actual microscope images of various types of cells. There was an option to watch a real time video of cells undergoing mitosis. In her exploration of this site, Sara found a model of a cell – a detailed, color representation that allowed the user to click on a desired organelle. It linked to a page that gave a more in depth explanation of the organelle along with more photographs and a few animations that simulated various functions. Sara showed these pages to the students and talked through the important points. The students were instructed to draw a model of the cell, and list the names and functions of the organelles in a chart format.

From earlier experiences using the Internet as part of instructional practice, Sara anticipated the students' many questions about spellings. Although the organelle names were on the web pages, these were only legible for the students nearest the television monitor. Sara used the computer as a chalkboard by taking advantage of its multitasking capabilities. As she used Netscape to navigate through the cellsalive page, Sara opened two windows within AppleWorks – one was for word processing and the other for painting. From here she dragged these windows into positions that would allowed her to click on the edges of the windows and easily switch applications. After introducing a new organelle, Sara clicked on the word processing window and typed its name in a font which was large enough for the students furthest from the monitor to read and copy. Once the students had an opportunity to copy this information, she clicked on the painting window and drew an example of a model cell, adding organelles to the drawing. This reinforced what the students were learning – first, students looked at the web page and discussed the organelle, then they saw the words and copied them down, and finally they labeled their drawings of the cell.

The next computer-based lesson focused on the skeletal system. Sara located a web page through the Penn State biology department that showed a full skeleton alongside the names of all the bones. When

the user clicked on a bone name or part of the body, a real picture of that bone was seen. Sara's intent was to use this as a guide to talk through the parts of the skeleton and look at the different features of bones and joints by examining individual bones

The final Internet based body lesson related to the muscular system. Sara located two sites with short movies about types of muscles and their functions. Since the first animated movie had a pause button, Sara was able to stop it at certain points to reinforce, question, or check for understanding. After the introductory movies, Sara moved to another site that had a large diagram of the muscles of the human body. Here, a user can move the pointer over a muscle and the muscle name popped up. Sara worked through this from the head to the toes, highlighting important muscles, while the students recorded these on their own diagrams. Again, the words on the screen were small and unfamiliar, Sara used a large font on AppleWorks to ensure that students recorded the information accurately.

## Conclusion

As we figure ways to facilitate the development of preservice teachers' skills and understandings about how to use and infuse technology into curriculum, teacher educators are faced with 'better problems.' Negotiating our better dilemmas leads us to ask questions such as: How do our philosophies of teaching and learning with technology impact the way preservice teachers understand using technology? How do we keep up with the changing technology? How can we further evolve our own understanding and skills about using technology? In what ways can we sustain classroom learning environments that facilitate preservice teachers understandings of technology? How we support and enhance inservice teachers in their efforts to model the effective use of technology in classrooms?

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