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ABSTRACT

This document contains the papers on research from the SITE (Society for Information Technology & Teacher Education) 2001 conference. Topics covered include: concerns of administrators and teachers in the diffusion of information technology; preservice elementary mathematics teachers' computer self efficacy, attitudes, and perceptions; information and communications technology (ICT) in high schools; technology education and practices of preservice teachers; multimedia tools and case-methods pedagogy; helping third grade low achievers through dynamic modeling software; instructional technology doctoral programs; predictive relationships among certain personality factors and novice teachers' use of the newer technologies; the Technology in Education Competency Survey; teacher mediation in development of hypertext projects; evaluating the impact of a teacher-focused technology integration program; teachers' perceptions of self efficacy and beliefs regarding ICT; graduate action research assessment; student rating of instruction in distance education and traditional courses; a model for courseware design; social and academic uses of the Internet by high school students; analysis, design, implementation, and evaluation of instructional software by computer science students and public school teachers; technology and the academic and social culture of a university campus; applying technology to restructuring and learning; evaluation of information technology courses in teacher education; using the Internet as a source of data for qualitative research in the social sciences; computer confidence and attitudes of students attending a notebook or traditional university; science concepts, technology, and higher order thinking skills; effects of peer status and self-efficacy on small group interactions; national technology standards; multimedia tools and case-method pedagogy; computer use in English as a Second Language instruction; the changing role of the teacher; assessing technology-assisted use of information; creative uses of digital technologies; classroom community in postsecondary classes; teachers' and principals' perceptions of barriers to the use of computers; a "blended-technology" approach to distance education; scoring activities on integrating technology during preservice training; benefits of an educational technologist in middle school environments; enhancing attitudes toward technology for middle school girls; effects of multimedia training on

teacher-centered versus student-centered classroom behaviors; comparison of preservice, inservice, and non-teacher education majors on technology confidence, ability, and use; domains of adaptation in technologically-mediated classrooms; impact of instructional technology on student achievement; use of Nvivo for classifying synchronous dialog resulting from Web-based professional development; professional development online; a Web-based precision teaching approach to undergraduate physics; teachers' roles in classrooms with/without computers; Internet-based learning environments in higher education; and technology in Arizona. Most papers contain references. (MES)

R E S E A R C H

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The importance of technology in the teaching and learning process has gained considerable support from educa tional institutions at all levels. As technology is increasingly incorporated into teaching and learning, researchers are answering the call for a better understanding of technology's role in education. This year's SITE conference papers reflect many issues that contribute to this understanding. The authors of these contributions highlighted students', teachers', and administrators' perceptions of technology and technology use, differences in competence and use of Instructional Technology (IT), evaluation of technology use in practice, and methodological issues in the use of IT.

Perceptions of technology and technology use

Many articles fell into the category of perceptions of technology and technology use. Askar & Umay related self-efficacy, attitudes, and perceptions to computer use by preservice elementary mathematics teachers in Turkey in their research. Askar & Usluel interviewed teachers and administrators in Turkey regarding an IT innovation and content analyses revealed two different diffusion processes: as an instructional tool, and as a management tool. Berson & Armstrong study technology beliefs and practices among graduating teacher education majors focusing on the International Society for Teacher Education's (ISTE) National Educational Technology Standards (NETS). Chambers, Smith, Hardy & Sienty used the Myers-Briggs Type Indicator (MBTI) to identify personality types of teachers, which were then related to teachers' willingness to use technology. deMontigny, Cloutier, Ouellet, Courville & Rondeau studied teachers' information and communication technology (ICT) self-efficacy preliminary to introducing ICT components into a Nursing Master's Program in Quebec. Heafner & McCoy reported on a survey of computer use and attitudes towards computers of seniors at a computer intensive liberal arts college that supplies each student with a personal laptop. Janz reported a survey study to determine how the use of a notebook computer will impact a student's computer experience, confidence, and attitudes when compared to those of a traditional university student. Kemker, Harmes, Kalaydijan & Barron focused on a survey of over two thousand teachers targeting their attitudes toward and use of computers in instruction, with specific emphasis on classroom uses consistent with the proposed National Educational Standards (NETS) for teachers and students. Litton reports a study addressing how the use of technology impacts teacher education programs by exploring what teacher education students learn besides content knowledge when using technology in the classroom. Owens & Magoun conducted a study of junior high girls to encourage enthusiasm for computer science and applications through an intensive summer program. Prater & MacNeil compare perceptions of instructional use of technology by teachers and principals. Results found that principals perceived students were using technology for higher level skills such as desktop publishing whereas teachers perceived student use for more drill and practice activities. Wang studied the redefined role of the teacher as technology is incorporated into teaching and learning. The focus of Wang's research centered on preservice teachers' perceptions when teaching with or without computers.

Differences in competence and use of Instructional Technology

Several articles came under the category of differences in competence and use of IT. Ang, Edwards, Kim, Little, Matuszak, Simmons, Stinson & Pierson reviewed constructivist-oriented practices supporting technology, cost-effectiveness of technology use, the effectiveness of virtual field trips, instructional courseware, online discussion tools, and computerized tests. Borthwick, Handler & McGrath, in seeking to determine the features of outstanding doctoral programs through survey and interview techniques, point out that the field lacks clear consistent definitions of terms such as IT, Instructional Design and Educational Technology. Heath, Burns, Dimock & Ravitz

focused on answering three questions: (1) What do constructivist learning environments (CLEs) supported by technology look like in practice? (2) How can teachers be assisted in developing CLEs supported by technology? (3) How does technology facilitate the development of a CLE? Hughes seeks to characterize some uses of web page data and the most common experiences of researchers who are new to the experience of working with large amounts of information in a theoretical paper. Leh & Ogata's work focused on how teachers use technology to better address the needs of diverse populations. Liu & Cheeks found that the nature of assessing technology-assisted use of information was to assess a learning process as well as specific skills. Pastore addressed how the effect of multimedia software training can be used to move from a teacher centered classroom to a more student centered environment. Reehm, Long & Dickey used performance criteria established by the Kentucky Department of Education technology standards to compare confidence among undergraduate and graduate education majors to non-education majors. Schmertzing & Schmertzing studied graduate education students' adaptation from traditional instruction to a technologically mediated classroom. Sherry & Billig presented findings from a five year Technology Innovation Challenge Grant purposing to infuse standards based instruction in multimedia, digital art, music composition and online discourse into the curricula of Vermont's schools.

Evaluation of technology use in practice

In the category of evaluation of technology use in practice, Sangrà & Bellot examined the use of information and communication technologies (ICT) in non-university settings in Spain using a survey, interviews, round tables and discussions. Bornas & Llabrés found that dynamic helping software combined with teacher assistance was more effective than software providing static help. Civiletti, Santos & Santoro used a longitudinal case-study method with genetic text analysis to focus on teacher effects during situations involving cooperative learning and autonomy. Dean provided a quasi-experimental program evaluation of a teacher preparation program designed to help teachers integrate technology into their teaching in the state of Washington. Elliott examined student teachers' ICT experiences in Australia with an eye to improving teacher preparation programs. Flowers, Jordan, Algozzine, Spooner & Fisher reported on a quasi-experimental study of student evaluations of the effectiveness of distance education courses and instructors. Guimaraes described a program in which teachers are introduced to and learn to evaluate educational software programs before leading students in educational activities. Juliana describe qualitative research focusing on 3rd and 4th grade students' understanding of science concepts before and after a technology rich learning experience in order to answer the question: How does technology support higher order thinking goals about science concepts? Kamb & Niederhauser examined self-efficacy and peer status as factors that influence interactions between students working in learning groups on a computer-centered activity. Kilbane examined the effects of CaseNET, a professional development course using case methods and web-assisted technology, on pre-service teachers' classroom problem solving skills. Leh & Keeler present case studies and action research to illustrate technology use in today's English as a Second Language (ESL) classrooms. Loveless, Taylor and Millwood addressed the progression in practice of visual literacy and information and communication technology (ICT) through a series of projects in a five year period. Lucking, Rovai & Ireland studied the impact of classroom community in a higher education classroom. This complex study looked at multiple factors including distance versus traditional instruction, type of school, level of schooling and gender. Preservice teachers were studied to help determine if technology activities encouraged higher cognitive levels using an adaptation of Bloom's taxonomy and ACOT scales in Murphy and McFarland's research. Nail, Hare, Davidson, Ferguson & Leman used a qualitative study to determine if an educational technologist was helpful in facilitating technology integration in the K-12 classroom. Rhodes reports that students from impoverished areas have too little access to IT; teachers have insufficient time to learn to use programs; and staff development on effective use of technology is not emphasized. Stuckey, Hedberg and Lockyer examined the role of an on-line professional development strategy and teacher implementation of a software application for the performing arts program in K-12 schools. Weber & Sabine present experiences from the HALUBO Project dealing with the relation between intercultural competence and the Internet. Willis, Tucker, Rowland, Wong & LeCrone studied the effectiveness of K-12 schools and universities in preparing a literate workforce.

Methodological issues in the use of Instructional Technology

The final category was methodological issues in the study of IT. Christensen & Knezek described the Technology in Education Competency Survey (TECS) related to NCATE standards. Baloian, Ochoa & Fuller presented a model for designing courses based on the authors' experiences designing and redesigning a software engineering course. Hughes & Walker provided a meta-analysis of text and documents in the public domain to characterize and evaluate the methodology adopted during IT course evaluation in the United Kingdom and the USA. Major suggests distance education courses should contain

multiple communication methods including threaded online discussions, video conferencing as well as printed materials for optimal effectiveness. Shotsberger extended research from an earlier SITE paper to encompass synchronous dialogue generated from a Web based inservice program using a qualitative analysis software package. Thomas, Wilkinson, Marr, Thomas & Buboltz studied measures to decrease the attrition rate in engineering programs through the instructional technique precision teaching in a web based approach.

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Concerns Of Administrators And Teachers In The Diffusion Of IT In Schools: A Case Study From Turkey

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Abstract: In this study 27 teachers and 6 administrators from three primary schools in Ankara were interviewed about the characteristics of IT: relative advantage, compatibility, complexity, triability and observability. In addition, the stages of concerns (awareness, informational, personal, management, consequence, collaboration and refocusing) of the teachers were assessed. Overall %30 of the teachers showed no interest in using computers. %40 of the teachers are between at awareness and personal stages. 30% the teachers are at the management stage.

Introduction

Use of information technology in schools for the purpose of teaching and learning is a kind of diffusion process in which IT is an innovation which is defined by Rogers (1995, p.11) as "any idea, practice or object that is perceived as new by an individual or other unit of adoption ". In fact , IT as a relatively new building block in the educational system, causes innovations which ranges from way of communications, and interactions to teaching methods, and materials.

Information technology were first introduced to schools in Turkey in 1984. Since then, computer literacy courses have been offered as elective courses in the primary and secondary schools. On the other hand Ministry of National Education has allocated considerable about of budget for the diffusion of computers in the teaching and learning process. For the diffusion of IT into schools, so many efforts have been undertaken like inservice training of teachers and administrators, courseware and educational material development and training of computer coordinators. The type of innovation-decisions in the educational system in Turkey are authority innovation –decisions which is explained by Rogers as the choices to adopt or reject an innovation that are made by a relatively few individuals in a system who possess power, status or technical expertise. The body of authority is the key policy makers in the Ministry of National Education for all levels of schools. However the implementation of any innovation, including IT is under the responsibility of the schools. Therefore the adoption rate varies due to the administrators and teachers. To install a computer lab or to get a trained teacher (computer coordinator) do'nt imply that adoption is successful even it is an authority innovation-decision.

The evaluation of one of the World Bank supported experimental study showed that: those schools with laboratories that were not yet in full operation often lacked computer formator teachers or computer teachers. On the other hand not all subject teachers are interested in training. One school reported that only 15 % of the teachers attented in-school training(A kar, Rehbein, Noel, 1996).

The theoretical framework of this research is based on these four elements defined by Rogers (1995, p.10-35) .As stated by Hall & Hord (1987), the diffusion of an innovation process strongly depends on the experiences, concerns, skills and knowledge of the individuals and groups involved in the innovation In addition according to Hall, George and Rutherhord, (1998), concerns will vary depending on the amount of one's knowledge about and experience with the innovation. Therefore concerns of the teachers and administrators play an important role in the diffusion of IT in the schools (Dooley, Metcalf, Martinez, 1999).

Study

In this study 37 teachers and 6 administrators (three of them are principals, the others are deputies) from three schools A, B and C were interviewed. School A, a private school, has been using computers for about seven years. School B, a public school, is a curriculum laboratory school which has received computers three years ago. School C , another public school, has started to use computers in this semester. The data were analyzed qualitatively. Content analyses was used and coding categories were created . It seems that there are two different diffusion processes : IT as an instructional tool and IT as a management tool.

Findings and Conclusions

Relative Advantage: One of the characteristics of an innovation as stated by Rogers (1995) is the relative advantage which is the degree to which an innovation is perceived as advantageous. Over all, this study has presented the advantage of using computers as a management tool. The perceived advantage is higher in Sool A which is using computers for at least seven years. However, many questions were raised when the computers are taken as instructional tools. The reasons for the concerns are related to crowded classrooms, curricula and the age of teachers. One classroom teacher stated that "computers are for younger teachers." Compatibility: Compatibility is the degree to which an innovation is perceived as being consistent with the existing applications in the schools. The results showed that in School A , teachers rated the degree of compatibility of computers as near to high where in the other schools they are rated as near to low. Complexity: In this study complexity is taken as the degree to which computer is perceived as difficult to understand and use. The results showed that teachers could be categorized in two groups. One group perceived computers as a very complex device, the others perceived as an easy tool to handle. These groups differ according to their ages. As age increases, the number of teachers regarding computers as complex devices getting higher. Triability: Triability is the degree to which computer as a tool experimented with on a limited basis in schools. As a management tool, it is perceived as triable. In fact as an instructional tool the rate of triability is very low.Observability: Observability is the degree to which the results of using computers in the schools are visible to others. As a managment too; preparing lesson plans, giving the test results or developing presentation materials are visible at some degree. However, teachers haven't seen enough examples for using computers as instructional tools.

Most of the teachers in the study showed their willingness to use computers for various reasons. One dominating reason is that, to know how to use computers is a necessary skill for information age. Another reason for using computers is its storage capability in which lesson and unit plans could be used several times with little changes, without making extra effort. Surprisingly, only one teacher out of 33 mentioned its impact on students' learning by stating its capabilities

The stages of concerns by Hall was stated as; awareness, informational, personal, management, consequence, collaboration, refocusing. Overall 30% of teachers in the study has no concern about computers as a management tool. We can not regard them even in the awareness stages. Most of these teachers are in school C in which a computer laboratory has been recently installed Overall %40 of the teachers are between awareness and management stages. They have general awareness of the use of computer in their daily routines, they are uncertain of their inadequecy to meet all their needs. 30% the teachers (Most of them are at school A) are at the management stage. Their attention is focused on the processes and tasks of using computers and the best use of information and recources. Only one teacher is at the consequence stage. She mentioned the impact of computers on students and focused on the relevance of computers for students.

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Preservice Elementary Mathematics Teachers' Computer Self-Efficacy, Attitudes towards Computers, and their Perceptions of Computer-Enriched Learning Environments

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Abstract: In this study 155 preservice elementary mathematics teachers responses were taken on Computer Self-Efficacy (CSE), Attitudes toward Computers (ATC), Perception of Computer-Enriched Teaching Environment (PCETE). The study showed that preservice elementary mathematics teachers have positive attitudes toward using computers, and learning and teaching with computers. They believe that CAI is better and more comfortable way of learning than are conventional methods. On the other hand their self efficacy in using computers is low.

Introduction

Increasingly, the schools are focusing their attention on the use of computer as a management and teaching-learning tool. The computer not only demandes changes in the school environment, but also requires new roles for the teachers.In fact , majority of the teachers have concerns in adopting computer as a tool to use in their daily applications. Lack of or inadequate training is one of the reason why teachers are not using computers for their courses. Moreover, studies stating that, students, in general , are far more knowledgeable than their teachers. It is obvious that unless teachers feel comfortable with the new technologies they will be unwilling or unable to use them meaningfully.On the other hand, research studies showed that most of the time inservice training programs are not effective and efficient for many reasons. Therefore preservice teacher training is getting more important.

The efforts for using computers in Turkey are growing exponentially. This leads to changes in preservice teacher training programs. One of the differences is the computer courses added in the preservice mathematics teachers training programs. Preservice mathematics teachers enrolled in the School of Education at the Hacettepe University in Ankara are required to take three courses related to computers: Computer Literacy, Instructional Technology and Material Development and Computer-Based Mathematics Instruction. The reason for these courses is to prepare the teacher candidates to be confident and competent in using computers in the schools.

In addition to the organizational implementations, individual differences in using computers is another critical issue to be taken into consideration. One of the concept that can explain individual differences in computer acceptance and utilization is computer self-efficacy which is defined as a judgement of one's capability to use a computer (Yi, M.Y.,& Venkatesh, V. 1996). Expectations of personal mastery affect both initiation and persistence of coping behavior (Bandura, 1977).One of the sources for efficacy expectation is performance accomplishment. The effects of failure on personal efficacy partly depend on timing and the total pattern of experiences in which failures occur. Another source of information is seeing others perform threatining activities. If others can do it, they should be able to achieve at least some improvement in performance. (Bandura, 1977). A study done in Turkey showed that a course on computer literacy for pre-service teachers increased their self-efficacy in application tools.(Cakiroglu & others, 1999) Another issue might be related to the acceptance of computer usage in educational setting is its perceived characteristics in terms of usefulness and difficulty as a management and teaching-learning tool.

The purpose of the study is to address the following questions:

1. What is the computer self-efficacy (CSE) of preservice elementary mathematics teachers?
2. What is the attitude of students towards computers (ATC) in terms of usefulness and difficulty?
3. What are students' perceptions of the difference between computer-enriched teaching environment (PCET) and regular classroom environment?
4. What is the relationships CSE with experience, accesibility and fequency of using computers ?

Study

The subjects in this study are 155 pre-service elementary mathematics teachers. The students were assessed on three scales: Computer Self-Efficacy (CSE), Attitudes toward Computers (ATC), Perception of Computer-Enriched Teaching Environment (PCETE). In addition a questionnaire was administered to the students in order to get an information about: the frequency of using computers, accesibility and experience. The reliability estimates of CSE is 0.71, ATC is 0.85 and PCETE is 0.65 .

Findings and Conclusions

The first analysis was conducted to identify the preservice elementary teachers' responses, as a group, to the items on the computer self-efficacy scale.Results indicated that students' computer self-efficacy is relatively low. For example, the mean of the item " I believe in my abilities to use computers is 2.73 out of 5. One of the reasons for low self efficacy is limited experience on computers.

The responses of preservice teachers to computer-enriched teaching environment scale concerned with the differences between the regular classroom and CAI environment is in favor of CAI. Overall, preservice teachers believed that interest , attention and success would be increased and the level of understanding the material presented on computers could be higher. In addition , they stated that fear and anxiety would be decreased. On the other hand they saw no difference between these two environments with respect to interaction between studentand teacher and class participation. The responses to one of the item related to self-confidence is high, indicated that experience with computers improve beliefs about their self.

Preservice elementary mathematics teachers felt positive attitudes toward computers since they believe that computers play an important role in their lives. They thought computers are useful and essential tools. However, since their experience is limited, the responses to the items in the affective domain showed uncertainity about the degree of attitudes.

The correlation coefficients between the computer self-efficacy scores and experience, frequencu of using computers and access to computers are, 0.42, 0.37 and 0.18 which are significant at 0.05. The positive and significant correlation coefficients indicated that self efficacy on computers is increased with experience and usage.

The study showed that preservice elementary mathematics teachers have positive attitudes toward using computers, and learning and teaching with computers. They believe that CAI is better and more comfortable way of learning than are conventional methods. On the other hand their self efficacy in using computers is low which means that recently added computer courses are not enough to improve their confidence. Nonetheless, computers are now available in most schools. If the role of teacher preparation programs is to produce teachers able and confident to use computers, there is a need to re-analysis the courses and activities.

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THE OBSERVATORY OF THE ICT IN HIGH SCHOOL CENTRES

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What is it?

The observatory of ICT in non-university schools is a project implemented by Jaume Bofill Foundation and the Edu Lab of the Universitat Oberta de Catalunya, whose purpose is to analyse the use of information and communication technologies (ICT) in the non university education.

Main goals

Measuring the evolution of real use of ICT in non-university schools

Comparing the use of ICT in different communities and countries

Detecting useful ideas for the centres to act with a future view

Creating topics for discussion around the pedagogical use of ICT

Who is participating?

Around 33 centres in Catalonia with different characteristics according to their ownership, population and technologies resources are taking part of a proof to examine (from survey, interviews, round tables and discussions) the situation of the use of ICT.

An assessment council integrated by experts who undertake the use of ICT in non-university school from different fields (trainer of trainers, teachers association, educational administration, etc) are establishing the principles of the project from the analysis of the sample centres work.

A technical team undertakes the communication with the sample centres, from the data collecting and analysis, the research diffusion, and the main conclusions reached every time.

Main aspects subject to study by the observatory

There are many aspects to consider with regard to the ICT use in the non university school. The study of the following list of questions adduce a pedagogical enrichment in the use of ICT in the non university centres. We will formulate hypothesis for each aspect and the study will be orientated attending two criteria:

Possibility of having conclusions more or less immediate and useful to make better the use of ICT.
Interest demonstrated from the centres and educational institutions involved in the project.

Work Methodology

The use of ICT by teaching staff: Knowing how teachers use the ICT can help us to answer questions like: Is it a priority? Is another resource for the teacher? Is a qualitative improvement? What is the contribution of ICT to the educational process?

Strategies the use of the ICT are responding to. It is worth to detect the motivation that teaching staff has to implement ICT in the centre. Is it a new pedagogical resource? Is it just a motivation tool?...

The presence in the centres of interschool projects as a result of the use of ICT. Detecting new experiences can help the Observatory to evaluate changes in the methodology, in the standard of learning and the motivation of the pupils as well as detecting which changes the curricular design is making (basically focussed on the interdisciplinary) comparing co-operative projects with other individual projects focussed in the school without the participation of the ICT.

Changes in the pedagogical exposition of the centre according to the use of ICT. Knowing if the use of ICT raise the co-operative work or reinforce the individual one either the pupils or the teachers, if teachers are forced to expose the subject in a different way. How do work teachers with pupils? And with the rest of the teaching staff?

The interdisciplinary: Although the curricular design is made to be interdisciplinary most of the times the credits proposed become insulated from the rest of the curriculum. Can the use of ICT promote a learning planning more interdisciplinary?

Strategies of the teaching staff to re-establish curricular projects according to the use of ICT. Knowing if planning are re-established according to the use of ICT. It is very important to detect the consideration of the teaching staff face to ICT. Is the new technologies another resource or an essential tool of work that helps to articulate a credit.

Departments (credits, subjects...) with more affinity to the use of ICT. Are there any areas that have tendency towards the use of ICT?

The integration of ICT in the curricular project. Has any influence the use of ICT to the curricular project of the centre?

The capacity of innovation of the teaching staff in the centres which use ICT. Do teaching staff work as usual when using ICT or this use allows teachers to make innovations affording a qualitative improvement? How do teaching staff value the changes made when using ICT?

Teaching staff

- The use done by teaching staff of ICT We do believe knowing what are the uses made by teaching staff of the new technologies. The point is knowing if teachers have a priority in the use of ICT. Do teaching staff consider ICT as a pedagogical resource or it is only another tool else to develop their job?

- The re-defining of the curricular project according to the use of ICT. We value the necessity of knowing if the curricular project has been modified because of the use ICT. Do the modifications in the curriculum make better its understanding, and its adaptability to the different levels of pupils making better and wider the subject to course?

- The innovation in the centres through teachers that use ICT: The point is knowing if the use of the ICT produce innovation in the pedagogical field, new ways of work organisation, increasing of the interdisciplinary work and increasing of co-operation among different centres.

- Changes in the role of teaching staff. Traditionally, the teacher assumed the role of knowledge transmitting. How do modify ICT this change of mentality? We have to value if the following aspects affects in the work of the teaching staff: research through Internet, teachers on-line and changes of the pedagogical exposition when using computers.

Attitude of the teaching staff face ICT: The complicity of teaching staff is essential to implement ICT in the centres. This is the raison why it is necessary to know the attitude of teachers. Knowing the grade of implication will help us to know the consensus in the cluster about the use of ICT. Moreover, detecting how teachers see the use of ICT become essential to suppose how difficult, or easy, will be the penetration of ICT in these centres. Mistrust for not knowing how to use them? Uncertainty for the changes implied for using usually ICT? Or, contrariwise, we are talking about been enthusiastic for been able to innovate?

Pupils

How to manage the information received by pupils through Internet. Are there any filters established by teachers? Does the quantity, and sometimes the lack of quality, of the information going round by Internet unable a correct evaluation of its possibility of use? How do pupils use this information?

The use of ICT as a possible generator of inequality. Can a new borderline born between pupils with more initiative and some others passives face the use of the computers. Is it possible to have pupils passing the subjects successfully in the traditional educational but not motivated at using the ICT in the new model of learning? On the other hand, economic inequality among pupils can be widely increased because of the use of ICT in educational centres? Or, contrariwise, the use of ICT become an element which democratize the access and improvement of learning?

The abilities related with the reading and writing of pupils. Which use do pupils of ICT and how are they affected? Are these abilities condition for been useful at using ICT? Do the use of ICT make worse these traditional abilities?

The motivation of the pupil Is a real motivation the use of ICT that brings improvement in the capacity of learning?

The variation of the relation of ICT with pupils. How do the learning of ICT (either the formal one in the school or the intuitive at home) is integrated by pupils? How do they front the learning of a new environment or a new program?

Educational centres and its organisation

The consensus in the cluster about the use of ICT. The use of the ICT as a pedagogical tool of the centre is an aspect to discuss in the cluster, it would exist different inclinations among teaching staff (People against and for). Observing the vision that each cluster has about the use of ICT can help us to detect inclinations and difficulties of each centre.

The appearance of new private educational services through Internet (teachers on-line, new educational software) The thing is to check if the proliferation of these services make evident the limitations of the own centres to reply for the pedagogical necessities of their pupils modifying, in a certain way, the role of the teacher in the classroom.

The performance organisational in the centre. Technology serve to the professionals that use it. From this point of view we think is worth to know if the infrastructure of communication has been modified among the members of the educational community of the centre for the application of the new technologies. It would be important to know also if the bureaucratic process has been modified and the administrative management (making them shorter and quicker) before and after using ICT. Is the communication process with parents and pupils better than before?

The reports of the observatory

Every three months the observatory will make a thematic report reflecting all the study conclusions and the exchange of information with the centres.

The objective of the report is to gather in a systematic way the reality and the work made by the centres with the new technologies in order to obtain a dynamic image about the activities, the expositions and the problems the centres find when implementing new technologies.

The reports are directly linked with those aspects that we pretend to study in the observatory. Three reports will be published in 2000:

First report - April 2000: the reality of the centres will be analysed according to their software and number of PCs, the activities usually made which are based on pedagogic expositions.

Second report - July 2000: the teaching staff role will be analysed in the setting up of ICT, changes in the teaching staff role and their attitude towards the ICT.

Third report - November 2000: First of all, we will study the relationship between pupils and new technologies, the way to manage the information obtained by the pupils from Internet, to know if ICT generates differences, pupils reading and writing improvement with the use of ICT, and their motivation.

The observatory web

The observatory web page is, mainly, an informative reference based on what is done and offered:

Framework for non-university professionals who use ICT, exchange of experiences
Framework for the exchange of experiences in innovation projects
Innovation initiatives as a way to implement achievements in the dialogue between ICT and the educational community members
Knowledge viewed as a way to improve in the ICT use in educational centres
Discussions for enriching all the opinions about this subject

http://www.edulab.net
http://www.uoc.es
e-mail: infoedulab@campus.uoc.es

Examining Technology Education and Practices of Preservice Teachers: Lessons Learned from a Large, Urban College of Education

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Abstract: This paper describes the results of a study of the technology beliefs and practices among graduating teacher education majors. The purpose of the study was an exploratory effort to examine the University's compliance with The International Society for Teacher Education's (ISTE) National Educational Technology Standards (NETS): Standards for Students and state graduation skill requirements in the area of Technology education. Additionally, application of technology skills during the students' internships was evaluated. Participants (N=175) were proportionately representative of the enrollment by major and demographics of the college. Recommendations for technology integration and curriculum modifications are proposed.

Purpose

In order to assess the degree to which the University was in compliance with The International Society for Teacher Education's (ISTE) National Educational Technology Standards (NETS): Standards for Students (International Society for Technology in Education, 2000) and the state graduation skill requirements (Accomplished Practices) in the area of Technology Education (Florida Education Standards Commission, 1996) an exploratory study was conducted.

Resources allocated to increasing classroom access to technology have resulted in 96% of all public schools and 75% of all classrooms having computers (NRP Online, 2000); and 90% of schools have Internet connections (Becker, 1999). When schools are given access to technology, the emphasis shifts from the number of computers to how technology is used in the schools (CEO Forum, 2000). However, the U.S Department of Education reports that only 20% of the 2.5 million teachers currently working in our public schools feel comfortable using these technologies in their classrooms (U.S. Department of Education, 1999). A 2000 study by the Center for Educational Statistics reported that: only 24% of the teachers with access to computers make assignments involving the production of multimedia reports; only 30% assigned research using the Internet; and only 19% percent required graphical presentations (Rowland, 2000). The need for teachers adequately prepared to use technology in the classroom is evident and the focus for this study.

Results and recommendations are intended to provide the basis for development and implementation of policy and the identification of future efforts in the area of Technology Education. Education majors are currently required to complete one basic course in computer applications prior to acceptance, however, the generalizability of the skills students gained in this course to the classroom setting was unknown.

Areas of interest assessed in the survey include: technology skills and knowledge students had obtained as well as the sources of these skills and knowledge, student confidence in applying technology skills in the classroom for both teaching and lesson preparation, and the amount of exposure to technology uses in the classroom gained by students during their semester long internships.

Methods

Participants

At the completion of their final semester-Spring 2000, graduating Education majors were administered the survey 'on-line' during their final internship seminars. One hundred and seventy five students participated in the survey. Seventy-six percent of the respondents were female, and 24% were male. Eight-two percent identified themselves as Caucasian, 7 percent African-American, 8 percent Hispanic, 2.5 percent Native American, and .5 percent as Asian.

Sixty-three percent of the group were under 25 years of age, 23 percent between the ages of 26 and 35, 10 percent between 36 and 45 years, and 4 percent were over age 46. Respondents were representatively distributed across majors within the College of Education: 38 % Elementary Childhood Education, 14% Early Childhood Education, 11% Social Science Education, 9% Special Education, 7% English Education, 6% Physical Education, 6% Mathematics Education, 4% Science Education, and 2% or less from Foreign Language Education , Teachers for All Students and Business Education.

Instrumentation

The International Society for Teacher Education's (ISTE) National Educational Technology Standards (NETS):Standards for Students, served as the foundation for development of the survey. College of Education Faculty members provided expert review in the construction, modification, and development of the survey items and format.

In addition to demographic data, students were requested to complete three sections of the survey and make recommendations for current and future technology training for teachers. Section I –Computer Instruction and Frequency of Use was composed of two parts. The first part asked students to indicate the primary way in which they had learned various computer skills and applications by selecting one of the following categories: Not learned, On-the-job, Self-taught, In a workshop, or In a required course. In the second part, students were asked to indicate the frequency with which they used the skill or application by indicating use as daily, weekly, monthly or never.

Section II-Confidence using Technology for Instruction and Experience with Technology applications during Internship was also composed of two parts. The first part asked the respondents to describe their level of confidence in using technology for instruction in the areas of a) lesson planning, b) lesson development, and c) lesson delivery. Responses were indicated on a three-point scale: none, somewhat or very confident. In the second part students were requested to indicate the amount of experience they had applying technology during their internship. Students responded on a five-point scale: 1) I have not observed or performed this skill, 2) I have observed but not performed this skill, 3) I have performed this skill under direct supervision, 4) I have performed this skill independently once or twice, and 5) I perform this skill routinely in my work.

Section III-Confidence in Teaching Technology Content assessed students' confidence in transferring technology content through teaching. Students were asked to rate their level of confidence in teaching various content areas to students on a four-point scale: 1) Not confident, 2) Somewhat, 3) Usually, or 4) Very Confident.

Students were asked to provide information regarding the technology availability and accessibility at their internship sites and information regarding the number and type of technology courses taken.

Results

Table 1 displays the responses to the survey items in Section I.-Computer Instruction and Frequency of Use. Technology Information was categorized by Technology Use: Telecommunications, Program Applications, Advanced Applications and Equipment Based Uses. In part A of the following section, students were requested to indicate the primary way in which they learned the listed computer skills/applications. In part B, to indicate the frequency with which they use the skill or application. Tabled values represent the percent of respondents selecting each response choice. Category averages are shaded. With the exception of Advanced Applications (Hyperstudio, C++), students report being self-taught as the most frequent learning method. Knowledge gained in required courses was the next most identified source of technology training. On-the-job training and workshops were not significant sources of acquiring technology skills.

Seventy percent of respondents indicated daily computer use for Telecommunications purposes (E-mail, Web-browsing). A similar number of students are using word processing programs on a daily basis, however, other program applications are used with much less frequency, with at least 40 % of all respondents indicating they never use other computer-based program applications. Over 85% of the respondents indicated that they never used Advanced Applications or Equipment Based Uses of Technology tools such as scanners and digital cameras.

Table 2 provides student responses indicating their level of confidence in using technology during instruction and the experience students had applying technology during their internships. Technology tasks are grouped into lesson planning, lesson development and lesson delivery applications. In part A, students were asked to rate their confidence in using the listed technology during lesson planning, development and delivery. In Section B, students indicated the amount of experience in applying technology they had received during their internships. Tabled values represent the percent of respondents selecting each response choice. Category averages are shaded. Students felt most confident using technology for lesson planning and delivery, with over 80% of students indicating

they were very confident or at least somewhat confident in their ability to access technology for these tasks. Students were less confident in their ability to use technology for lesson development—over 25% of the students indicated no confidence in this area.

Responses to Internship opportunities to apply technology in the areas of lesson planning, lesson development and lesson delivery indicated that students frequently did not encounter the opportunity to apply technology in the internship setting. Over 50% of the respondents indicated they had not witnessed technology use nor did they have the opportunity to use technology during their internships in the areas of lesson delivery and development. Students did indicate more exposure to technology use in lesson planning and that they had self-initiated the incorporation of technology into lesson planning during their internships. Lesson Planning responses indicated that students were also working more independently in this area than in the areas of development or delivery.

In response to a related question regarding internship site technology availability, students reported that the technology they wanted to use for instruction was available at their internship sites always (40%), sometimes available (48%) or not available (12%). Students reported that 83% of the schools where they completed their internships were equipped with adequate technology and that 17% of the schools were below average or not equipped.

Table 1. Computer Instruction and Frequency of Use

	Part A: Where did you learn to use this technology?					Part B : How frequently do you typically use this technology?			
	Not Learned	*On-the-Job*	*Self-Taught*	*Workshop*	*Required Course*	*Daily*	*Weekly*	*Monthly*	*Never*
Telecommunication Uses	**0.6**	**4.3**	**78.2**	**1.7**	**15.2**	**69.7**	**27.0**	**4.6**	**3.7**
World Wide Web/Internet Browsing	0.6	2.9	79.4	1.1	16.0	62.9	28.6	6.3	2.3
Telecommunications (Email, Internet, etc.)	0.6	5.8	76.9	2.3	14.5	76.4	15.5	2.9	5.2
Program Applications	**23.3**	**4.8**	**42.8**	**3.6**	**25.5**	**16.7**	**15.9**	**24.1**	**43.4**
Word Processing Programs (e.g. Word, Word Perfect)	0.0	5.1	72.2	4.0	18.8	71.0	23.3	3.4	2.3
Desktop Publishing Programs (e.g. Pagemaker, Printshop)	27.7	6.9	51.4	2.3	11.6	8.1	20.9	28.5	42.4
Spreadsheet Programs (e.g. Excel)	13.3	5.8	37.0	5.2	38.7	9.2	14.9	33.3	42.5
Presentation Tools Programs (e.g., PowerPoint)	12.7	3.5	26.0	4.6	53.2	2.3	11.6	37.2	48.8
Graphics Programs (e.g. PhotoShop, FreeHand)	39.2	2.9	48.0	2.3	7.6	2.9	12.8	27.3	57.0
Database Programs (e.g. Access, FileMaker Pro)	46.8	4.7	22.2	3.5	22.8	6.5	11.8	14.7	67.1
Advanced Applications	**62.5**	**2.9**	**10.4**	**2.9**	**21.3**	**1.8**	**2.9**	**9.6**	**85.7**
Multimedia Development Programs (e.g., Hyper Studio, Macromedia Director)	51.1	2.9	13.8	3.4	28.7	1.2	4.7	14.5	79.7
Computer Programming (e.g. C++, Visual Basic)	74.1	2.9	6.9	2.3	13.8	2.4	1.2	4.8	91.7
Equipment Based Uses	**81.5**	**3.1**	**10.3**	**0.9**	**4.2**	**2.5**	**4.7**	**3.0**	**89.8**
Hand Held Personal Computing device (e.g. Palm Pilot)	73.9	2.3	19.3	1.1	3.4	5.3	8.2	5.3	81.2

Video Conferencing	83.9	3.4	6.9	0.6	5.2	1.2	2.9	1.2	94.7
Technology tools such as scanners and digital cameras	86.7	3.5	4.6	1.2	4.0	1.2	3.0	2.4	93.5

Table 2. Confidence in Using Technology for Instruction and Experience with Technology Applications During Internship

	A **What is your level of self-confidence in using technology during instruction?**			B **How much experience you have had applying technology during your internship.**				
USING TECHNOLOGY IN INSTRUCTION:	None	Somewhat	Very Confident	①= I have not observed or performed this skill. ②= I have observed BUT NOT performed this skill. ③=I have performed this skill under direct supervision. ④= I have performed this skill independently once or twice. ⑤=I perform this skill routinely in my work.				
	Percent of Responses			Percent of Responses				
				①	②	③	④	⑤
Planning for Lessons	**11.6**	**38.4**	**50.0**	**24.7**	**10.0**	**9.0**	**23.5**	**32.8**
Select appropriate technology to support lessons	7.8	46.4	45.8	14.5	7.3	10.9	32.7	34.5
Identify technology resources appropriate for the Florida Sunshine State Standards	11.0	53.7	35.4	23.2	11.6	16.5	25.6	23.2
Choose effective instructional software	16.1	49.1	34.8	33.1	17.2	11.0	24.5	14.1
Access the electronic information that I want/need	11.9	20.6	67.5	21.0	8.0	3.1	20.4	47.5
Incorporate telecommunications (e-mail, Internet)	11.6	22.0	66.5	31.7	5.6	3.1	14.3	45.3
Lesson Development	**27.6**	**32.6**	**39.8**	**54.2**	**9.6**	**6.3**	**17.8**	**12.1**
Develop computer based presentations using the Internet	27.5	35.0	37.5	56.4	11.7	5.5	16.6	9.8
Develop computer-based presentations using presentation tools (e.g., Power Point)	26.8	31.7	41.5	46.0	13.5	8.6	25.2	6.7
Incorporating word processors into lessons	15.3	27.0	57.7	42.5	5.6	4.4	16.9	30.6
Incorporating spreadsheets and data bases into lessons	35.4	32.9	31.7	63.5	5.7	6.9	15.1	8.8
Use linear (e.g. Power Point) and nonlinear (Web) multimedia presentations	32.9	36.6	30.4	62.7	11.4	6.3	15.2	4.4
Lesson Delivery	**18.5**	**28.2**	**53.3**	**52.0**	**10.2**	**5.4**	**15.6**	**16.7**
Use computers in different settings (e.g., classroom, laboratory, etc.)	13.0	31.1	55.9	30.8	11.9	9.4	22.6	25.2
Using e-mail and the Internet to support small group or individual's work	19.8	26.5	53.7	59.6	10.6	3.7	12.4	13.7
Using e-mail and Internet to support student centered projects	22.7	27.0	50.3	65.4	8.2	3.1	11.9	11.3

Table 3 summarizes student confidence in transferring technology through teaching. Survey items were categorized as either Theoretical Bases for Technology Use or Applications of Technology. Students were asked to rate their personal confidence in teaching their students the computer knowledge and skills listed. In general, students felt more confident teaching students to use different Technology Applications than with the Theoretical Bases for

Technology Use. As noted in Sections I and II, students were most confident in the Telecommunications areas of email and web-surfing.

Table 3. Summary of Student Confidence in Teaching Technology Content

	How confident are you in teaching your students the following technology information and skills areas?			
TECHNOLOGY CONTENT AREAS:	None	Somewhat	Usually	Very Confident
Theoretical Bases for Technology Use				
Basic computer theory such as bytes and bits	38.0	30.7	13.9	17.5
Technology vocabulary (e.g., cursor, memory, Internet, WWW)	8.4	25.7	23.4	42.5
Use guidelines for Internet safety	15.9	23.8	24.4	36.0
Copyright laws as they relate to the Internet	25.3	27.7	18.1	28.9
Use technology legally and ethically	13.3	21.1	24.1	41.6
Applications of Technology				
Use word processors in their work	6.0	12.0	26.9	55.1
Use telecommunications (e.g., e-mail, Internet)	7.8	13.3	22.9	56.0
Use spreadsheets and databases	24.0	31.1	22.8	22.2
Create a bar graph that is linked to a spread sheet	31.7	24.0	18.6	25.7
Incorporate graphics into their computer-based written documents	16.0	25.3	21.6	37.0
Select appropriate technology for a given task (e.g., problem solving, writing)	11.3	22.6	30.4	35.7
Use search strategies with the Internet and CD-ROMS, etc.	10.8	18.7	22.3	48.2
Use electronic encyclopedias and catalogs	12.7	14.5	24.7	48.2
Access information using networks and modems	19.8	17.3	21.0	42.0

Student suggestions for enhancing technology training in the College of Education were requested. Students were asked to respond to the following question: "What suggestions do you have for enhancing future technology training and instruction in the College of Education? What would have been useful to you?" Responses were categorized as either Comments on Current Courses or Further Technology Training. The number of student responses precedes each subcategory.

Comments on Current Courses

9- Courses not useful as technology not currently used in school classrooms
6- Classes too large
6- Technology information is not relevant to program, information is not applicable
5- Inadequate support, TA's not helpful, more one-on-one assistance needed

Suggestions for Future Technology Training

14- More real life applications-develop actual lessons-hands on experience
13- More technology courses are needed
10- Incorporate technology more into current courses
5- Specific training in PowerPoint & Web Page Development
4- More open access labs with more educational software available to review
4- Training on Macintosh/ Apple-IBM not used in schools.

Summary and Recommendations

Although the incorporation of technology into education has grown at a massive rate, the lack of teacher preparedness has necessitated development of standards and graduation requirements to facilitate the seamless integration of technology into instruction. Enhancing the efficacy of technology for transformation of schools is a strong basis for reform; however, the focus of educational development and design needs to be informed by a

conceptual framework which explicitly addresses the challenges and potential of technology innovation in education. We are at a crossroads with tremendous potential, and the following recommendations are suggested to direct the use of technology implementation.

- Faculty technology leaders within COE departments are encouraged to develop content specific examples of technology integrated into lesson plans. For example, Social Studies Faculty may use the CITE Forum web site to gain ideas for integration: http:\\www.citeforum.org
- Reexamine and restructure undergraduate technology course.
- Consider more content focused courses by major area of study. For example, technology in Science Education.
- Work with area school districts to ensure students are exposed to technology applications in the classroom by selecting good model teachers and technologically equipped schools.
- Offer individual (one-on-one) training for faculty on the seamless integration of technology into courses.
- Consider reward systems for faculty who integrate technology into courses in the areas of classroom assignments and tenure-promotion.
- Develop college-wide grant writing initiatives for technology development.
- Provide students and faculty better access to and training on technology equipment such as scanners, digital cameras and teleconferencing.
- Create a supportive environment within the College of Education that provides risk-free opportunities for the practice of using various forms of technology.

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Multimedia Tools and Case-Method Pedagogy for Teaching and Learning

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Teacher educators face the challenge of preparing teachers to recognize and respond to educational problems as they arise in highly variable, often unpredictable contexts. Two recent innovations in teacher education offer promising possibilities for doing so: case-method pedagogy and multimedia tools for teaching and learning. The purpose of this research was to explore how these innovations interacted in CaseNET to help preservice teachers learn to address problems as they emerge in K-12 classrooms.

CaseNET is a set of Web-assisted professional development courses for educators that combines the use of case methods and Web-based technologies. CaseNET provides preservice and inservice teachers at approximately 20 universities in four countries and 15 school districts in the United States and three other countries opportunities to improve their professional problem-solving skills. Participants in CaseNET use a variety of technologies including videoconferencing, electronic journals, and online discussion groups to learn to analyze multimedia cases. Throughout a fourteen-week academic semester, participants learn to analyze cases using a specific five-step problem-solving strategy (McNergney, Herbert, & Ford, 1994; Herbert & McNergney, 1995, McNergney & Herbert, 1995) and practice this strategy when analzying a set of multimedia teaching case studies.

Teaching case studies might be described as stories, vignettes, or "slices of real life." These cases present predicaments from practice that demand some kind of action (Gideonse,1999). They illustrate reality in its intricate complexity and often include important contextual evidence. Although based on reality, cases condense facts or elaborate on real events to create succinct analytic puzzles. Cases illustrate life in the classroom as it is, not necessarily as it should be. Learning with cases provide preservice and inservice teachers with opportunities to practice problem identification (Merseth, 1996). The skills developed through case methods are useful in a variety of settings. Experience with various types of cases also helps professionals develop a repertoire of defensible solutions for commonly occurring problems (Kleinfeld, 1992; Merseth & Lacey, 1993).

This study investigated the efficacy of a particular problem-solving method on participants' experiences with a multimedia case. The sample consisted of 33 preservice teachers participating in CaseNET at two institutions of higher education (Group One), 26 preservice teachers from these institutions of higher education not participating in CaseNET (Group Two), and 34 other students enrolled in arts and sciences from these institutions of higher education who were neither CaseNET participants nor preservice teachers (Group Three). Problem-solving proficiency, as demonstrated by participants' three-page written case analyses, was determined by a panel of professional educators, or judges, who were prepared to use an instrument measuring participants' abilities to: (1) identify educational issues, (ISSUES); (2) consider events in the case from different points of view, (PERSPECTIVES); (3) identify professional knowledge (personal, empirical, theoretical) relevant to issues in the case and raise questions about other potentially useful knowledge, (KNOWLEDGE); (4) propose actions for addressing a variety of issues, (ACTIONS); and (5) speculate about the consequences of such actions, (CONSEQUENCES).

Participants in the study assembled in groups of about 15 in computer labs where they were asked to read and analyze a case presented in hypertext and multimedia format called "Here to Serve." The case tells the story of a middle school technology coordinator who is challenged to address the needs of mainstreamed students with special needs, attend to the professional development of teachers under her authority, and deal with the many other tasks her position demands. Information useful for analyzing the case was embedded in descriptions of the characters and events occurring in the case and in ancillary materials contained in a resource area linked to the case. After reading the case, participants submitted a three-page analysis that was then rated by a panel of judges.

In examining the generalizability of the judges' ratings, analyses were considered the objects of measurement. Judges were considered random facets and subscale scores were considered fixed facets. The design of the study was participants' written analyses (p) crossed with judges, (j) who were nested within subscales (i), p x (j : i). Using GENOVA, the generalizabilty coefficient was sufficient to propose adequate dependability (g=.77).

Scores indicating participants' problem-solving performance were calculated and a comparison of these sub-scale scores and a total scores was performed. Participants' subscale scores were calculated by summing the points participants received from both judges on each of the subscales on the judges' rating instrument (issues, perspectives, knowledge, actions, and consequences). The subscales reflected each participant's performance on the individual steps of the five-step method.

Judges' ratings were summed to yield the total score. A direct discriminate function analysis was performed using the five variables as predictors of membership in the groups. Variables were ISSUES, PERSPECTIVES, KNOWLEDGE, ACTION, and CONSEQUENCES. One discriminant function was significant. With a combined $x^2_{(10)} = .81$, $p<.01$. After removal of the first function, there was no strong association between group and predictors. The loading matrix of correlations between predictors and discriminant functions suggests that the best predictors for distinguishing between CaseNET participants and those in the other two groups was the rating participants' analyses received on the subscale KNOWLEDGE, ISSUES, and CONSEQUENCES. Group One had higher scores on this variable (M=17.79) than Group Two (M=14.73) and Group Three (M=14.26). Variables loading less than .50 were not interpreted.

The total scores reflected participants' performance on all the subscale items combined. Group scores obtained for participants' total scores were significantly different among groups ($F_{(2, 90)} = 57.91$, $p<.01$). A Tukey post hoc test revealed that there were differences between Group One (M=71.06, s=4.37), and Group Two (M=63.54, s=3.01) and Group Three (M=62.24, s=3.07), but not between Groups Two and Three.

Results suggest that preservice teachers in CaseNET were able to learn the problem-solving strategy and apply it when analyzing a multimedia case study. Participants in this group identified problems, applied professional knowledge, and anticipated consequences more proficiently than did the participants in the other groups.

At least since John Dewey (1910) promoted the joining of education and real life, teacher educators have tried to help preservice teachers develop reflexive teaching strategies that are adaptable to many learners. Teacher educators have provided opportunities for preservice teachers to learn from one another in college and university classrooms and from more experienced colleagues in K-12 schools. Now, multimedia technology offers teacher educators new ways to provide realistic educational experiences for teachers.

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Helping Third Grade Low Achievers Through Dynamical Modelling Software: An Experimental Study

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Abstract: The aim of our study was to evaluate the instructional effectiveness of a curriculum based software for low achieving children students (LA). In order to test the importance of the type of help, two versions of the same software were developed (static vs dynamic help). Furthermore, the dynamical version was used in two ways (computer alone vs computer and psychologist's support). Sixty students participated in the research. The results of our study clearly suggest that computer technology can help teachers to attend the LA students, at least when the instructional software has been developed regarding the school curriculum and the teaching style of the regular teacher. However, LA students working with the computer alone used less advanced strategies than those used by the LA students who got psychologist's support. Therefore, our results recommend to put computers into the regular classroom so that teachers can "be there" if the student needs help.

Introduction

Although low achieving students (LA) usually do not cause serious problems in the school, they need an individualized instruction to learn what high achievers learn in the classroom through regular teaching (Bornas, Servera, & Llabrés 1997). Teachers have too many students in the classroom, so they could not attend their LA students individually. Computers can deliver such instruction if an appropraite software is used (Bender & Bender 1996). This software has to be based on the specific school curriculum. In addition, the software teaching style has to be in accordance with the regular teacher's style. Despite we know that, generally speaking, instructional software with those characteristics can be useful, several specific questions remain unclear. One of these questions is related to the type of help the software must provide when the student does not understand a concept or when he or she is not using the correct strategy to solve a specific task. Static help is provided when the computer just reminds the student "to be careful", "to pay attention", "to try again", and so on. However, computers can provide dynamic help too. Dynamic help is provided by showing the student the process of solving a specific task (Shute & Miksad 1997). For example, to teach how to solve the addition of 1/4 and 1/2, the computer could show several tanks with water and how water flows from small tanks to a big tank with 1/4 and 1/2 marks. Dynamic help is provided also when the computer teaches a specific strategy. Using criteria to group words (e.g. "red" and "blue" are names of colors) may be a good strategy to remember a list of words. Moreover, dynamic help can be provided by the computer as the only instruction tool or by the computer and the teacher together. Traditional curriculum materials (textbooks) only provide static help. Dynamic help is usually provided by teachers when they draw on the blackboard, play with blocks or other things, build some apparatus in the classroom, etc. (Bornas, Servera & Llabrés 1996).

The aim of our study was to evaluate the instructional effectiveness of a curriculum based software for LA students. In order to test the importance of the type of help, two versions of the same software were developed. One of them provided static help, and the other one provided dynamic help. Furthermore, this dynamical version was used in two ways: with the computer alone and with the computer and a psychologist who gave help to the students if they needed it.

Method

Subjects

Sixty low achieving (LA) students from four third-grade classrooms of a private school in Palma (Spain) participated in the research. They were selected because of their low achievement in the school as well as in the Math and reading specific tests that were administered before they start using the software. The students' teachers also gave their opinion about the achievement level of every student. LA students were randomly assigned to one of four conditions: Attentional Instruction (AI), Computer Driven Instruction (CDI), Computer Assisted Instruction (CAI) or control. Each group was made up of fifteen students.

Educators

There were two psychology students in each group who had been trained to be educators, both in the knowledge of the software and the purely educational aspects. One of them only had the function of observer but could substitute the other when necessary (which did not happen). These students participated both in the pre-intervention assessment and in the post-intervention assessment.

Variables and measures

Academic achievement in math and reading was measured using curriculum based tests before and after the instructional period. In addition, a measure concerning the process of doing the instructional tasks was used for the three experimental groups (see below). Standard attention and impulsivity tests were administered as additional selection criteria.

Procedure

Regular teachers contributed to select the academic contents (reading and math) the software should include as well as the strategies they were teaching in the classroom to solve specific tasks (e.g. dividing). Even some figures that appeared in the students textbooks were reproduced in the software to make it more familiar to the students. In other words, what the software was going to teach and how was going to do it was determined by the school teachers and the school curriculum and materials. The software was developed using the Toolbook® authoring package and it took three months. When the software was almost completed, it was installed on the school computers, and the ten-weeks instruction period started. Some more exercises were added later, during this period, because some students did the programmed tasks very quickly. The AI group worked with the software that provided only static help, and the educator could only refer to this software for help. The CDI group used the same software but it provided dynamic help and the educator did not help students. In the CAI group, dynamic help was also available and the educator helped students if they needed it. Students in the control condition did not work with the software and they followed the regular instruction in the classroom, while the other three groups went out of the classroom to go to the technology classroom to use the software when they had reading or math tasks with their regular teachers. It is worth to note that the software *replaced*, and it was not added to, the regular instruction during the ten weeks research period.

Sixteen computers were located in the school's technology classroom, and the instructional software was installed on all of them. LA students went to this classroom two times a week during ten weeks. Every instructional session lasted 45 minutes, so the total time they could use the software was 15 hours. During each session students had a sheet of paper where they could write or draw whatever they want. These sheets of paper were collected at the end of each session to have some knowledge about the strategies students were using to solve the tasks, but no comment about them was made to the students. At the end of the instruction period, LA students were administered Math and reading performance tests. These tests were designed in accordance with what the regular teachers said they have taught in the classroom during that period.

Results

In general, as to the achievement in the math and reading tests used, there were no statistically significant differences between the four experimental groups. In other words, the children in the control group, who continued to attend regular classes, had the same achievement at the end of the intervention as those who had worked with the computer. As far as the reading comprehension is concerned, by making an analysis of the main effects we obtained a

"group" factor score of F=0.90. Neither was the interaction between the two design factors significant (F=0.38), which is why we analyzed the "test" factor (F=51.87; p<.001) uni-factorially, but none of the groups showed any significant difference between the two assessment points. With respect to the math scores, the same pattern of lack of differences between groups is maintained. The study of the main effects of the different factors indicates there is no significant "group x test" effect (F=1.92) although significant "test" factor differences can be seen (F=67.37; p<.001). The analysis of this factor shows how despite the fact that the four groups improve significantly from the statistical point of view, the three intervention groups are the ones that show the greatest difference after treatment (see table 1).

	PRE		POST			
	M	SD	M	SD	F	
AI	9.38	3.92	14.15	0.89	20.83	**
CDI	8.40	3.48	13.33	1.63	39.03	**
CAI	10.15	3.95	13.38	1.38	10.83	**
CTRL	9.84	2.96	11.76	2.94	5.71	*

* p<.05; ** p<.01

Table 1: Calculation Score Before and After Intervention

The analysis of the strategies employed by the children in solving the intervention tasks has been carried out with the information obtained from the sheets of paper handed out to the children involved in the three experimental groups during the intervention sessions. We do not have the strategies of the control group because if we had handed out a sheet of paper while they were in class with their regular teacher we would have distorted the study. The sheets collected during the math lessons did not show any particularly interesting strategy given the fact that the children only made use of them to do the necessary calculations in order to solve the math problems set by the computer. In the case of reading, the sheets showed more varied, interesting strategies. The strategies used were independently assessed by two experts, who only had a list of all the strategies used without knowing at any moment in time the subjects who had carried them out or which group they belonged to. Each expert categorized each strategy as rudimentary, normal or advanced and gave it a score of between 1 and 10. For instance, copying the full list of new words to be remembered was considered a less advanced strategy than grouping words according to certain criteria (e.g. arm, leg, and foot, or red, green, yellow, and white). Afterwards, the value of each strategy was defined as the mean of the two scores appointed by each observer whenever they were placed in the same category and there was a difference of no more than two points between the two scores (otherwise the strategy was not taken into account in the analysis).

According to the ANOVA carried out (see table 2), the CAI group used significantly more strategies than the AI group, and the strategies they used were more advanced than those used by the other two groups.

	AI		CDI		CAI				
	M	SD	M	SD	M	SD	F		Contr.[a]
Number[b]	2.26	1.03	3.42	1.45	4.30	2.17	5.79	**	1-3
Value[c]	7.80	4.68	13.14	7.77	21.42	12.49	8.55	**	1-3 / 2-3
No. X Val.	16.03	13.09	33.85	21.14	60.73	40.58	9.75	**	1-3 / 2-3

** p<.01; [a] Contrasts SNK with a significance level of .05 (1=AI, 2=CDI, 3=CAI); [b] Number of strategies used; [c] Value assigned to the strategies

Table 2: Strategies used in reading activities

Discussion

The results of our study clearly suggest that computer technology can help teachers to attend the low achieving students they have in the classroom, at least when the instructional software has been developed regarding the school curriculum and the teaching style of the regular teacher. It is worth noting that the children in the control group continued learning in class the same as what the other groups learned with the computers. Therefore, the computers have been just as efficient as the teachers as far as academic achievement is concerned.

The results obtained as to the strategies are the most important point. Unfortunately, we did not find a good way of assessing the strategies used in math and this would need more research in the future. In addition, it should be said that the procedure we used to know the students' strategies has a clear limitation: A blank sheet does not mean that the student has not used any strategy. However, we chose the blank sheet procedure because it is less reactive than directly asking students what strategies they had been using. Further research is needed to develop better strategies'

assessment procedures. Despite this limitation, which recommends caution when reading the following discussion, we think that the results on the strategies in reading deserve close consideration.

Statistically speaking, only the CAI group used strategies which were more advanced than the other groups working with computers. Below, we will comment on this result, but it would now be worth noting the differences between the three groups. The AI group worked with software offering static help and the value of the strategies employed was 7.80. When the software offered dynamic help (CDI) the corresponding group used rather more advanced strategies (13.14). And when, in addition to the software's dynamic help, the educator provided further assitance (CAI) we find much more advanced strategies (21.42). The progression, at first glance, is curious: the value of the CDI group strategies practically doubles the value of those used by group AI, and the value of those used by group CAI practically triples this value. The fact that this was not reflected in the academic achievement could be simply a question of time. It could be supposed that on a more long term basis, the children who acquire advanced strategies will have higher achievement.

Let us now focus on the CAI group which statistically used more advanced strategies than the others. This group, like the CDI group, worked with the computers that offered dynamic helps. The difference between the CDI and CAI groups was not in the software employed but rather in the additional help provided by the educator. Whereas in the CDI group it was minimal or non-existent (the whole responsibility was the software's), in the CAI group the educator actively helped the children who asked for it. Hence, the human factor seems to have been decisive.

If we analyse this factor a bit more we see that the scaffolding provided is meta-cognitive, whereas the scaffolding provided by the software is cognitive. The software with dynamic helps provides cognitive strategies but does not deal with (at least not intentionally or explicitly) the meta-cognitive aspects. For instance, knowing when it is convenient to use a particular strategy, which makes it possible to generalise its use in different tasks or activities is not provided by the designed software. On the other hand the educator, despite having instructions not to teach cognitive strategies directly, could suggest or remind the child of a previously learned strategy. Thus, he was putting himself in a meta-cognitive scaffolding level and this could then explain how this CAI group used statistically more advanced strategies than the others.

To close, specific meta-cognitive aspects could probably be introduced without too much difficulty, and this is a challenge for research into educational software in the near future, but meta-cognition also involves flexibility and speed in adapting to children's needs. Therefore, computers by themselves can be useful instructors to consolidate the sudents' knowledge, but they have limitations to teach advanced strategies to solve specific tasks. If this is the teacher's goal then the teacher must be there.

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Our Own Tower of Babel: Describing Instructional Technology or Educational Technology Doctoral Programs

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Abstract: Many of us who teach those who will become tomorrow's professors have not found a way to clearly share what we do and find out what others are doing in their doctoral programs. Information the authors gathered about a variety of educational/instructional technology programs demonstrated the complexity and richness of doctoral programs in this area. This appears to be the right time for discussion of how we are alike and different and for the possible development of additional doctoral programs in the area. A better understanding of our missions, visions and language within this community will assist us in our conversations. Further, clarity in our program foci is reflected in program goals, university/grant-funded research opportunities for graduate students, employment options for graduates, and the hiring of appropriate faculty. This round table will discuss a project that aims to help build a common vocabulary and common understandings to encourage the conversation.

Predictive Relationships Among Certain Personality Factors and Novice Teachers' Use of the Newer Technologies

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Abstract: As a result of innovative technologies designed to enhance learning, today's teachers must learn to incorporate the newer technologies into instructional strategies. The present study examined the impact of certain personality types of Emergency Permit secondary teachers' inclination to use technology. A selected sample of 200 Emergency Permit teachers was surveyed using the Myers-Briggs Type Indicator and a questionnaire designed to determine the subjects' willingness to use technology. The Kruskal-Wallis one-way analysis of variance test was applied to each of the 20 items contained in the survey. Findings indicate that Intuitive-Thinking types of personalities were more likely to utilize technology in teaching while the Sensory/Feeling types were the least likely.

Introduction

The quality of public school education has been of grave concern since the Nation at Risk report in 1983 (National commission of Excellence in Education, 1983; Schlechty and Vance, 1981, 1983; Doyle and Hartle, 1985; Seely, 1990). Commission reports--The Twentieth Century Fund Task force on Federal Education Policy (Making the Grade), the Task Force for Economic Growth (Action for Excellence), and the National Science Board Commission (Educating Americans for the 21st Century) supported the growing alarm and called for changes in public education and reform in the preparation of teachers. Major concern in the U.S. today focuses on public education and teachers' ability to educate students for the 21st Century. One major challenge is the use or disuse of newer technologies available. The importance of a technology-based, integrated learning environment for students cannot be over emphasized since technological transformation is occurring

daily (Reed and Sautter, 1987; Crow and Buckley, 1988). As early as 1989, Dezell stated," We must work together to ensure that technology becomes a constructive force in children's lives (p.3)." Technology is an instructional tool that can lure students to engage actively in the learning process. Public schools must incorporate and transfer the use of technology into teaching methodology to successfully educate students for tomorrow's generation.

In addition to the use or disuse of technology in teaching, there has been an interest highlighting the types of personalities that tend to use or not use technology. Erdle, Murray, and Rushton (1985) found that specific personality traits of teachers are reflected in classroom instruction, especially through the teacher's use of various instructional strategies and material. They also found that a positive relationship existed between individual personality constructs and learning styles. Meisgeier and Richardson (a996) concluded that all personality types and learning styles of children in the classroom would receive direct benefits from teacher education and preparation programs that used the Myers-Briggs Type Indicator (MBTI) in preparing future educators. One of their more supportive findings stated that teachers and pre-service teachers knowing the implications of their MBTI, as well as their students' MBTI, may have a more global understanding of a useful framework for modeling instructional technology. In addition, they will be more likely to include it as a tool to focus on integrating the curriculum both vertically and horizontally. Research results support the use of the Myers-Briggs Type Indicator (MBPI) as a valid means of identifying the different types of cognitive styles and how individuals process information and make decisions. Once identified, the MBPI also describes how individual types make needed adaptations through self-reflection and personal growth (Lyons, 1984; Thompson and Borrello, 1986; McNickle and Veltman, 1986; Clark and Peterson, 1986).

Griddler and Stratton (1990) found that the MBPI results could be used to help teachers develop different teaching methods and more readily accept materials and technology. Studies indicate that extroverted, stable, and tough-minded personalities were more receptive to the use of the computer (Grant and Cambre, 1990; Katz, 1992). Knupfer (1989), in a study with elementary education majors concluded that a "sensing" individual desired direct access to technology but that a "intuitive" type was cautious and needed some prior training before initiating multimedia procedures. "Intuitive/thinking" types of intermediate/secondary teachers or those educators who are creative, analytical, logical, and imaginative are more receptive to the use of technology than the "sensory" types who are practical, realistic, and sociable (Sudol, 1991; Katz, 1992; Smith, Munday and Windham, 1993). "Sensory/feeling" types of teachers are interested in examining meanings and relationships and are least likely to be comfortable with technology that other personality types (Grindler & Stratton, 1990; Smith, Munday and Windham, 1993).

The 1995 NCATE standards have raised expectations for colleges of education for candidate and faculty use of technology in instruction and assessment. Wise, Leibbrand, and Williams (1997) state, "The challenge is how to change the situation so that teacher candidates are provided with a solid foundation in technology skills which they can use in the classroom. The accreditation standards will continue to have higher expectations for educators to utilize technology for teaching and assessment.

Instrumentation

The Myers-Briggs Type Indicator (MBTI), used to identify personality types, and a questionnaire designed to describe teachers' willingness to use technology were administered to collect data for the present investigation. C. G. Jung created and tested the MBTI model in his clinical practices, and Isabel Myers furthered the model through the development of the Indicator to make it possible to test and use Jung's theory with nonclinical populations. The instrument, developed through clinical experiences and supported by research, was created in the 1940's and revalidated in 1977 (Myers and McCaulley, 1985). In order to make practical applications of the instrument possible for research, the MBTI was published by the Educational Testing Service (ETS).

The MBTI is a widely used personality inventory with positive evidence of its construct validity (Thompson and Borelo, 1994). Mendelsohn (1965, p. 321) reported that "an unusually large body of reliability and validity data" has been completed on the MBTI. Test-retest correlation of approximately 0.70 were obtained for three of the indices and 0.48 for the fourth. Further, Mendelshon reported the internal consistency reliabilities (split-half) for the indices ranged from 0.70 to 0.80 (1965).

The MBTI, form G, is a self-administering questionnaire that has a 96 item in forced-choice self-scoring format. Scores generate eight basic personality preferences that assist individuals in understanding themselves and their behavior. Of these eight, this study used the following four: Sensory/Feeling (SF), Sensory/Thinking (ST), Intuitive/Feeling (IF), and Intuitive/Thinking (NT).

Background literature and similar studies guided the selection of questionnaire items for the technology questionnaire (Dezell, 1989; Callister & Burbules, 1990; Cicchelli & Baecher, 1989). A panel of six professional educators with expertise in the field of educational technology and who met criteria established by the researchers established content validity for the survey. The questionnaire contained 20 statements, with eleven of the 20 statements considered to elicit positive responses concerning the respondent's perception of his or her willingness to use technology. Nine items were considered to elicit negative responses on similar issues. A Likert-type scale was used to indicate the relative importance of each item. Number "6" on the scale indicated the lowest degree of acceptance, strongly disagree; and number "1" revealed the highest degree of acceptance, strongly agree.

Methodology

During the spring semester, 2000, a selected sample of 200 Emergency Permit teachers enrolled in university courses, SHED 515 and Reading 515 and who are currently teaching on an emergency permit contract in grades 7 -12, were invited to participate in the study. These teachers were employed in school districts on emergency permit teaching certificates in the Northeast Texas area. Data for this study was acquired from scores on a technology questionnaire and the Myers-Briggs Type Indicator (Form G). Demographic data was obtained from personal reports included in the questionnaire. Instruments were administered in a regularly scheduled class period by the researchers. Of the 200 teachers contacted, 149 returned both instruments with their responses.

Treatment

To assess the impact of teacher's personality types their willingness to use technology, the Kruskal-Wallis one-way analysis of variance test was applied each of the 20 items contained in the technology survey. For ten out of the twenty items, a significance difference between ranks were obtained ($p<.05$). For each of the ten significant items, a Mann-Whitney U test was applied to assess the impact of specific personality types – Intuitive/Thinking (NT), Intuitive/Feeling (NF), Sensory/Thinking (ST), and Sensory/Feeling (SF). Tables 1. and 2. provide a listing of the significant ($p<.05$) personality type pair-wise comparisons within each item.

Conclusions

Alternative certification program participants classified as Intuitive (N) were more receptive to the use of technology than Sensory (S) types. Pair-wise comparisons of personality types within ten of the technology survey items found significant differences between Intuitive associated and Sensory associated types. This conclusion is congruent with cumulated research on type-indicators and their relationship to teaching and learning styles (Grindler & Stratton, 1990). Smith, Munday & Windom (1993) found that Intuitive/Thinking (N) types of secondary teachers, those educators who are creative, analytical, logical, and imaginative, are more receptive to the use of technology than the Sensory (S) types who are practical, realistic, and sociable. They also discovered that Sensory/Feeling types of educators who are interested in investigating meanings and relationships are also least likely to be comfortable with technology than other personality types.

Within Intuitive types, a significant difference was found between Thinking (T) and Feeling (F) types on two technology survey items. Within Sensory (S) types, no differences were noted between Thinking (T) and Feeling (F) types.

	Comparisons				
	NT/NF	NF/SF	NF/ST	NT/SF	NT/ST
I enjoy using computers.		*		*	
I feel comfortable using a word processing program.		*		*	*
I can think of several ways to use computer software for instructional purposes.		*	*	*	*
I look forward to the time that telecommunication systems are in every classroom.		*	*		*
If my school district would pay the tuition, I would take an educational technology course.		*		*	*

(1) An asterisk (*) represents a pair of groups significantly different ($p<.05$). For each pair-wise comparison, the first personality type listed represents higher agreement with each statement.

Table 1: Mann-Whitney *U* Test Significant Personality Type Pair-Wise Comparisons, Positively Stated Items

	Comparisons				
	NF/NT	SF/NF	ST/NF	SF/NT	ST/NT
Using media & technology is more trouble than it is worth.				*	*
I feel very negative about computers in general.	*	*		*	*
I am not comfortable using technology in the presence of others.	*	*		*	*
I feel that instructional software is nothing more than an attempt to replace the teacher.		*	*	*	
I think that the use of instructional technology is best limited to certain subjects.			*		*

(2) An asterisk (*) represents a pair of groups significantly different ($p<.05$). For each pair-wise comparison, the first personality type listed represents higher agreement with each statement.

Table 2: Mann-Whitney *U* Test Significant Personality Type Pair-Wise Comparisons, Negatively Stated Items

Implications for Practice

Because of the emerging demand for teachers to use technology, the research data may add to the body of knowledge on professional development and be used by educators to modify and adapt programs and curriculum through the identification and individualization of the different personality types. This study suggests that those who are charged with educating preservice and novice teachers need to be aware of specific types of personalities that tend to use or not use technology as an instructional tool and their tendency to incorporate and transfer this information into a practical teaching methodology. Therefore, educators must support the call for change and reform in the preparation of teachers in order to successfully reduce anxieties often experienced by some novice teachers when challenged with the task of supporting alternate ways to align materials and their teaching styles with new technology-related projects and curriculum packages.

Teachers who are aware of their own and others' type profiles can develop different attitudes and teaching methods that will empower them to accept materials and technologies as well as help to facilitate the learning process of diverse student populations. In return, they will be able to provide a more solid foundation in educational technology which will improve the potential for each individual to develop those global technology skills needed to survive in a high-technological society. For effective training educators need to design programs for pre and in-service teachers that include descriptions of how different personalities can best use technology in the classroom with diverse students. Those individuals more inclined to use technology may be identified to work in interdisciplinary teams with others who are less successful using the newer technologies in the instructional process. Building on the ability of those personality types more inclined to use technology, provide models that could enhance the use of technology of others in schools.

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The Technology in Education Competency Survey (TECS): A Self-Appraisal Instrument for NCATE Standards

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Abstract: The Technology in Education Competency Survey (TECS v1.1) is a self-assessment rating form covering teacher competencies in major areas addressed by the National Council for the Accreditation of Teacher Education (NCATE) standards for the USA. It is intended for preservice educators interested in measuring the level of technology competency in their students. Preservice programs may wish to use this instrument as a posttest to determine if students, upon exiting, feel competent to use information technology in their future classrooms. TECS v1.1 may also be useful as tool to assess pre-post changes in classes that intend to teach integration techniques.

Introduction

TECS v1.1 is a self-report measure for use in assessing teacher education graduates' technology competency in six major areas: Professional Productivity, Project-based Learning, Problem Solving, Assisting Students with Special Needs, Teaching about Technology, and Ability to Use a Range of IT Learning Environments. The instrument was constructed using the ISTE guidelines contained in "Preparedness of Graduates" (ISTE, 1999) as a blueprint. Nine items were written to represent the areas listed in Table 1. Five-choice Likert rating categories (1= strongly disagree to 5 = strongly agree) were selected as the means of gathering responses. Normal completion time is less than 5 minutes.

TECS Content and Construct Validity

A factor analysis (ULS, Oblimin rotation) was carried out on data gathered from 188 preservice teachers and 44 university faculty in Texas during 1999-2000 in order to explore the underlying construct(s) of the scale. A scree plot of the eigen values produced by factor analysis indicated that either 1 or 2 factors existed in the data. Successive interval scaling (T-scale, Dunn-Rankin, 1983) performed on the same data indicated that the 9 items form a reasonable unidimensional scale. These analysis outcomes were judged to be sufficient evidence that the TECS has high content and construct validity.

Internal Consistency Reliability

This direct appraisal, 9-item form has yielded an internal consistency reliability estimate of .92 across 188 preservice educators and 40 university faculty (Christensen & Knezek, 2000). The instrument appears to consistently yield reliability estimates in the range that instrumentation authorities such as DeVellis (1991) would label "very good."

Contemplated Refinements

Psychometricians have suggested that removal of compound item components in items 1, 5, and 6 may further improve the scale. Future research is planned to determine if selecting just one descriptor of skill level for a given NCATE competency, rather than listing the several examples included in the specification, is sufficient. For example, deletion of the phrase "and implementing" from item #5, "I feel competent constructing and implementing..." may improve its measurement characteristics. TECS v1.1 is

currently available in the book, *Instruments for Assessing Educator Progress in Technology Integration* (Knezek, Christensen, Miyashita, & Ropp, 2000). It can also be found online at http://www.iittl.org.

Table 1. Items on the Technology in Education Competency Survey (TECS) v1.1

1. I feel competent using a word processor and graphics to develop lesson plans.
2. I feel competent using e-mail to communicate with colleagues.
3. I feel competent using the World Wide Web to find educational resources.
4. I feel competent using an electronic grade book.
5. I feel competent constructing and implementing project-based learning lessons in which students use a range of information technologies.
6. I feel competent to help students learn to solve problems, accomplish complex tasks, and use higher-order thinking skills in an information technology environment.
7. I feel competent in recognizing when a student with special needs may benefit significantly by the use of adaptive technology.
8. I feel competent about teaching K-12 students age-appropriate information-technology skills and knowledge.
9. I feel competent working with students in various IT environments (such as standalone and networked computers, on-computer classrooms, labs, etc.).

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The Role of Teacher's Mediation in the Development of Hypertext Projects

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Abstract: This research aims to investigate the role of teacher's mediation in the development of cooperative learning and autonomy. It was based on the constructivist and social interactionist learning teaching conception. In order to do that, we accomplished a longitudinal case study with genetic analysis of the occurrence of situations involving co-operation and autonomy among 8-10 year old children in the course of a work project using Microworld software. A field journal was organized by the teacher and four categories were used in its analysis: "Cooperative learning", "Autonomy", "Non-existent cooperative learning" and "Heteronomy". The increase of the two first categories and the extinction of the last ones were verified during the intervention, demonstrating the importance of teacher's intervention in the development of those characteristics.

Introduction

The current study, based on a constructivist and social/interact ional concept of the teaching-learning process, aimed to investigate how teacher's mediation in the construction of hypertext projects benefit the cooperative learning and autonomy development. In order to do so, a longitudinal case study was accomplished. It lasted five months, during which a genetic analysis about the rising of situations involving cooperation and autonomy among children engaged in the construction of a work project with *Micromundos* software (Logo language) took place.

We can consider the pedagogic approach adopted by the teacher as a guide to his/her work, either towards reproduction or construction of knowledge. Coll (1994), based on Deutsch's studies (1973), states that some investigations succeeded in demonstrating how cooperative learning experiences provide the establishment of more positive relationships among students than competitive ones. The students' connections became more friendly, attentive, respectful and helping.

Seidl de Moura and Oliva (1996) point out some of the cooperative working traits: it is a long term activity with a longitudinal evaluation of the student who should be able to overcome a plausible stipulated stage; it is a group with a common goal and co-helping elements; it is an active, dynamic search for knowledge through individual reading and sharing; the teacher should suggest about the task division; there should be a division of the material to be studied making everyone responsible for the knowledge to be collectively acquired; it should promote critical evaluation by presenting a topic, a subject to the students.

Socializing has been Vygotsky's study subject (1984). He affirms that social interaction has an essential role in cognitive development and identifies two child development levels that can be extended to any other

learner. The real development level, determined by one's capacity to accomplish the proposed task by him/herself and the potential development level which is determined through proposed activities achieved with help or cooperation of a more skilled person.

The gap between the real development level and the potential development level is known as the 'Proximal Development Zone' and that is where the learning process should be taking place. *"Already consolidated processed do not require outside interference to get started; on the other hand, processes yet to be structured do not benefit from this sort of interference"* (Oliveira, 1997, p.61).

According to Vygotsky (1984, p.60), *"(...) other people's interference really affects the results of an individual action"*, therefore social interaction is considered very important in the building of human psychological functions, promoting one's development.

"Other people" could be their own classmates, more capable or not, or even the teacher. Seidl de Moura and Oliva (1997) say that his/her classmates help the student's development during a cooperative activity, which does not depend on spontaneous formation but on *"a person who coordinates these interactions by distributing the prompting tasks. The teacher establishes certain objectives that should be accomplished by the group"* (p.3). However the partners for promoting the Proximal Development Zones are not always the more experienced ones: classmates with similar development level can be actors throughout this process for the significant amount of time they spend together.

As you can see, the child is considered an actor in the scenery and not a mere receiver of social interference. For that reason, he/she can assume multiple roles, having the opportunity to live meaningful experiences and interact with others, promoting the development of superior mental functions.

Newman, Griffin and Cole (1989) bring about the concept of construction zone, which amplifies the conception of proximal development zone. The construction zones are development-promoting spaces, where signification is traded, shared and interchanged. In these sites, the growth of the partners engaged in the trading and acquirement of a wide range of signification is very likely to occur.

Tudge (1996) calls our attention to certain studies, which could suggest that *children learn meanings, behaviors and adult technology during a process of collaboration* (p.152). As a result, the development of appropriated cultural forms happens because of the cooperation with grown ups or an advanced classmate. Beyond its social aspect, partner collaboration is an effective way of stimulating cognitive growth, and, to researchers based on Piaget, the social cognitive conflict would be its promoting agent. Nevertheless, the ones based on Vygotsky, have concluded, *"for interaction to be effective, children should work as a group towards a common goal"* (p.164).

Forman (1981, in Tudge, 1996) describes a research involving fourth grade children in which it was verified that during a certain age the individual does not think about coordinating his/her activities with the other classmates. Still, many of these children gradually grew more able of working in groups and even subordinating their own individual roles to a partner's, willing to accomplish a common objective.

Many studies have proved that children learn more historical concepts when working in groups than in individual activities, confirming that active participation towards a collective aim is a necessary element for collaboration and critical evaluation (Tudge, 1996).

Piaget (1977) deals with autonomy and heteronomy as he presents a study about the game rules in the book "The moral judgment of the child". According to it, two group of phenomena are connected to these rules: a) rule practice, or how they are applied and b) the consciousness of these laws, and either autonomy or heteronomy, which are inherent to the rules.

Through his studies of moral realism, Piaget (1977) concluded *"it seems like there are two distinct morals for the child"* (p. 170), as a result of experienced processes: adult moral enforcement and cooperation. The first one promotes heteronomy and moral realism while the second generates autonomy.

The last one begins to develop when the child discovers that veracity is essential to friendly relations and mutual respect. *"There is moral autonomy when the consciousness longs for an ideal independent from any external pressure. Without relationship there is no moral necessity"* (Piaget, 1977, p.172). In every connection to another person with unilateral respect, heteronomy can be found. Autonomy rises with reciprocity, mutual respect and necessity to treat others, as they would like to be treated.

To this author, cooperation and autonomy are always together what can be easily noticed by the statement that there are two types of respect, and consequently two morals: one is heteronymous and the other, autonomous or cooperative: *"Heteronomy provides objective responsibility as well as autonomy, natural to mutual respect, leads to subjective responsibility"* (1977, p.290).

Kamii (1988) defines autonomy, as being governed by one's self in opposition to heteronomy, that implies to be guided by another person.

According to her, children are gradually able to become more autonomous and thus more independent, being less guided by others. However, it happens only if adults adopt an attitude that promotes the development of autonomy. Any how, as she reviewed Piaget's theory, Kamii (1988) stated that adults reinforce children's natural heteronomy by using rewards and punishments.

The punishment has three different consequences: repetition of the act but this time the child worries about not being caught, obedience, which assures safety and respect, or reaction, which can lead to criminal behavior. Therefore, punishment strengths children's heteronomy, stopping the development of autonomy

According to Kamii (1988), Piaget has developed a new theory on how children learn moral values. While traditional conception believes that children assimilate such values from their environment, Piaget defends that, in order to acquire these principles, children must first construct them inwardly, by interacting with their environment. The outside does not absorb the values.

Autonomy is also developed intellectually and not only on the moral field, by using the same principle: knowledge construction should come from the inside instead of an outside insertion. Children acquire knowledge by creating and coordinating connections. This is what we call constructivism.

We believe that reporting this sort of educational proposal, which uses work projects and computers to promote an appropriated environment for developing a more cooperative and autonomous subjectivity, is a pertinent contribution to teachers because: *"a well-succeeded school performance would be the one that agreed to the student's potentials and demands, promoting their growth and creative production, motivating the assimilation of new knowledge and learning attitudes, comprehending life in its modern complexity"* (Novaes, 1999, p.105).

Method

Twenty-three students, ranging from 8 to 10 years old (third grade of elementary school), took part in the project. A longitudinal case study with a genetic analysis of the rising of situations involving cooperative learning and autonomy was adopted as the research model. It happened throughout a pedagogic intervention consisting of an interdisciplinary project with hypertext production. The theme, object of the interdisciplinary work, was included in the Social Studies program: "Rio de Janeiro at different times (Colony, Empire and Republic)". Other subjects were involved in the study, such as Geography, Science, Math and Portuguese Language, allowing the knowledge to be expanded and inter-related.

Fourteen topics on the yet to be researched subject matter were selected by the students (occupation of space, fauna, flora, water supply, illumination system, clothing, communication means, economic activities, sewerage, transportation means, alimentation, and significant historical and scientific facts.

During the entire project, there were various communication sources available to the students (videos, magazines, newspaper, CD-ROM, books, songs, suggestions of field trips), stimulating the group and bringing up interest and curiosity towards the subject. Besides there was a field trip to downtown Rio de Janeiro, in order to verify some researched aspects. The book adopted by the school was also very useful through written exercises, which helped to organize and register the data.

The activities were divided in seventeen steps, distributed along the weeks from August to December. First of all, an initial study was done with the whole group, then a series of researches about the selected topics of each historical period, a data assemblage, discussion, organization of the texts, seminaries, and finally, a test and computer implementation (through *Micromundos* software, based on Logo language).

During the initial study, some activities were used in order to prepare and stimulate the group, bringing up interest and curiosity towards the subject. Regarding the research, data assemblage, discussion and text organization, the students worked in randomly chosen pairs, trading places with each other every time the focused historical period changed. After organizing the reports on each period, the pairs presented seminaries sharing the gathered information with the rest of the group, which was then able to evaluate their work, make suggestions and select the words to go in the glossary. The computer implementation occurred, throughout the three periods, right after the seminar analysis. During the first week of December, by the end of the experience, the class determined what links should be used to connect the "knots" (information islands) developed by *Micromundos*. This moment of wrapping up the hypermedia was considered the climax of the entire process.

In its final form, the hypermedia presents a summarizing scene in the opening page with the elements referring to the three historical periods. Each aspect, including the ones not represented with drawings, has an icon, which enables the user to move on to the next page, holds an index of the included matters and presents the chosen subject in the historical periods.

On the next page there are three icons with the aspect name and the numbers 1, 2 and 3 that illustrate the following time periods: Colony, Empire and Republic. There is also another icon called "Voice" through which the user can hear the students' explanations on how to proceed when getting information about the selected matter. As one of the three icons is chosen, it moves on to the next page and a new topic is explained in the same way. The page contains information about the selected aspect and more icons leading to other pages with drawings, games and other topics.

In order to collect data, the teacher elaborated a field journal. The analysis was done through four different categories: 'Cooperative learning', 'Non-existent cooperative learning', 'Autonomy' and 'Heteronomy'. 'Cooperative learning' situations involved: interaction; shared action; sharing of information; respect to individual differences; negotiation practice; collective responsibility. Situations with opposite qualities were identified as 'Non-existent cooperative learning'. A situation of 'Autonomy' presented the following items: information search through different sources; ability to question, evaluate, gather and organize the most relevant information and capacity to take decisions alone. On the other hand, a situation of 'Heteronomy' was recognized by passive demand of information; acceptance of a transmitted knowledge or situation without questioning; incapability to take decisions.

Results and Discussion

The category frequency was grouped in three time periods. Teacher's mediation throughout the project allowed the rising of certain categories: 'Cooperative learning' (5 times during the first period, 20 during the second and 21 in the third) and 'Autonomy' (27 times during the first period, 39 during the second and 41 in the third); as well as the extinction of others such as 'Non-existent cooperative learning' (5 times in the first, 4 in the second and none in the third) and 'Heteronomy' (10 times in the first, 3 in the second and none in the third).

Categories Periods	Cooperative learning	Non-existent cooperative learning	Autonomy	Heteronomy
Period I	05	05	27	10
Period II	20	04	39	03
Period III	21	00	41	00

Table 1: Evolution of the frequency of the categories throughout each period

Data analysis verified that the students had learned to work in groups, becoming more autonomous and cooperative during the project implementation.

Cooperative work resulted from the teacher's planning and could be easily identified through some parts of the field journal, as can be seen in the following examples.

Group elements engaged in mutual support aiming to overcome difficulties:

> *Some pairs (three), which had finished their part before the others, offered help by giving tips of how to complete the implementation and explaining the right procedure to accomplish it.* (Santos 1999, p. 119)

Active search for knowledge, through individual reading and group sharing:

> *A couple of students (working in 'Transportation means used during Imperial Times') brought two books on different topics about Rio de Janeiro. After using the books and marking some pages considered relevant to the seminar, they offered the same material to other classmates.* (Santos, 1999, p.163)

Task division suggested by the teacher:

> *Each group organized the task division. Each student, from the three teams, was responsible for bringing a poster or drawing of a certain time period.* (Santos, 1999, p.111)

Division of the topics to be studied, making each member responsible for a piece of the whole:

> *The class was divided into five groups that had to look up more information about the Republican period using books and magazines. One of the students suggested that each group had a different theme in order to avoid gathering similar data.*
> (Santos, 1999, p.186).

Presenting a topic to the group, allowing critical evaluation:

> *The teacher explained about the procedures during the seminar (intervention if necessary to ask*

anything or suggest any change in the explanations and choosing of the words that should go to the glossary) and let the children decide which group should be the first one. (...) Every child stood up in front of the class; some held posters, others just stood aside and a student explained the topic. (Santos, 1999, p.112)

There was still another relevant topic, promoter of cooperative learning and that considers the act of 'explaining a certain subject that has been elaborated to somebody else', as one of the most efficient ways to attain cognitive restructuring. In the first group (republicans), two classmates talked about the system of government and architecture, while the others explained the drawings, representing what had been said before.

According to the analyzed authors, interactions of this nature allow the students, both the explainers and the listeners, to learn in a much more successful way.

Collective responsibility was also identified during the project:

During the video, one of the student's grandfather made an interruption and asked his grandson to leave the room for a moment. A few minutes later, the child returned with a smile and told the teacher that he would only leave after the video exhibition. The day after, the teacher found out that the student had explained to his relative that the video was very important for what he was doing, his group work and that it would be unfair with his partner not to stay. The little boy then asked his grandfather to wait by the school gate for he would meet him right after the end of the class.

(Santos, 1999, p.134)

During the discussions about the project, "concept controversies" (Coll, 1994) were verified, or in other words, *"a disagreement of ideas, information, opinions, believes, conclusions or theories among the members of a group, and a desire to reach common ground"* (p.89). These situations may also be described as social-cognitive conflict, in which the group members have different opinions but need to reach a common conclusion, generating intellectual progress:

During the presentation of the group about 'Water supply', there was a real mess and misunderstanding because they also talked about 'sewerage'. When the student started this part of the explanation, a girl said, 'that again? Thierry's group have already talked about it?' Another child replied: 'Let them finish and then we talk'. After the group was done... 'There is water in the sewerage, that's why we decided to talk about it.' But another element of the group said: 'No, that wasn't the reason. The thing was that Ariene gave us this material and we figured we could add it to our topic...' There was still another one that tried to explain...'It's ok, there is water in the sewerage, but it's dirty, it's not the same water they used to drink, take a bath, make food, and that was what your seminar should be about'. After a lot of discussion, the class decided to take this part out of their seminar and keep only the one about the water supply. (Santos, 1999, pp.145-146)

The occurrence of cooperative learning and autonomy was possible, mainly as a result of the attitude adopted by the teacher, based on the constructivist theory.

In a changing world, where things are gradually becoming more uncertain and unpredictable, it is necessary to prepare individuals to be agent of this transformation. Beyond adapting subjects, these individuals must be able to think by themselves and question any sort of proposal, either from work or society in general.

In order to accomplish that, the school ought to focus on the development of cooperation, autonomy and critical thought, which are fundamental features to a citizen to be a critical and questioning agent.

Unfortunately there are few elementary school projects like the one analyzed through this research. Generally, the schools emphasize activities involving competition or non-cooperative exercises.

Conclusion

We concluded that two aspects were essential for the work to succeed: teacher's mediation and its hypertext feature.

The teacher's mediation promoted a complete interaction among the students. They really learned to work as a group, respecting the classmate opinion and sharing their information and discovers.

In this context, the teacher did not adopt an attitude of merely transmitting information, going from simple to more complex concepts and stimulating the students to absorb the knowledge just to express it during a test. She acted as a mediator between the student and the information to be learned.

Therefore, the teacher promoted the student's contact with different subjects and sources, stimulating a critical analysis: *"learner and information emerged with new meanings after each contact, reflecting new knots, links of the extraordinary web of human knowledge"* (Civiletti & Araujo, 1997, p.244).

A hypertext project was possible by the use of *Micromundos*, authorship software that allows the

construction of multimedia pages (text, pictures, photos, music, moving images, etc.), which may be interlinked in a non-linear way: *"hypermedia production from authorship software may be considered a very useful pedagogic strategy because it is able to integrate different subjects, promoting a web-like knowledge construction"* (Civiletti & Araujo, 1997, p.245).

However, choosing 'constructivist' software did not guarantee a pedagogic use based on the same principle. It was viable because of the project context. Being constructivist is not an abstract conception. It is a responsibility of the educator. The teacher provided a propitious environment to the students, through which they could be active during the exercises, in a cooperative, autonomous and critical way.

The lack of linearity was presupposed in the project organization. Knowledge construction was not meant to be focused on "the master" but fragmented in multiple intersections among the students, in a collective search of information about some common interest. It happened when the different subject matters included in the project started to establish internal links, relating the groups and demanding discussions and analysis in order to effectively achieve these connections.

Actually, two hypertexts were developed. The first one involved the children themselves, who cheerfully collected data to produce knowledge and feed the knots and links yet to be negotiated. It represented unique moments, filled with friendship and learning. The second, a virtual reflection of the other, is also its recorded memory. Besides a rich source for future users, it proves that transformation is a perennial possibility.

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Infusing Technology in K-12 Classrooms: A Study of One Method Used to Evaluate the Impact of a Teacher-Focused Technology Integration Program

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Abstract: This paper describes one method used to evaluate a program designed to prepare teachers to integrate technology into the classroom so that children will become capable and confident users of technology. The method observed involved in-depth training conducted outside of teachers' school districts via the Teacher Leadership Program sponsored by the Bill and Melinda Gates Foundation in Washington state. A quasi-experimental evaluation method was used. Results showed significant improvements in teachers' computer attitudes, self-efficacy, and experience measured on a pre to post test basis. Responses on post-test only factors indicated that: (a) school districts did not contribute significantly to participant's technology infusion efforts; (b) teachers described themselves as collaborative, mentoring, confident integrators of technology, and (c) teachers perceived that student learning was being positively impacted.

Introduction

This paper examines the author's recent evaluation of a statewide technology infusion effort in Washington state. What evaluation method was used? Why? How was the evaluation implemented? What were the results of the evaluation? The focus of this paper is on HOW and WHY the specific evaluation method was used and administered. Results from the study are included in this paper in order to illustrate the kinds of findings which can be achieved by the evaluation method used. The research described in this paper took place in the context of the authors' Doctoral dissertation study. This paper provides an extremely abbreviated description of the study.

In the state of Washington, school administrators and teachers are being pressured to improve student performance on standardized exams and they are being asked to integrate technology into their curriculum. Factors supporting the development of exemplary computer-using teachers should be studied to determine their relative cost effectiveness and to demonstrate to administrators that teaching practices will change given time and an appropriate technology environment for teachers (Becker, 1994, p. 319). Research was conducted on 210 teacher participants of the 1999-2000 school year Teacher Leadership Project (TLP), sponsored by the Bill and Melinda Gates Foundation (the "Foundation") in Washington state. The training method observed involved seventy hours of in-depth training conducted outside of teachers' school districts. Participants received technology training, a laptop, and funding for technology for their classroom.

Conceptually, the research project consisted of six distinct steps: (1) Conduct research to build a scholarly foundation, (2) Identify research questions, (3) Determine methodology and develop or locate a research instrument, (4) Execute the study, (5) Analyze data, and (6) Present findings in context with the research questions. A discussion of the evaluation of the Teacher Leadership Project (TLP) follows. The TLP study is described in the context of these six research steps.

Case Study - Teacher Leadership Project

Conduct Research to Build a Scholarly Foundation

It is critical to take time to perform background research before executing a study. This step is the equivalent to scraping and priming a house before it is painted. The more thorough job that is done in preparation of the house (or in building the foundation for your evaluation effort) the better and more long-standing will be the results when the actual task – painting the house (or administering your study) – is performed. Take time to gather background materials and to discover how previous researchers have tackled evaluation projects similar to the one you face.

For the TLP study, a review of the literature regarding integration of technology into the classroom revealed that teachers will be much more likely to infuse technology into their curriculum if the following items are true: (a) training is available on the use of computers; (b) training is available on integration of computers into the curriculum; (c) the teacher has a sense of self-confidence; (d) the teacher believes that computers are, or can be, relevant to their role as a teacher; (e) the teacher is innovative; (f) the district has conveyed an expectation to the teacher supporting the importance of computers in the classroom; (g) technical support is available to the teacher; and (h) the teacher has peers to collaborate with regarding instructional uses of information technologies (Becker, 1994; Chiero, 1997; Evans-Andris, 1995; Koontz, 1992; Marcinkiewicz, 1994-1995).

The study of the TLP incorporated research from 51 recent studies, the majority of which involve research conducted within the past three years. These studies focused on identifying: (a) differences between exemplary computer-using teachers and "typical" computer-using teachers (e.g. Becker, 1994; Evans-Andris, 1995); (b) differences in technology infusion skills between pre-service and practicing teachers (e.g., Marcinkiewicz, 1994-1995; Rosenthal, 1999; Trilling & Hood, 1999); (c) specific hypothetical "causal factors" such as gender, age, classroom environment, and percentage of budget spent on technology where the researcher seeks to determine the significance of such factors in teachers' technology infusion practices (e.g. Busch, 1995; Loyd & Gressard, 1984a); (d) the current level of teacher technology infusion skills and "best practice" factors which lead to technology infusion excellence (e.g. Peck, 1998; Smith, 1995); (e) the relationship between positive classroom experiences and self-efficacy (e.g. Ertmer, et. al, 1994; National Science Foundation, 1984-1989); and (f) the relationships among computer self-efficacy, attitudes toward computers and the desirability of learning computer skills (e.g. Bandura, 1997; Zhang & Espinoza, 1998).

Identify Research Questions

As the saying goes, "If you don't know where you are going, how will you know when you've arrived?" Properly designed research questions provide a study with direction. In a sense, when designing the study you "reverse engineer" the study to identify what you want to know at the conclusion of the study. Design research questions with the conclusion of the study in mind. The research questions also allow the researcher to narrow the focus of the study so that a methodology and a research instrument can be identified.

In the case of the TLP, the following research questions were identified at the beginning of the study and were answered by the study:

1. Is there a significant change in the level of computer attitudes, self-efficacy, experience, and frequency of use of computers among the participants following the 10 month treatment?
2. What level of support have participants received, from their school districts, for technology infusion?
3. What are participants' perceptions of the impact technology has had on their role as teacher?
4. What are participants' perceptions of the impact of technology infusion on their students' learning experiences?
5. What impact do demographic variables (number of years of experience teaching, age, gender, and grade level taught) have on CASE scores, teacher perceptions of district role, teacher perceptions of their own role, and teacher perceptions of the impact the training has had on student learning?

Develop or Locate Research Instrument

Instrument Design: A Computer Attitudes, Self-Efficacy, and Experience (CASE) assessment instrument was designed by the researcher for this study. The CASE was modeled after three instruments – the Bath County Computer Attitudes Scale (BCCAS) by Bear, Richards, and Lancaster (1987), the Computer Self-Efficacy Scale (CSE), developed by Murphy, Coover, and Owen (1988), and a measurement of Computer Experience as described by Moroz and Nash (1997a).

The instrument consisted of four parts. Part One contained attitude items modeled after the BCCAS. Part Two included items of computer self-efficacy modeled after the CSE. Part Three asked computer experience questions in a format similar to that described by Moroz and Nash. Part Four asked demographic questions. The CASE pre-program questionnaire included 21 questions pertaining to attitudes about computers, 18 questions regarding computer self-efficacy (perceived computer skills), and 13 questions that measured computer experience. A six-point scale was used to measure attitudes and self-efficacy. Teachers were asked to rate the extent to which they agreed or disagreed with each statement, on a scale where 1 = strongly disagree and 6 = strongly agree. Computer experience was measured on a five-point scale, where 1 = never use and 5 = use daily. In addition to these questions, four demographic questions were asked regarding (a) the number of years of teaching experience, (b) participant age group, (c) participant gender, and (d) grade level taught.

Computer Attitudes: The BCCAS was selected as the model for the attitudinal component of the CASE because it has been used with several large groups of elementary grade level students as well as with adult populations, and it has been found to effectively measure overall attitude towards computers (Francis & Evans, 1995; Katz, Evans & Francis, 1995; Moroz & Nash, 1997b). Developed by Bear, Richards, and Lancaster (1987), the original BCCAS questionnaire included thirty-eight Likert items designed to assess attitudes toward computer use. Some items were worded positively (e.g., "I enjoy learning about how computers are used in our daily lives"); others were worded negatively (e.g., "Reading and talking about how computers might be used in the future is boring").

Self-Efficacy: A variety of studies have examined the relationship between computer self-efficacy and other attributes. Miura (1986) suggested that self-efficacy may play an important role in a person's acquisition of computing skills. Self-efficacy is defined as an estimation of one's ability to successfully perform target behaviors to product outcomes (Bandura, 1986). Self-efficacy theory proposes that individuals who judge themselves as capable (efficacious) to perform certain tasks or activities will tend to attempt and successfully execute them (Murphy, Coover, & Owen, 1988).

Busch (1995) defined self efficacy as "the belief in one's ability to execute successfully a certain course of behaviors" (p. 174). Miura (1986) found that self-efficacy impacted a person's understanding of the importance of computers in the future and she found that self-efficacy could be used to help predict an individual's intention to learn about computers. Woodrow (1991) asserted that students' attitudes toward computers played a key role in their success with computer classes and with self-paced computer materials.

Bandura (1997) encouraged the development of an instrument designed to measure teacher self-efficacy for a specific domain, such as computer self-efficacy. "Teacher's sense of instructional efficacy is not necessarily uniform across different subjects. Thus, teachers who judge themselves highly efficacious in mathematical or science instruction may be much less assured of their efficacy in language instruction and vice versa. Therefore, teacher efficacy scales should be linked to the various knowledge domains" (p. 243).

The Computer Self-Efficacy Scale (CSE) was chosen as the model for the self-efficacy component in the CASE instrument. The CSE scale was developed by Murphy, Coover and Owen (1988) to measure perceptions of respondent's capabilities regarding specific computer-related skills and knowledge. The scale employs a 5-point Likert-style response format, with each question preceded by "I feel confident." A high score indicates that the person has a high level of confidence in his/her ability to use computers. The CSE has been found to have a high level of validity when administered to groups of adults and students.

Computer Experience: Research has shown that the amount of experience a person has with computers will significantly impact that person's assessment of their computer self-efficacy (Ertmer, Evenbeck, Cennamo, & Lehman, 1994; Loyd & Gressard, 1984a; Loyd & Gressard, 1984b). It has also been shown that computer experience and computer anxiety are interrelated (Loyd & Gressard, 1984b) and studies have found a link between computer experience and attitudes about computers (Bear, Richards, & Lancaster, 1987; Delcourt & Kinzie, 1993; Loyd & Loyd, 1985; Moroz & Nash, 1997a; Zhang & Espinoza, 1998).

Exemplary computer-using teachers have been found to spend more than twice as many hours personally working on computers at school than do "typical" computer-using teachers. Only a small difference has been found in computer use at home between typical and exemplary computer-using teachers (Becker, 1994, p. 307). Computer experience questions in the CASE, were developed to collect data pertaining to the respondents' computer-related activities – distinguishing between computing activities performed at work and those performed at home. Questions ask the respondent to select appropriate indicators of computer usage that describe the intensity and consistency of activity rather than asking for indicators that would measure the length of time they spend on that activity. This method of measuring computer experience based on <u>frequency</u> of activity rather than <u>temporality</u> (time on task) has been employed in a variety of studies (Chiero, 1997; Hudiburg, 1990; Mitra, 1998; Nash & Moroz, 1997; Zhang & Espinoza, 1998).

Demographics: Demographic questions on the CASE, include: (a) number of years the respondent has taught, (b) respondent age range, (c) respondent gender, and (d) grade level of students the respondent teaches. Research indicates that exemplary computer-using teachers have more years of teaching experience and more years of exposure to computers than the typical computer using teacher – exemplary computer-using teachers had taught their subject for three years longer than other computer users, and they had used computers for about one year longer (4.0 years versus 3.2 years) (Becker, 1994, p. 309).

Post-Program Questions: The post-test instrument was enhanced by the addition of questions arising from the literature and geared to provide insights in the areas of: (a) school district role in participant's technology infusion efforts, (b) teachers' perception of their teaching role upon exit of the TLP, and (c) teachers' perception of the impact their technology infusion efforts are having on student learning.

Execute the Study

Pre-test data collection took place at the start of the first week of training for each participant (July and August, 1999). Two-hundred and twenty-five surveys were collected during administration of the pre-test. At each (of seven) initial training sessions, attendees were given a copy of the CASE (Computer Attitudes, Self-Efficacy, and Experience) instrument and were asked to randomly select a small manila envelope from a collection of similar envelopes. Each envelope contained two adhesive mailing labels, each label displaying a printed control number unique from other participants' number. This control number, adhered to pre and post assessments, guaranteed respondent anonymity while providing a mechanism to correlate pre and post program data for each participant.

Post-test data collection took place at eight locations across Washington State on April 29, 2000, the last day of the final TLP-sponsored training session attended by the 1999-2000 school year's participants. In early April, participants were instructed by the Foundation to reserve their place with the appropriate regional coordinator for the location at which they planned to attend. The Foundation provided the researcher with a list of participants by location. Sealed envelopes containing the matching control number were sorted by region and forwarded, along with surveys, survey instructions, and post-paid return envelopes to the regional coordinators. Regional coordinators administered the surveys the morning of the last day of the last TLP training session for this group. Completed surveys were returned to the researcher.

Gather and Analyze Data

Initially, all of the data were analyzed using descriptive statistics. Frequency scores, mean scores, and standard deviation scores were computed for all Likert scale responses for all response items – both pre and post treatment. A total CASE score for each individual was calculated to measure TLP impact pre and post test. In order to answer research question number one, which asks whether there were significant differences in teacher responses pre to post treatment, t-tests for correlated samples were calculated for each of the 62 CASE factors. Research questions number two, three, and four were answered based exclusively on the results of descriptive statistics calculated on post-treatment data (questions 61-74, which were used to answer research questions number two, three, and four, appeared only on the post-instrument). Two statistical routines were utilized to answer research question number five, which asks whether there was a significant relationship between CASE factors and demographic factors. A Pearson correlation score was calculated to determine if a significant relationship existed between the first demographic factor (number of years teaching) and CASE scores pre, post, and case-change (post minus pre score). Oneway Analysis of Variation (ANOVA) statistics were calculated to determine if a significant relationship existed between the three other demographic factors (age range, gender, and teaching grade level) and CASE scores pre, post, and case-change.

Present Findings in Context with the Research Questions

Results of this study led to seven conclusions:

1. Teacher's computer attitudes are significantly higher following the TLP.
2. Teacher's computer self-efficacy is significantly higher following the TLP.
3. Teacher's computer experience is significantly higher following the TLP.
4. Teachers perceive that school districts provide little support for TLP participants' technology infusion efforts.
5. TLP participants' perceive their role as a teacher to be dramatically different from the classical role of the teacher as the "sage on the stage."
6. Teachers perceive that students benefit from technology infusion efforts.

7. Participants' age, gender, number of years teaching experience, and grade level taught do not significantly relate to CASE scores.

Summary

Research can be exciting, rewarding, and enlightening. Take the time to do the "scraping and priming." Reverse engineer your study and determine ahead of time what you want to know when the study is completed. Avoid creating your own instrument – get permission to utilize existing instruments if possible. Make sure you are gathering data that will allow you to answer the research questions. Carefully analyze the data and report your findings in the context of the original research questions.

The Teacher Leadership Project (TLP), has concluded its third year and has reached more than 400 teachers. Interestingly, the focus of the TLP training model is not on computer use (the "which button do I push" kind of class), but rather the focus is on helping teachers learn how to adopt a mentoring, collaborative teaching style. Training emphasizes use of discovery learning lessons with the appropriate use of technology as a tool to improve student achievement. Sixty of seventy hours of training focus on: discovery learning, technology infusion, and teacher collaboration. About 10 hours of traditional computer application training is provided, nevertheless, the minimum computer experience score doubled on a pre to post test basis indicating a substantial increase in the frequency of use of computers by even the least experienced respondent.

A new environment is emerging in the classrooms of TLP participants. Students often become teachers, and teachers learners. Students are engaged, curious and interested in active inquiry. They have begun collaborating with each other and serving as peer mentors. Teachers have adopted a mentoring, collaborating style of interacting. And through regular meetings and workshops, teachers had the opportunity to share and learn from their peers' new strategies.

Research conducted by the National Center for Educational Statistics (NCES) found that only 20% of the 2.5 million teachers who currently work in public schools feel comfortable using information technologies in their classrooms (Rosenthal, 1999). In contrast with the NCES finding, the majority of participants in the 1999-2000 Teacher Leadership Project indicated overwhelmingly that they are comfortable using information technologies in the classroom. Participants reported that they enjoy using computers (99% positive response), they feel school is a better place with computers (100% positive response), they indicate a positive self-efficacy score on a variety of computing tasks, and they uniformly believe (99% agreement) that student learning is being positively impacted due to participants' technology infusion efforts.

The author hopes this abbreviated description of the Teacher Leadership Project evaluation will provide one more example of an evaluation effort that future studies will build upon.

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Teachers' Perceptions of Self-Efficacy and Beliefs Regarding Information and Communications Technology (ICT)

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Abstract: The aim of this three-year project is to develop information and communications technology (ICT) competencies in both nursing students and teaching staff by means of, implementing technologies into a graduate nursing program offered throughout the province of Quebec, (Canada). Through reviews of the literature and experience from other colleagues, we have learned that actors' motivation is essential for the success of such a project. Our first step was the identification of teachers' perceptions of efficacy and beliefs. These two concepts were then examined in an exploratory research with a mixed research design. In all, twenty-four nursing professors participated, and findings indicate that they perceive themselves as being more efficient in basic level ICT, and less so in advanced ICT. Nevertheless, the research sample in general expressed their belief in the importance of integrating ICT in graduate students' curriculum.

Introduction

During the past four years, nursing professors have been involved in initiating a master's degree in nursing, which has become effective since September 2000 in five universities throughout the province of Quebec, (Canada). These five universities work together as networked learning environments (Chute, Sayers, Gardner, 1997) to ensure that graduate studies are accessible to nurses in all Quebec regions. We anticipated that this geographic layout would represent a big challenge in terms of allowing a specific teacher's expertise to be available to students from all institutions; however, we feared that both actors, students and teachers, would eventually feel isolated.

Integrating information and communication technology (ICT) in the program offers interesting possibilities in terms of enhancing access to knowledge and promoting networking activities. We wanted to create a learning community on the web, that is, a community of practice, which could stimulate energy exchange between the program's partners. We feel that the use of video-conferencing, e-mailing, and the creation of a technological learning environment, etc, seem to provide interesting answers to the needs of both teachers and students. Referring to experiences in the United States, we observe that since 1995, one third of all superior education institutions offer distance-learning opportunities (Cravener, 1999). Amongst them, nursing teaching experiences can be found (Milstead & Nelson, 1998; Cravener, 1999). In Europe, the Open University in England is a leader in distance education. Closer to home, in Quebec, a growing number of experiences have been attempted by colleagues, but never to the extent of offering a full graduate program. Cloutier, (1999) deMontigny & al, (1997, 1999) agree that appropriating information technology is a major challenge for all actors involved. For most of these projects, the conclusions appear quite similar; for one thing, the leaders are thrilled with the existing possibilities however, at some point, they doubt that their colleague teachers and students involved have the intention or the capabilities of really integrating the technologies into their everyday work. Many of these projects have their grounds in the leader's will but do not proceed from the actors' wishes.

In order to implement technologies into our master degree program, we developed a three-year project called MÎSTIC, (Maîtrise en Sciences infirmières intégrant les Technologies de l'Information et de la Communication). The purpose of MISTIC is to develop competencies in both students and teaching staff, thus facilitating integration of information and communications technology. Knowing, (from our colleague's experience and upon reviewing the literature) that the actor's "intention" is a fundamental aspect in the success of such a project, we first attempted to consult around us. We were in fact, unable to make a description of teachers' knowledge or abilities pertaining to information technologies, although we were aware that there were variations and disparities. It was obvious that our first step had to be the proper identification of teachers' perceptions of efficacy, learning needs, beliefs and motivation (Cloutier & al, 2000). This paper presents nursing teachers' self-efficacy perceptions and beliefs relating to information and communications technology.

The study

This study's objectives are to identify nursing teachers' self-efficacy perceptions and beliefs. This exploratory research has a mixed research design, and the instruments combine both quantitative and qualitative items. A self-efficacy perception questionnaire was devised for this research, based on Bandura's definition of personal self-efficacy, in which he states that beliefs are built by an individual regarding his abilities to mobilize his motivation, his cognitive resources and the behaviours necessary to meet the demands of a given situation (Bandura, 1991; Ozer & Bandura, 1990; Bandura, 1996). The twenty items questionnaire was constructed by a team of three professors and was submitted to two expert judges for content validity. Qualitative data concerning beliefs relating to obstacles and facilitating factors in the use of information and communication technology were gathered. Beliefs were defined as: "the conviction that a subjective reality is the truth" (Wright, Watson & Bell, 1996, p.41). According to these authors, constraining beliefs decrease solution options to problems, whereas facilitating beliefs increase solution options. ICT was defined as usually accepted technologies of communication and information, such as cyberspace, e-mail, discussion groups, chat, video-conferencing, etc. For this study, we distinguished between basic techniques and advanced techniques; the former referring to daily teaching and research activities (for example, e-mailing) and the latter referring to more specialized activities requiring mastery of basic techniques (for example, creating a web page).

Participation was anonymous and on a voluntary basis. Twenty-four nursing professors participated by filling in an online questionnaire, which was available on a web site for a ten-day period. This questionnaire, which the creation in itself was a technological innovation, is presently being used in an independent study carried on by Pothier (2000). It allows data to be compiled into descriptive statistics, which are automatically transferred into a data base.

Participation rate was 73%, which is considered acceptable. According to Polit and Hungler (1999), a response rate greater than 60% is sufficient for most purposes. Among the participants, 50% (12) were in the 40-49 year age group, as illustrated in tab.1. Of the twenty-four participants, 83% (20) were women and 17% (4) were men.

	Nursing teachers N (%) T=24
20-29 years old	0 (0)
30-39 years old	5 (21)
40-49 years old	12 (50)
50 and over	7 (29)

Table 1. Distribution of nursing teachers by age group.

Data Analysis

Data were recorded using Microsoft Excel and Oracle and content analysis was performed with the qualitative data.

Findings

Nursing teachers' self-efficacy perceptions of ICT

Analysis of self-efficacy perceptions revealed that nursing teachers perceive themselves as mastering all basic information and communication techniques, except for participating in group discussions, and using and upgrading anti-virus software. Nursing teachers perceive themselves as being limited in terms of their efficacy in using their university's library web site (tab. 2).

Item	Basic ICT	I could not do it (%)	I could reasonably do it (%)	I could certainly do it (%)
1	Operating a computer	5	0	95
2	Creating a backup copy	5	0	95
3	Using an anti-virus software	14	29	57
4	Using a text editor	0	5	95
5	Using a presentation software	9	0	91
7	Using e-mail	0	5	95
8	Using a browser	5	0	95
9	Using a web search tool	5	14	82
13	Participating in a discussion group	24	24	52
20	Using the library web site	14	14	73

Table 2. Nursing teachers' self-efficacy perceptions of basic ICT.

In terms of advanced information and communication techniques, nursing teachers perceive themselves as being efficient in the use of multimedia material. Few however were able to create web pages or transfer data on the web with FTP (tab.3).

Item	Basic ICT	I could not do it (%)	I could reasonably do it (%)	I could certainly do it (%)
6	Data base	23	32	45
10	Creating web pages	50	35	15
11	Using ER (Electronic Reserves)	20	25	55
12	Using FTP protocol	29	50	21
14	Using a scanner	12	18	71
15	Treating images	22	33	44
16	Using a multimedia room	19	10	71
17	Video-conferencing	33	10	57
18	Computerizing references	26	26	47
19	Chatting	20	25	55

Table 3. Nursing teachers self-efficacy perceptions of advanced ICT.

Nursing teachers' beliefs in ICT

Facilitating beliefs

As for beliefs, we found that the majority of nursing teachers (85%) believe that ICT should be used in nursing graduate studies (tab. 4). They are also convinced that ICT could improve their way of teaching and the students' learning. We observed that the motivation to use ICT was high in this group (84%). The nursing teachers felt they were supported in their experiences with ICT with sufficient equipment (84%) and available expertise (74%).

Constraining beliefs

Nursing teachers hold some beliefs that can be seen as obstacles when using ICT in teaching-learning experiences. For example, 60% of the participants mentioned that the lack of time was an important restraint, and 50% felt the cost of the equipment was a limitation factor. Several of the teachers consulted believe that the development of such activities needs further recognition from their peers.

Interestingly, although nursing teachers perceive themselves as being competent with ICT, a large proportion doubt (75%) that their students have the abilities to work with ICT.

Beliefs	Importance
Facilitating beliefs	
I think it is important to integrate ICT in my teaching	85%
I am interested in using ICT in my teaching	84%
The equipment necessary to use ICT in my teaching is available in my institution	84%
I think that ICT will allow me to improve my teaching	80%
I think that ICT will improve students' learning	80%
The expertise offered in my institution facilitates using ICT in my teaching	74%
I possess the abilities required to integrate ICT in my teaching	65%
Constraining beliefs	
Students do not possess the abilities to use ICT	75%
There is little time available; this restrains my using ICT in my teaching	60%
The cost of equipment required to use ICT retrains my using ICT	50%

Table 4. Nursing teachers' beliefs in integrating ICT in education

Limits

One of this study's limitations took its root in the complexity of technical concepts that are sometimes difficult to translate into a simple question. This could have biased the answers, since technical terms may have been misunderstood. Considering the fact that some teachers did not answer the questionnaire, we assume that some teachers did not have access to a computer or, were unable to access the web site even though a technical support was available for them in all institutions.

Conclusion

When new elements are introduced into teaching-learning situations, it can be expected that teachers will perceive these as important stressors, especially when these changes are imposed from the outside and when the time required to learn how to use technologies is time taken away from course content development (Akerlind & Trevitt, 1999). In this context, the study sample's positive attitude about ICT integration in teaching stands out. This may be attributed to the fact that most nursing teachers in these institutions are mature professionals who have experienced a variety of instructional methods in their career, and are thus more able to adapt to novelty. According to Bandura & Wood (1989), an individual's history of success and failure and his past experiences are his most significant sources of information to evaluate his abilities and limits.

In the end, our findings are not unusual. For instance, Roblyer's (1993) reports that usually, teachers quickly recognise the importance of using technology in teaching situations. Self-efficacy theory stipulates that an individual's self-efficacy perceptions will influence the quantity of effort he is likely to put into an activity and the length of time he will maintain his effort in spite of obstacles and failures met (Stretcher, de Vellis, Becker & Rosenstock, 1986). Considering this study's results, we are lead to believe that the participants will be persistent in integrating ICT in their teaching experiences.

Even though most teachers realize the importance of integrating ICT in their curriculum, different obstacles encountered often hinder their efforts, such as: difficulties working with a new software or the fear of negatively affecting their teaching performance (Ertmer, 1999). These apprehensions can be found in the qualitative data,

despite the overall positive comments. It is clear that both pedagogical and technical supports are important aspects of integrating technology in the curricula. This leads us to recommend: an investigation of nursing professors' learning needs regarding ICT, training sessions to meet those needs, and finally, a re-evaluation of self-efficacy perceptions following the training sessions.

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Academic Product Assessment: A tool for graduate action research assessment

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This research project examines a systematic assessment process as part of the Educational System Design (ESD) model, derived from work at Vanderbilt University by the Cognition Research Team and by Charles Reigeluth at Indiana University at Bloomington. The ESD model outlines four principles of effective learning environments: Problem-Based Learning, Scaffolding, Deepening Learning, and Collaboration. The research will explore the use of a formative assessment tool within this educational model. As part of Gannon University's M.Ed. Cohort program, academic portfolios are required as a final synthesizing activity. A part of this portfolio is the Applied Master's Project (AMP), an ongoing action research project. Students in the cohort program are to design, construct, and implement a research project over the course of the 18 months of cohort coursework. The AMP project is to be incorporated as a component of each of the six core courses, advancing the project from design and construction, through implementation and culmination. Research indicates that feedback, provided at key stages in the portfolio development process, results in improved final products. Providing effective feedback during this course should contribute to product improvement. Questions are raised however, about the type of feedback provided and the mechanism for providing this feedback.

The use of portfolios has emerged in recent years as a mechanism for students to demonstrate their subject knowledge and skill proficiency. In the area of fine arts and English, portfolios have a documented history and specific purpose. In these curricula, students assemble a collection of their best work to present for final evaluation. Each element of the portfolio has undergone a process of design, construction, and revision.

Inherent in portfolios is the understanding that these collections represent the student's best work. It is understood that each product has undergone the design, construction, and revision process. Portfolios are a work in progress and feedback is an important part of the portfolio's development. How the feedback is gathered and used plays a significant factor in the quality of the final product(s). When the final portfolio is presented, reviewers expect to see the highest quality work possible from the student.

At the time of the final portfolio submission, reviewers use some criteria to evaluate the portfolio products. The assessment instruments are typically rubrics, which the student may have been using to guide and direct the portfolio's design and construction. There may be a separate rubric for each item in the student's academic portfolio, making evaluation a maze of rubrics. More often, one standard assessment instrument is applied to each portfolio product or applied to the portfolio as a whole, focusing on global learning goals.

The review process is the focus of this research initiative. In this project, a standard assessment tool (Academic Product Assessment Form – APAF) was used to provide direction and guidance in the design and construction of portfolio products, through its use in providing feedback to students. This assessment tool was derived from the work of Reigeluth and Reis. Feedback was provided through assessment by peers and contemporaries.

There appear to be a number of unique features in this research project, which address some of the criticisms of portfolio use and academic product assessment. It was the goal of the research initiative to address the following objectives: determine the utility of the Academic Product Assessment Form (APAF) in evaluating components of a Master's degree Applied Master's Project and Portfolio; examine the use of this assessment tool as an integral part of a comprehensive assessment program; establish reliability and validity of the Academic Product Assessment Form (APAF).

The Academic Product Assessment Form (APAF) is a modified version of the Student Product Assessment Form (SPAF) designed and constructed by Drs. Joseph Renzulli and Sally Reis at the University of Connecticut. The original assessment form was designed to be used as a formative assessment tool used by younger students in enrichment programs. The form used in this study incorporated the same nine categories used in the original format. These included eight (8) individual dimensions: Statement of Purpose; Problem Focusing; Level of Resources; Diversity of Resources; Appropriateness of Resources; Logic, Sequence and Transition; Action Orientation; Audience. A ninth category incorporated seven (7) descriptors used for the

Overall Assessment of the product. These included: Originality of the idea; Achieved objectives stated in plan; Reflects familiarity with subject matter; Reflects a level of quality beyond what is normally expected; Reflects care, attention to detail, and overall pride on the part of the student; Reflects commitment of time, effort and energy; Reflects an original contribution. The category descriptors were revised only to eliminate the use of terms referent to younger students, school, or age. The item descriptions were modified to reflect the project at hand and the adult students engaged in the project. Four additional items were included in the assessment form. These came from the Gannon Cohort Applied Master's Program Manual, detailing the current evaluation criteria for the program.

As part of Gannon University's M.Ed. Cohort Program, academic portfolios are required as a final synthesizing activity. A part of this portfolio is the Applied Master's Project (AMP), an ongoing action research project. Students in the cohort program are to design, construct, and implement a research project over the course of the 18-month program of study. The AMP project is to be incorporated as a component of each of the six core courses, advancing the project from design and construction, through implementation and culmination.

Students enrolled in Technology as a Change Agent (GC 654) were to advance their AMP project as part of the course. Students electronically posted an abstract of their project. Learning teams were formed and these teams evaluated each other's projects and assisted in resource building throughout the course. Each cohort member presented their project at the last class meeting for the course. This session was set up using a conference format, where students presented either during a poster session or oral presentation. At this class meeting, colleagues provided input to presenters of each poster and presentation. The daylong conference was intended to provide each cohort student an opportunity to develop and present what may become a part of a final portfolio presentation for the M.Ed. program. Graduate students enrolled in the Cohort Master's Program offered through Gannon University's School of Education were recruited to participate in the study as part of a course within the core program of study. Data from the APAF is currently be collected and reviewed.

Students were asked to complete the Academic Product Assessment Form for each of the poster and oral presentations, scheduled to take place during the last day of class. Confidentiality of student information was assured through a process of random coding. The instructor and research assistant's assessment forms were not included in the research data. A copy of each completed assessment form was returned to the each student in the course for his/her project. Students used this input as they continued to develop their projects and prepare for their final portfolio presentation. A second collection point is being planned at the final portfolio presentation of each student, where evaluators will be solicited to complete the APAF on a voluntary basis. The forms will not be used for grading, but may be copied and given to the research participants. All evaluator names will be eliminated from the APAF in all cases.

At the current time, this research project has implemented the phase one collection process. This has generated over 500 assessments on 48 projects and presentations. These have been completed by cohort peers. Some general observations have been included in this stage of research progress. The use of one standard assessment device for the variety of portfolio projects and presentations has benefits and limitations. Although a customized form for each individual project would be preferred, this would require that the device be conceived at each project's initial creation and then would have to be modified throughout the project life. An alternative form might be constructed around each of the eight core courses in the program of study, with the hope that students would integrate something from each of these courses. This creates another series of issues due to the diversity of projects in which students are engaged. Students have found the form easy to use with minimal orientation to the item descriptions. The ranking scale (1 to 5) has not discriminated adequately the projects on any particular scale. In effect, cohort peers are being rather generous in rating each others' projects.

As students in the cohort program undergo their final portfolio presentations, faculty reviewers will be asked to complete the APAF for specific portfolio products. These reviews will be examined for internal consistency and inter-rater reliability, and then compared with peer assessment reliability data and previous studies using this instrument. Additionally, assessments conducted by M. Ed. Students and cohort faculty reviewers will be compared on specific products and students to examine variations between peer and contemporary assessments. This study is expected to continue through the academic year 2001-2002, initially focusing on the establishment of the instrument's reliability and face validity. As cohort student complete their portfolio presentations, additional reviews will be conducted as sufficient data becomes available.

Student teachers' information technology experiences in schools

Alison Elliott

Step into many elementary classrooms and it's like stepping into a time warp. Classrooms look, feel and operate much the same as they did in the 1970s. While many teachers use computers to support children's learning in meaningful ways, most in-class use of computers is minimal and has changed little from the drill and practice and story writing models of the 1980s (Marcinkiewicz, 1994-95, Elliott, 1998). With information and communication technologies (ICTs) now so widely available in schools and the community, the possibilities for classroom adoption are ripe. Yet, few elementary school students' experiences of ICT, and especially in the early years of schooling, encapsulate the potential of the technology to enliven, enrich and individualise learning.

The reasons for teachers' limited adoption of ICTs, even in schools that are well resourced, have perplexed researchers and policy makers. Further, limited classroom use of computers has implications for pre-service teacher educators who rely on partnerships with schools to provide student teachers with experiences of contemporary pedagogies, curriculum content and classroom management. As teacher educators, we expect that during school professional experiences (practicum and internships) students will be involved in a range of first hand, authentic teaching experiences that complement university-based teaching, including ICT experiences.

At the same time, policies and practices in teacher education affect students' engagement with information and communications technologies and are important in shaping pre-service teachers' attitudes to adoption and integration. In Australia, the document *Computer Proficiency for Teachers* (1997) represented an attempt to ensure greater awareness of contemporary computer needs in schools, to specify the ICT competencies required by beginning teachers, and to remind teacher educators of their responsibilities to prepare students for teaching in an information and knowledge oriented society (DET, 1997). Clearly, teacher educators must continually strengthen applications of information and communications technologies across their programs if student teachers are to gain relevant pedagogical understandings, attitudes and skills. Explicating ways of using the technologies in an integrated manner must be a cornerstone of teacher education curricula. Concomitantly, student teachers must have opportunities to work with children in classrooms as they use information and communications technologies, including the internet.

In NSW, almost all schools have good access to technology, infrastructure, and teacher support, but many have done little to adapt instructional processes to capitalise on ICT access, strengths and flexibility. While schools are known as inherently conservative entities (Rizvi, 1993), reluctance to embrace ICT to focus on improving educational outcomes is of concern to education policy makers, and to teacher educators.

There is considerable evidence showing that student teachers have only limited opportunities to experience computer use in classrooms (Bosch & Cardinale, 1993; Downes, 1993; Elliott, 1996; 1998; Hunt, 1995; Yang & Holthaus, 1997).. From a teacher education perspective, cooperating teachers' limited modelling of computer use in teaching and their seemingly negative or ambivalent attitudes to ICT, are not conducive to developing student teachers' ICT competencies.

Translating information and communication technology from the policy documents and marketing brochures into classroom practice has been an elusive goal over past decade. Clearly though, developing future teachers' expertise in hamessing ICT to provide meaningful leaming opportunities in classrooms is important for current teacher education programs.

The aim of this paper is to report student teachers' ICT experiences in some 60 early childhood classrooms (Kindergarten to Year 2) during recent pre-service professional teaching periods in greater Western Sydney. Drawing on both quantitative and qualitative data I document student teachers' perceptions of children's in-class information technology activities and identify some characteristics students associated with computer-using teachers. The purpose of highlighting student teachers ICT experiences and their perceptions of computer-using teachers is to articulate some of the qualities that might be capitalised on or complemented in building programs to support teachers' ICT competence. In particular, a clearer understanding of characteristics of computer-using-teachers might ensure that teacher education programs can better prepare students to deal with realities of classroom situations where computers are not widely used because teachers are not particularly committed to improving practice through adoption of relevant ICT support. Student teachers may also be better prepared for the more hostile situation where specific strategies are needed to counter teacher pressures, often subtle, to adjust to the way things are and maintain the status quo (Britzman, 1991). Finally, greater knowledge of the classroom situation may help us better prepare student teachers who find themselves having to persuade well meaning, but technologically novice classroom teachers to "allow" them to observe and use computers in class.

Finally, reference is made to the computer enactment model for teacher education proposed previously (Elliott, 1999b) and its role in helping teacher educators develop partnerships with schools to support student teachers' ICT experiences during professional experience programs.

Method

After completing a 4 week block teaching practice on K-2 classrooms in elementary schools in the western suburbs of Sydney, NSW, 60 student teachers completed a short questionnaire probing the nature of the computer experiences encountered in schools and participated in focus group discussions about characteristics of teachers who embraced ICT in their classrooms.

Results and Discussion

Consistent with previous studies (Elliott, 1996, 1998, 1999b), results from the present research showed that most students had limited opportunities to observe computer use in day-to-day classroom practice. All students reported that teachers had access to computers in their classroom or adjacent space, in a dedicated computer room, or in the library. A few had access to computers on multiple sites. Over the four week period, nearly half the student teachers (43%) estimated that each child in their class used computers for less than 15 minutes per week. Two students reported children did not engage in any computer-based learning activities while at school. A further 25% estimated that each child had 20-30 minutes of computer use per week and 16% estimated that children spent about 35-45 minutes engaged in computer activities. Only 5 students reported that children in their classrooms had over one hour of computer use per week.

Again, as noted in earlier studies of student teachers' experiences in schools (Elliott, 1996, 1998, 1999b), the main types of activities observed in the classroom were word processing for story writing, some directed maths activities (number recognition, counting, shapes), reading electronic books and some word recognition and spelling. Only five students saw children using the internet; in each case activities related mainly to the Olympic games; emailing athletes, tracing the journey of the torch, and other Olympic-related activities. Internet use occurred only in classrooms where children averaged over 35 minutes of computer use per week.

There were a number of cases where children went to a dedicated "computer room" for "computer lessons" with a "specialist teacher" on a weekly basis. In several cases "computer lessons" were held in the library. In five cases, the only computer-based activities for children were those provided by the student teacher as part of the practical requirements of the professional experience. Two students claimed that children in their classes had no computer use of any sort during the 4 weeks and that they were "not allowed" or "not able" to complete the university required computer tasks with children.

In classes where student teachers reported that children averaged 20 minutes of more computer use per week, and computer activities were initiated by the regular classroom teacher rather than a "specialist computer teacher", terms such as "motivated", "creative" and "involved" were often used to describe the cooperating teachers. The main distinction though, between descriptors of teachers in these more "computer-active classrooms", as opposed to classrooms where computer use was less evident, was teachers' apparent strong "communication" with parents, their "excitement" about teaching, their positive attitudes, motivation, and enthusiasm, and their "confidence", and expertise in teaching. In some cases, the teacher described as "fantastic" or "excellent".

Focus group discussions with student teachers based in classrooms where children averaged in excess of 35 minutes computer use per week suggested that cooperating teachers articulated a strong commitment to ICT use in learning, were good classroom managers, and tended, generally, to be involved in a wider than normal range of school activities. One teacher, for example, was the school's "computer coordinator", another the head of the junior school, and another the "choir leader". Indeed, good classroom management strategies have long been regarded as a cornerstone to effective teaching (Stannard, 1995) and in most cases students commented that their cooperating teacher was a "great organiser" and always "very busy".

That only 10 students claimed that each child in their class had in excess of 35 minutes of computer use per week, and 5 reported experiences in excess of one hour per week, hardly points to a major classroom adoption of ICT. Nor is there any indication that children are having *too much* computer use. Further, data do not show that computer-based activities were particularly innovative. Indeed, even in the high-use classes, most children engaged in the standard word processing, and basic skill-type activities associated with reading and math. There were no apparent differences between the types of activities in high-use and low-use classes, except for internet use.

As discussed elsewhere (Elliott, 1996; 1998; 1999b), that student teachers had few opportunities to observe teachers and children using ICT in every-day classroom situations is not surprising given the limited integration of computers in the enactment of curriculum. And, as also mentioned previously, the situation is affected not so much lack of appropriate technology, but rather lack of teacher commitment to changing pedagogy to facilitate enactment and integration of technologies (Elliott, 1999a).

In the light of the present findings, it seems teachers are not confronting the main tasks that must be addressed before change of any type, and in this case, adoption of ICTs can be effected. A major tenet of organisational theory is that effective organisational structures and directions can be shaped around tasks (Bolman & Dealo, 1997; Scott, 1998) and, in turn, that tasks are pivotal for shaping teachers' work (Rogoff, 1990). In the case of ICT, three main tasks confront schools- fostering new understandings of ways teaching and learning processes can be supported through use of ICT; promoting and supporting use of ICT in classrooms; and building partnerships between school and community through the use of ICT.

As shown previously (Elliott, 1999a) individual teachers must be prepared to reconstruct their conceptions of pedagogy to embody less teacher-centred notions about learning and embrace more fundamentally democratic understandings, beliefs and values about classroom practice. Further, major changes to classroom structures and pedagogies needed to adopt ICT will not occur until teachers both understand and commit to change. Change occurs only when participants construct new understandings of the tasks and processes, not simply when technical innovations are introduced.

From a teacher education perspective, it is important that cooperating teachers are able to support student teachers' development of ICT competencies. Part of teachers' professional role is inducting new teachers to the culture and practice of teaching in all its complexities. Thus, efforts to enhance beginning teachers' ICT skills must involve partnerships between teacher educators and classroom teachers. Using computers to enhance classrooms learning should be as important as guiding learning and practice in more traditional aspects of pedagogy and curriculum.

Explicating ways of using and managing information technology to complement and support children's learning must be an integral part of teacher education curricula. Importantly, student teachers must have authentic opportunities to work with children as they use information technologies, including the Internet, to complement and support their learning. Adoption of an ICT enactment model (Elliott, 1999b) can assist in developing partnerships between teacher educators and schools. Significantly, such a model proposes joint ownership and collaboration between teacher educators, student teachers and teachers. In such partnerships teachers must work as co-creators of new pedagogies that embody ICT, because for changes to be lasting they must be accompanied by new values and understandings.

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Comparison of Student Rating of Instruction in Distance Education and Traditional Courses

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Abstract: This study examined differences in student perceptions of course and instructor effectiveness in distance education and traditional courses. The type of distance education examined was a two-way interactive TV. Three different modes of course delivery were studied: (1) distance education off-campus, (2) distance education on-campus, and (3) traditional on-campus. Eight instructors taught a course using each method of delivery. On-campus students in traditional courses perceived the course and the instructor as being more effective than their off-campus peers in distance education courses. The magnitude of difference between the means was large.

Introduction

The term "distance learning" describes any instructional arrangement where the teacher and learner are geographically separated (Moore & Thompson 1997). Distance learning, sometimes described as distance education (DE), home study, correspondence study, independent study, or external studies, has been an alternative method for delivering university-level courses for almost 300 years. Correspondence education was invented in the late 19th century to enable learners to receive instruction when they could not attend traditional classes (Moore & Thompson 1997). Today, the more popular term for this type of learning at a distance is distance education.

Moore and Thompson (1997) describe effective distance education as requiring communication between the instructor and learners through media and new approach to instruction. Currently, distance education incorporates many alternative education opportunities, a significant number that involve emerging technologies such as two-way interactive TV, video, and web-based or web-enhanced instruction.

Keegan (1988) suggests that there are six defining characteristics of distance learning. First, there is separation of the teacher and the student (i.e., separation vs. face-to-face in the same classroom). Next, there is a

component not typically found in most on-campus courses, the influence of an educational organization (e.g., department or college) in the planning, preparation or delivery of material (vs. a stand alone instructor responsible for content generation and delivery of course information). Third, there is the use of technical media. Historically, this technical media has been print, but as technology advances, electronic media (computers, TV studio delivery, computer software presentation packages) will be added to a list of technical options. The fourth defining characteristic is the provision for two-way communication. This could be via a telephone conference with a single student, or a group of students at a central location at a prescribed time. Another defining characteristic is the possibility of an occasional seminar. This would be the opportunity for students working independently, to assemble as a group in the presence of the instructor.

The last defining characteristic as illustrated by Keegan is participation of the most industrialized form of education. Simply said, the industrialized form of education means a division of labor. Basically, there would be a team of individuals involved in the preparation and delivery of course content. Members of the team could be a content expert (e.g., a faculty member in elementary education, for a course offered from that program), graphic illustrators, who for all practical purposes, have no knowledge of the content, but, take the content and bring it to life with related illustrations, and a "TV personality," an individual trained to work in the presence of the camera and a TV or radio announcer's voice to deliver the content.

Although distance education has been viewed to be effective by some, in the eyes of others it has been seen as something less than education typically received on a university or college campus. In studies of various types of distance education, comfort and convenience were repeatedly cited as positive elements of the distance experience (Moore & Thompson 1997). Essentially, students in these studies like the convenience of distance education, but if given the choice to be in the same room with the instructor, most students will choose the personal contact.

Research on the effectiveness of distance learning is sparse. For example, a comprehensive historical review of technology research in special education does not mention distance learning (Woodward & Reith 1997). Moore and Thompson (1997) reviewed research on learning outcomes and attitudes for students in higher education. The studies included in their review reflected no differences in cognitive factors (amount of learning, academic performance, achievement, and exam and assignment grades) between the distance classes and traditional classes.

Other factors (e.g., student satisfaction with the course, comfort, convenience, communication with instructor, interaction and collaboration between students, independence, and perceptions of effectiveness) had more mixed results in the Moore and Thompson review. In the majority of the studies where interaction was studied, the distance condition seemed to negatively affect opportunities for interaction between students and with the instructor. In contrast, distance condition was found to positively affect collaboration and interdependence among students, in addition to support for independent learning activities.

Comfort and convenience were repeatedly cited as positive elements of the distance condition. However, a promising characteristic of one of the studies described distance education as "an acquired taste." Students reported that the more experience that they had with distance education technology and conditions, the more comfortable they became with the course and mode of interaction (Jones 1992). Perhaps the lessening of "distance tension" would allow students to enjoy the benefits of distance education (e.g., comfort, convenience) to a greater extent. Spooner, Spooner, Algozzine, and Jordan (1998) assert that learning, attending classes, and obtaining information should be enhanced via distance learning.

Initial support for the "no difference phenomenon" in higher education was provided by Spooner, Jordan, Algozzine, and Spooner (1999) who compared student ratings in two special education courses in a masters-level curriculum sequence for students in the area of severe disabilities when each was offered on campus and off campus. Additionally, student ratings were compared when distance classes via two-way interactive TV were taught at local and remote facilities. Student evaluations suggested no differences for overall course means. Organizational ratings were similar for a methods course taught on campus and at a distance, but were different for a curriculum course. When outcome measures for on-campus students vs. off-campus students were examined no differences were found in the overall ratings. Ratings for course, instructor, and communication were similar across settings and courses. Ratings for organization were similar for a curriculum course taught on campus, but were different for a methods course.

The purpose of this study was to empirically compare students' perceptions of (a) course effectiveness, (b) instructor effectiveness, and (c) overall effectiveness of the instruction in distance education (DE) courses, both off- and on-campus locations, and traditional on-campus courses. The courses included in this study are part of a graduate program in special education in learning disabilities.

Method

A quasi-experimental study was conducted to examine differences between DE courses, both off- and on-campus, and traditional on-campus courses. The independent variable was mode of course delivery – DE off-campus, DE on-campus, and traditional on-campus. To control for the effects of instructor and course topic, the same instructor and same class were taught under all 3 conditions; that is, each instructor taught the same course under the DE off-campus, DE on-campus, and traditional on-campus conditions. Students self selected into the type of class they would attend. A questionnaire was administered to students at the end of the course to evaluate their perception concerning course effectiveness, instructor effectiveness, and overall effectiveness of instruction. The instructor was not present when the questionnaires were administered and all responses were anonymous.

Participants

All participants were graduate students enrolled at a large university in the southeast United States. Most students were white (89%) females (91%) and worked full-time (83%). All courses were required for graduation by all participants.

Treatment

This study examined three modes of course delivery – DE off-campus, DE on-campus, and traditional on-campus. All the DE courses were delivered using a two-way interactive TV that allowed for real-time interaction between the instructor and students. The only difference between the DE off-campus and DE on-campus was the location of the instructor. Typically the instructor taught the class from the on-campus location. Students in the DE off-campus viewed the lesson from the two-way interactive TV screen. Students enrolled in DE off-campus classes met in a community college classroom fully equipped with video and audio communication equipment. The traditional on-campus classes were taught with the instructor and students in the same classroom.

Instrumentation

The questionnaire consisted of 23 items that examined course effectiveness (e.g., This course had clearly stated objectives), instructor effectiveness (e.g., Instructor was able to simplify difficult materials), and overall satisfaction with the course. Each item was answered on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5). The questionnaire consisted of three domains, (1) course effectiveness (items 1-11), (2) instructor effectiveness (items 12-18), and (3) overall course effectiveness (items 19-23). The domain scores were calculated by averaging all the items within the domain with scores ranging from 1 to 5. Coefficient alpha internal consistency reliability estimates were 0.98 for all 23 items, 0.95 for the scale that evaluated the course effectiveness (items 1 to 11), 0.95 for the scale that evaluated the instructor's effectiveness (items 12 to 18), and 0.94 for the overall course evaluation (items 19-23).

Results

Eight instructors teaching eight different courses that were required in a graduate degree program were examined in this study. A total of 261 DE off-campus, 106 DE on-campus, and 176 traditional on-campus students completed and returned the questionnaires. Student results were aggregated to the class level and used in the analyses; that is, the mean class scores were used in the analyses.

A series of repeated measures ANOVAs was conducted with one within factor (i.e., mode of course delivery) to determine differences between the three modes of instruction. The means, standard deviations, *F*-values, and effect sizes (*partial* η^2) for each domain (course effectiveness, instructor effectiveness, and overall course effectiveness) are reported in Table 1. The means for the DE off-campus were lower than those of the on-campus courses in all the domains. The DE on-campus courses had lower means than the traditional on-campus courses. In addition, there was greater variability in scores for the DE off-campus courses.

There was a statistically significant difference between the mode of course delivery for all three domains. The mode of course delivery accounted for a large part of the explained variance (η^2), ranging from .33 to .41. Follow-up analysis (dependent *t*-tests) indicated that there were statistically significant differences between the DE off-campus courses and the traditional on-campus courses; large effect sizes (Hedges, 1981) were found for (a)

course effectiveness (g=1.16), (b) instructor rating (g=1.14), and (c) overall course effectiveness (g=1.10). There were no statistically significant differences between the DE off-campus courses and the DE on-campus. In addition, there were no differences detected between the DE on-campus and traditional on-campus domain scores.

	Distance Education				Traditional			
	Off-Campus		On-Campus		On-Campus			
Domain	M	SD	M	SD	M	SD	F	Paritial η^2
Course Effectiveness Rating	4.13	.50	4.36	.33	4.56	.15	5.61*	.33
Instructor Rating	4.13	.59	4.47	.30	4.63	.20	4.77*	.40
Overall Course Rating	3.85	.69	4.28	.39	4.43	.29	4.79*	.41

* p<.05

Table 1: Descriptive Statistics, Repeated Measures ANOVAs, and Effect Sizes for the Three Domains

To better understand the differences between the mode of delivery, each item was examined. Examining the course effectiveness items (Tab. 2), there were statistically significant differences for items 3, 4, 5, 8, and 9. Follow-up analyses indicated that the mean differences were between the DE off-campus and the traditional on-campus courses. The magnitude of differences between the means was large, ranging from .97 to 1.34. There were no differences between the DE off-campus and DE on-campus or the DE on-campus and the traditional on-campus course means.

	Distance Education				Traditional			
	Off-Campus		On-Campus		On-Campus			
Item	M	SD	M	SD	M	SD	F	Paritial η^2
1. This course had clearly stated objectives.	4.34	.52	4.54	.24	4.68	.11	2.02	.22
2. The stated goals of this course were consistently pursued.	4.25	.45	4.41	.31	4.60	.15	2.92	.30
3. I always felt challenged and motivated to learn.	3.90	.60	4.32	.39	4.49	.16	4.37*	.38
4. The class meetings helped me see other points of view.	4.15	.40	4.37	.37	4.56	.27	4.12*	.37
5. This course built understanding of concepts and principles.	4.17	.51	4.45	.32	4.62	.17	4.20*	.38
6. The practical application of subject matter was apparent.	4.13	.62	4.43	.43	4.60	.22	2.46	.26
7. The climate of this class was conductive to learning.	4.12	.59	4.15	.39	4.55	.22	2.71	.28
8. When I had a question/comment I knew it would be respected.	4.20	.59	4.62	.24	4.69	.13	4.48*	.39
9. This course contributes significantly to my professional growth.	4.00	.58	4.27	.44	4.53	.15	3.93*	.36
10. Assignments were of definite instructional value.	4.08	.52	4.26	.44	4.54	.16	3.03	.30
11. Assigned readings significantly contributed to this course.	4.03	.45	4.20	.47	4.34	.25	1.32	.16

p<.05

Table 2: Descriptive Statistics, Repeated Measures ANOVAs, and Effect Sizes for the Course Effectiveness Items

Examining the instructor effectiveness items (Tab. 3), there were statistically significant differences for all items except item 13. Follow-up analyses indicated that the differences were between the DE off-campus and the traditional on-campus courses. The magnitudes of differences for all items were large, ranging from .83 to 1.42.

	Distance Education				Traditional			
	Off-Campus		On-Campus		On-Campus			
Item	M	SD	M	SD	M	SD	F	Paritial η^2
12. Instructor displayed clear understanding of course topics.	4.45	.49	4.75	.26	4.76	.19	3.73*	.35
13. Instructor was able to simplify difficulty materials.	4.06	.72	4.44	.42	4.59	.29	3.00	.30
14. Instructor seemed well-prepared for class.	4.33	.58	4.63	.36	4.69	.19	4.57*	.39
15. Instructor stimulated interest in the course.	4.09	.66	4.46	.38	4.59	.30	5.16*	.42
16. Instructor helped me apply theory to solve problems.	3.95	.56	4.36	.39	4.52	.24	4.77*	.41
17. Instructor evaluated often and provided help when needed.	4.02	.60	4.31	.37	4.65	.18	5.29*	.43
18. Instructor adjusted to fit individual abilities and interests.	4.04	.62	4.36	.32	4.58	.26	4.28*	.38

Table 3: Descriptive Statistics, Repeated Measures ANOVAs, and Effect Sizes for the Instructor Effectiveness Items

Examining the overall course effectiveness items (i.e., items 19 to 23), there were statistically significant differences for all items. Again, follow-up analyses indicated that the differences were between the DE off-campus and the traditional on-campus courses. The differences were large, ranging from .83 to 1.20.

	Distance Education				Traditional			
	Off-Campus		On-Campus		On-Campus			
Item	M	SD	M	SD	M	SD	F	Paritial η^2
19. Instructor had an effective presentation style.	4.06	.66	4.50	.35	4.54	.33	5.07*	.42
20. Instructional methods used in this course were effective.	3.97	.65	4.34	.39	4.52	.28	3.96*	.36
21. Evaluation methods were fair and effective.	4.09	.56	4.50	.26	4.56	.25	4.22*	.38
22. This course is among the best I have ever taken.	3.40	.81	3.79	.64	4.18	.43	4.61*	.40
23. This instructor is among the best teachers I have known.	3.70	.80	4.25	.47	4.36	.30	5.14*	.42

Table 4: Descriptive Statistics, Repeated Measures ANOVAs, and Effect Sizes for the Overall Course Effectiveness Items

Summary

The results suggest that on-campus students perceive their courses and instructors as being more effective than the off-campus DE students. Students in the off-campus sections consistently rated the course and instructor lower than both on-campus groups. The students in the DE off-campus courses reported (a) not being as challenged

and motivated to learn, (b) lower opinions about the extent to which the class meetings helped them see other points of view, (c) lower opinions about the course building understanding of concepts and principles, (d) less feeling of respect, and (e) lower opinions of the contribution of the course to their professional growth. In addition, the DE off-campus students rated the instructor lower in (a) displaying clear understanding of topics, (b) being prepared for class, (c) stimulating interest in the course, (d) applying theory to solve problems, (e) evaluating often and providing help when needed, and (f) adjusting to fit individuals abilities and interests.

Universities that base instructors' performance on student evaluations should be aware that teaching DE courses might present disadvantages to overcome. What can be done to address the potential hazards? Spooner, Algozzine, Flowers, Gretes, and Jordan. (1998) suggest seven strategies that can be used to facilitate faculty/student interaction at a distance, so that the students at the remote sites believe that they are connected to their peers and the instructor in the studio classroom on campus. These techniques include: (a) establishing weekly agenda that goes beyond the syllabus, (b) facilitating a weekly student share to encourage class participation, (c) establishing off-line small group discussion with reporting, (d) tapping sites and individuals at remote sites for questions, (e) encouraging across site questioning by students, (f) traveling to remote sites for broadcast (each site one per semester), and (g) playing off of your local audience.

Other variables which will likely impact on the instructor's ability to reach students at remote sites, in addition to altering presentation style might be the overall size of the class. The instructor will likely have to work harder at making ALL students feel included as part of the group when the collective numbers approach 50, as opposed to as smaller number of students. A second important variable, and one that could potentially affect the evaluation outcomes is the number of times that the instructor delivers a course at a distance. The more practice the instructor has and the more times that s/he is "on the air" will also likely impact that individual's ability to be effective at reaching those students at remote sites. The type of presentation equipment (e.g., white board "on the fly" writing, or prepared overhead material, or material developed with electronic presentation software with appropriate images to illustrate content) that the instructor uses to deliver the content is another variable that could likely affect the outcome of student evaluation of instruction as well. Regardless of the approach taken to address potential problems and difficulties when teaching at a distance, there is a clear need for additional research evaluating implementations of improvement strategies and their effects in distance education courses.

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A Model for Courseware Development (MCD)

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Abstract: Today's educational requirements have forced the traditional institutions to introduce technology in the education and modify the teaching-learning process in order to maintain curricula updated and cope with the constant changes. Although this is a costly and time consuming task there is still not a proper methodology which would help authors to carry out this task. The model proposed in this paper (MCD) is a systematized way for designing/redesigning computer technology-based courses (coursewares), based on their learning goals. This model is a formalization of a set of successful strategies applied by the authors, in the design/redesign courses in the computer science area.

Introduction

Most of the existing courseware development tools have a very poor support for the course design and redesign, especially for curriculum design if any. This may be a serious drawback of them, because the evolution of technology and knowledge is demanding courseware authors to continuously update and/or redesign their courses. This task is difficult, slowly and costly, so we think it is important to define one which can be easily embedded in a courseware development tool or used for complementing the work did by these tools, in order to support a clear and systematic methodology for designing courseware. We introduce here such a methodology, based on the hierarchical definition of the course's pedagogical goals. This methodology called "MCD".

The proposed model (MCD) arises as a formalization of the authors' experience in the process of design and redesign of a courseware in order to improve the achievement of its learning goals. The course is called "Software Engineering Workshop" and it is part of the curriculum of the Computer Engineer of the Catholic University of Chile. Many design principles of the software engineering were used for defining MCD, adapting them to the courseware design (Jackson, 1999). We also used some ideas taken from the Artificial Intelligence area, especially those used for designing curriculum in Intelligent Tutoring Systems (ITS). In the next section we present the proposed model, and finally, the conclusions of this work.

A Model for Courseware Development (MCD)

The proposed model offers a guide, step by step, to design a course and then to build a courseware based on this design. The model is based on the prototype development model used for software engineering (see figure 1), which is very easy to adapt it to the design/redesign of a course.

The model has tree stages: The first stage called the "course design" consists in the hierarchical definition of the specific goals and restrictions of a course. The second stage consists of the development of the curriculum which will be used to implement the courseware. We understand the curriculum as the selection and logical sequencing of the learning material in order to achieve the learning goals. Finally, this implementation is tested to find errors or weaknesses. In order to do the reengineering of the course, it is important to implement feedback mechanisms about teaching/learning process, in order to identify each wrong or weak strategy to replace it, and each successful strategy to repeat it and maybe to extend it.

In the design phase we have defined three steps. The first step is called "goals design" in which a hierarchical goals tree is defined. The root of this tree is represented by the overall goal of the course. The nodes of the second level of the tree will define the chapters goals, and the nodes on the third level will be the sections goals. Several cycles can be employed to get a final goals design and it can involve people such as lecturers, assistants, students, and experts in the course domain. The reason for organising the goals in a hierarchical way (tree) and with this organizing the whole courseware in this way is because it is the most natural way for human beings to organize things in their mind (Novak, 1998). Beside the nodes that represent the goals this tree has another type of nodes called "means". Goals are intermediate objectives that contribute to achieve the main goal, means are the activities that should be executed, to reach the designed goals. These are the leaves of the tree.

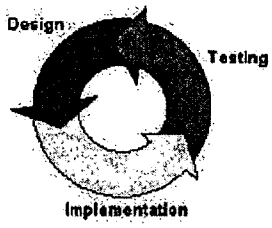

Figure 1. Proposed Development Model

The second step of the design phase is called "means design". In this step, the activities/contents (means) to reach each goal are selected and designed. The combination of one activity and the computer-based learning material, which will support this activity (content), is called a mean. For example, a mean to satisfy a certain goal could be "the expositive presentation of the topic 1". The activity associated to the mean is the "expositive presentation", and the content associated is the "topic 1". In this stage, the duration of the mean (activity) should also be designed. These means can be student's means or teaching means, and both have different graphical representation on the tree. A student's mean is an activity for which the student is the main responsible to carry out.

On the other hand, the teaching means are the activities whose main responsible is an instructor (lecturer or assistant). An activity node is graphically represented as a rectangle while a goal node with a circle. The third step is called "means sequence design" and its goal is to organize the means as a sequence of activities which will implement the teaching-learning process to reach the goals. Once step 2 is concluded, it may be necessary to establish the implementation constraints among means of different branches, in order to achieve the goals. Normally there will be many possible means sequence, while keeping the constraints specified in by the tree. For that reason, the goal of this phase is to design the most appropriate sequence of activities. To carry out this task, it is necessary to sequence the teaching and student's means in two separate sequences. After that, both sequences should be joined to get the final course means sequence. Once this sequence is defined, it is possible to establish the course schedule. The sequence of the teaching means allows lecturer and assistant to fin out wether the time to be spent in each one is the appropriated, as well as whether the mean sequence is correct. In the "implementation" phase, all activities and course contents are created and linked together to get a courseware. This courseware will help the lecturer to carry out the teaching-learning process, and to get the course's goals. To build a courseware we use a framework of educational software components that permits to implementers to create a course assembling and adapting this predefined components. Thus, this is a way to reuse existent learning material.

Conclusions

With the proposed model we want to define a methodology that will systematize the design process of a course which will take place in the context of a normal high education institution in a simple way. As it was mentioned in the introduction, the proposed model is a formalization of a design and redesign process used by the authors on a software engineering course. This process has been carried out five times for three years. The student's performance in the course has improved notably with every redesign, indicating that this strategy may be correct. Recently the same methodology has been used to redesign the "Groupware Workshop" course also with good results. Part of the course design can be validated before its implementation, which it can reduce the product's development time and cost (Jacobson, 1999). Besides the courseware, a very important product that can be obtained applying the model is the course's activity plan (or course's schedule). This activity plan is generated automatically based on the course's final design. The construction of the courseware itself is carried out assembling the software components. Therefore, this model also promotes the reuse of the content and knowledge structures (like chapters, sections, etc.) of a courseware content in other courseware, thus reducing the efforts in the generation of future courses and improving the quality of the final product (Boehm, 1999).

Acknowledge

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ABSTRACT OF DISSERTATION
The University of Alabama Graduate School

Degree: Doctor of Philosophy Major Subject: Instructional Leadership

Name of Candidate: Jenka Keizer

Title of Dissertation: A Study of Social and Academic Uses of the Internet by High School Students

This research studies how ninth-grade students in a fully computerized, K-12, affluent school use computers for educational purposes and in their personal lives. The target population for the study was the student body from the American School Foundation of Mexico City (ASF), a K to 12 American-type school with an American curriculum for over 100 years, and 2,400 students. The survey also included parents and teachers.

The qualitative and quantitative surveys revealed that students use the Internet from one to three hours daily, and the predominant use is as a personal communications tool. Students are knowledgeable about precautionary measures that are required in conversations with strangers in the Internet social space.

Parents believe computers and the Internet help their children with school assignments, and that the lack of Internet connection at home would put their teenagers at a disadvantage with their peers. The students' use of computers and the Internet at the ASF is meeting their parents' expectations. Most teachers give daily assignments to be done on the computer and require Internet searches for their assignments. The majority of the students say they use the Internet for research.

Gender and nationality are not differentiating factors with respect to the use of computers and the Internet by high school students at the ASF for school-related work.

However, there are some variations in other applications. For example, male students use the Internet more than females for games and for accessing sexually explicit images.

The study sheds some light about the potential benefits of the introduction of computers and the Internet into U.S. classrooms. However, it also reveals that full integration of the technology into the curriculum is an elusive goal. Fundamental transformation in education, as in any major social change, certainly requires clear vision, hard work, and time.

Abstract Approved:

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Analysis, Design, Implementation and Evaluation of Instructional Software by Computer Science Students and Public School Teachers

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Abstract: This paper describes how computer science students of Texas A&M-CC (TAMUCC) and public school teachers benefited from an Eisenhower Funded Project "Training k-3 teachers on how to best use educational technology in the classroom" and were able to evaluate and construct educational software. During the first phase, teachers were exposed to educational technology. The next step was to evaluate educational software to teach science and rank the top software. They used a tool constructed by a computer science graduate student. In a third phase, they designed storyboards for computer science students from a Visual Programming Language Course to implement the software.

I) Introducing Educational Technology

During the first phase of our project, teachers became familiar with Educational Technology. After brief history of Computer Science & Computer Uses in Education, teachers became acquainted with the Web by searching for articles in educational technology (mainly from Northwestern and MIT) and wrote an essay analyzing Roger Schank and Seymour Papert's educational point of view. Many of the participants learned to search the web and use a word processor for the first time. MS-Powerpoint (in order to prepare their class presentations), MS-Excel (to grade their students) and Hyperstudio (to gain ideas concerning what an Educational Software may do) were also presented. Finally, teachers created their own web-pages.

II) Evaluating Educational Software

The primary reason that Educational Software is not widely used is not due to the difficulty of constructing good tools, but disseminating and incorporating them into the curriculum. It is frequently said that a limited software tool well applied to the curriculum is of much more value than a very good tool that is applied inappropriately [LAJO93]. Furthermore, there is reluctance on the part of instructors to incorporate these tools into their classrooms [STAS97].

Some authors [BORO97] believe that as the World Wide Web becomes the universal medium for disseminating information, all educational software will be platform independent, thus solving the dissemination problem. Although Educational Software is being made web compatible and this will increase its use, there are other barriers that keep instructors from using it.

This reluctance is in great part due to: faculty not knowing that the tools exist, difficulties in obtaining the tool, not knowing which tools to use, not knowing how to incorporate the tool into the curriculum, and fearing that the tool will increase their course load. What is needed is a mechanism for searching what Educational Software for a specific domain as well as a uniform location for students and teachers to discuss classroom experiences with the tool.

To solve this problem, we created an Interactive Repository for Educational Software (IRES) prototype that may be accessed from our project's home page (http://www2.tamucc.edu/ecdc/eisenhower.html). The functions of this software are to: 1) search for and add an educational software, 2) Evaluate, read evaluations, edit and/or delete evaluation(s), 3) Search for an educational web site, and add information about an educational web site.

Besides lacking security features (users could update or delete others' evaluation), we also received feedback concerning the unfriendly user interface. The feedback included too many fields to fill in

(separate the mandatory and the optional fields), some fields had to be more intuitive, an easy help system informing the objectives of the software and a tool to summarize the evaluation (example: if 20 evaluators rated the tool, obtain the avg. rating). We also found a necessity for a form to specify teachers' request for new software (Describe educational software that the user would like developed).

The software not only catalogs all the educational software available, but also allows the participants to view each other's evaluations. For each, software there are several evaluations (one for each participant).

III) Constructing Educational Software

After the teachers became familiar with Educational Technology and Evaluated the Software, they tested the softwares with experimental classes of K-3 grade children. Following this phase, each teacher chose the software they wanted to purchase and also used storyboards to specify what softwares they would like developed. This served as input to a Visual Programming Class held at TAMUCC. The students of the Programming class interacted with the teachers, providing them hands on experience with a real world scenario. At the end, a web page was produced where the prototypes can be downloadable http://www.sci.tamucc.edu/~mariog/vpproj/vp.html. Some of these prototypes are already being used in public schools.

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6) http://papert.www.media.mit.edu/people/papert/, Seymour Papert and MIT.

Technology and the Academic and Social Culture of a University Campus

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Abstract: As colleges and universities consider various options for wide scale "computerization," one southern liberal arts university has instituted a technology program that insures that all students have equal access to laptop computers. At this university each student is issued his or her own IBM ThinkPad, and activities involving this computer are infused throughout the academic and social life of the campus. Students use the computer extensively in class activities and projects and also in social communication and entertainment. This study sought to examine the computer attitudes of students who had experienced a technology-rich environment for four years.

Introduction

Much has been written about the infusion of technology into academic life. While colleges are moving at different paces in its integration, we all recognize that technology is an integral part of education in the 21st century (Brown, 1999). Research studies describe an exhaustive computing environment as a positive influence on academics (Corwin & Marcinkiewicz, 1998; Geissler & Horridge, 1998; Walters & Necessary 1996).

Papert (1987) implies that integrating technology involves a systematic change. Systematic change refers to systematic evolution of a university's political and social climate. "Potential computer networking may hold for creating, nourishing, and sustaining the genuine learning communities so desperately needed if we are to confront the social, cultural, economic, and ecological challenges of the coming years" (Sayers, 1995, p. 773). It is these communities that foster academic and social growth of university students immersed in a culturally rich learning environment.

Intensive implementation of computers transforms an academic institution's climate, culture and atmosphere. With increased experience with technology, students' academic and social lives are significantly impacted and student attitudes toward computers become more positive (Mitra & Steffensmeier, 2000). Through forced familiarity, students develop an appreciation for computers and readily accept the evolution of the university into a completely wired educational and cultural environment.

Methodology

Yahoo has identified the university where this study took place as one of the "most wired" campuses in the country. Upon initial registration, each first-year student at this university was given his or her own personal IBM ThinkPad computer and printer. At the beginning of the junior year, students traded in the initial computer for a new ThinkPad. A computer support system included professional and peer assistance. Each dormitory room was equipped with network connections and everyone on the campus had the same standard computer and standard software load. Professors regularly integrated the computer into instruction, and students also used it for personal and social tasks. At the end of the fourth year of this program, the senior class had lived and worked in this environment of ubiquitous computing for their entire

college career. Approximately 800 students were surveyed near the end of their senior year to obtain their self- reports of computer use and computer attitudes. This study reports the analysis of the attitude items and narrative comments from the student surveys.

A survey was constructed to obtain use and attitude data. The survey was posted online (with a CGI script to encode responses in a text file) and an email message was sent to all 800 seniors encouraging them to follow the included link and complete the survey. After one week, a reminder email was sent. Then after another week, a paper version of the survey was sent to all students who had not responded. After two more weeks, a random sample of the remaining nonresponders were interviewed by phone and asked the survey questions. To check for representativeness, Computer Expertise scores were compared for the three groups (web (n=274), paper (n=35), phone interview (n=10)) and there were no significant differences ($F(2, 316) = 0.391$, $p=0.67$).

Results

Campus Culture

Students reported, "Constant exposure to technology is great." On the attitude items, 73% of students reported that they "loved" computers, while 23% "liked" them, 4% "disliked" them, and 1% "hated" them. See Table 1.

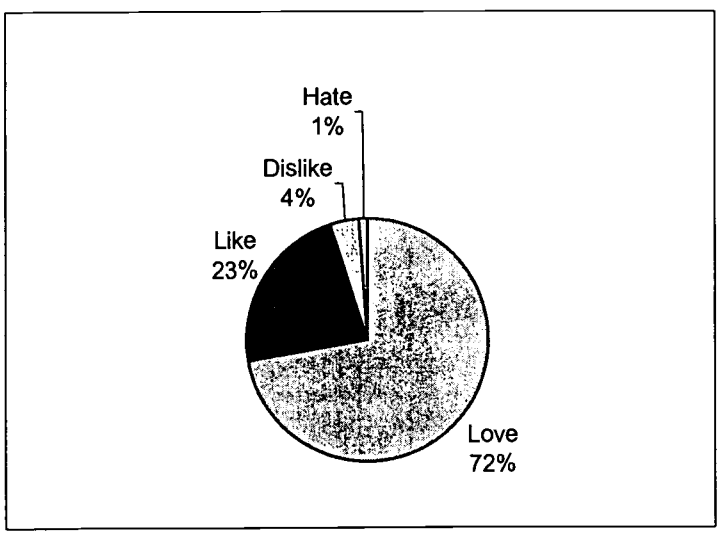

Table 1. Students' Attitudes toward Computers.

Many students developed an affinity toward technology, because it was such an integral part of their campus life. The integration of computers forced significant changes in the campus climate. Computer use, email, and web surfing are major components of everyday campus activities. Given the fact that all students unquestionably had the computer availability, there was forced familiarity with many different computer applications, which resulted in increased computer expertise. Self-ratings of computer expertise revealed that 80% of the students rated their abilities average or above. See Table 2. In a cyclical manner, students used the computer more, became more computer savvy, and found increasingly more needs for using the computer. 83% of the seniors felt that the ThinkPad had significantly impacted the campus culture. Students feel that "Technology pervades every aspect of college life in one way or another."

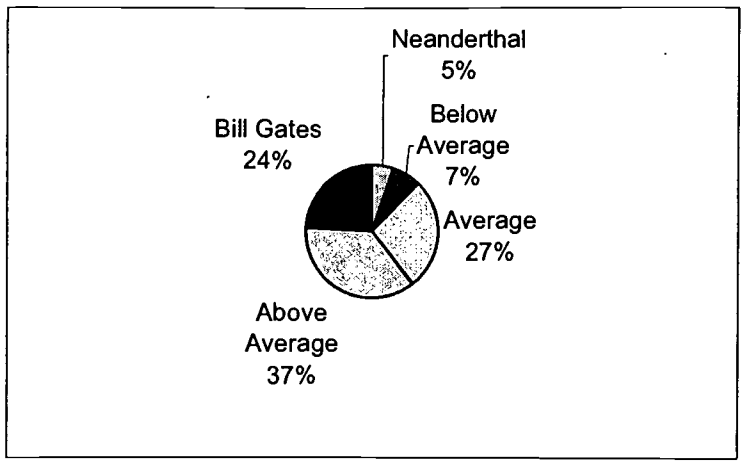

Table 2. Students' Self-reported Computer Expertise

Increased communication was another result of computer accessibility. Students used online technology tools to interact frequently with friends, family, and faculty. A student commented that "Email and IM are more accepted forms of communication here than on other campuses." Because of the widespread availability, email has become the preferred method of communication. This is true in both academic and social settings. It is common to hear students remark "email me" instead of "call me." In addition to regular email, students participate in list serves and news groups that keep them informed of academic and social information. Many students commented that email had enabled them to do more projects collaboratively. They also stated that they were more informed of university activities and functions. Many campus student groups, including social and service organizations, use email for routine communication. Other "real-time" communication, which is common includes chat rooms and Instant Messenger. A final means of computer communication is Internet phone, where a computer is used to make free long distant voice calls. 48% of the students surveyed felt that the ThinkPad had helped in their overall social life.

Many students emphasized the exclusivity of campus life as a result of the ThinkPad Initiative. Exposure to technology provides Wake students with invaluable skills and an intimate social experience. One student stated, "I believe that the ThinkPads have made Wake Forest a unique community/campus. It allows the students on this campus to experience something that students on other campuses do not have." In a question relating to job marketability, many students reported that in job interviews their computer expertise had given them an edge. It appears that future employers recognize Wake Forest University as a leading source of technical-savvy employees.

Academic Life

75% of the respondents felt that the ThinkPad had helped in their overall educational life. The accessibility to computers has decreased preconceived inequities among sexes and socioeconomic groups that infiltrate other universities. Because the ThinkPad is included in tuition fees, it is "covered" by financial aid packages. A further source of standardization is the fact that each student has the same computer and the same software. At many universities, even if a computer is required or recommended, there is wide variety in the hardware and consequently in the software. With the standard hardware and software, much time and effort is saved on the part of faculty and students in sharing resources and collaborating on assignments. A student commented, "Everyone is on equal footing. Everyone has the same access to resources, presentation, etc." As a result, students develop a familiarity with computer applications. Students use computers extensively; consequently, using computers becomes second nature. See Table 3. Students' views are summarized by one student's statement about ThinkPads, "It has redefined how we learn by adding an enormous new resource in information receiving." With the

increased accessibility of computers, students are forced to become technologically literate. A representative student comment suggests, "The ThinkPad has overall improved the education on this campus."

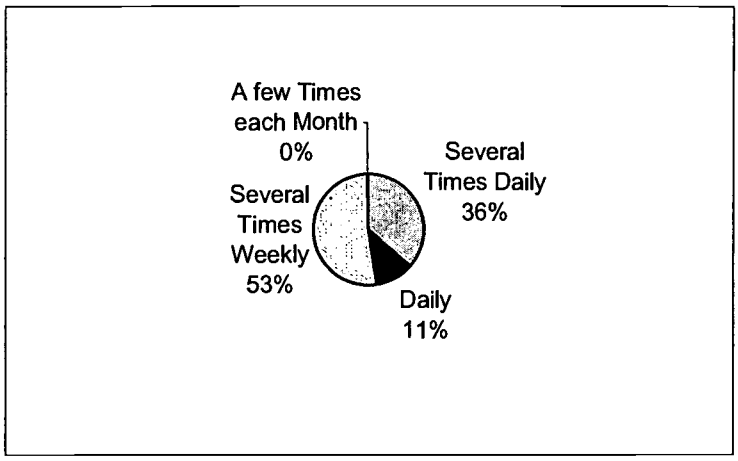

Table 3. Students' Self-Reported ThinkPad Use

Consistency of technical resources offers a commonality among students, which provokes conversation that in turn promotes collaborative learning. One students feels that "Whether it is just a topic of conversation, an article in the newspaper, or knowing that everyone had a computer when doing a project, the ThinkPad has been a major focus of energy in many areas." Many students stressed that with the ease of access to email, they were more able to collaborate on projects, discuss assignments with their classmates, and clarify professors' expectations through constant contact. A student remarked "Everyone I know uses the ThinkPad every day, to communicate, to do research, or just to goof around. We all discuss things we can do with our computers. Sometimes, we complain about what they can't do. But everyone knows that if they talk about the computer, every other student will understand what they mean."

Overall, 82% of the students felt that ThinkPads saved them time, but they recognized distractions and problems from having the computers. One student commented that "The convenience factor is a huge time-saver, however, I also wasted a lot of time goofing off. But overall, I feel like the time I have saved with the ThinkPad outweighs the time wasted." Arguments for time saved include convenience, accessibility, improved communication, and standardization. On the time-wasted side, students identified higher academic expectations, time-consuming tasks such as scanning, and distractions like games, chat rooms, and web surfing, which resulted in procrastination of academic work.

A student pointed out that "It (the ThinkPad) has saved me a significant amount of time due to the accessibility and the availability of the Internet." Many students recognized the limitations of computer labs and the advantage that they had in ease of access. A student remarked "Everyone has equal access to the internet, email, and word processors without having to wait in long lines in computer labs." It is common for students to research topics for major academic papers on the Internet. Even those who use the Library used the online card catalog and other online indices to locate materials. One student commented that "Being able to access the library catalog from my room was awesomely helpful. I could get abstracts even articles in the comfort of my pajamas." Efforts have been made to educate students on critical analysis of online sources, so that they select Internet references that are of the same quality as printed works.

A student stated, "I spent a lot of extra time surfing the web and emailing, just because I could." Because of the accessibility to the Internet, students were enticed by the entertainment features of the Web. Many students spend an inordinate amount of time with email and several students have become addicted to music and gaming on the Internet. Students commented that it was very convenient to use their computers in the comfort of their own rooms. One student reported that "If students still had to walk to a lab to check e-mail, surf the web, etc. They (myself included) wouldn't be so willing to spend time on the

web, etc. However, since we have easy access to the Internet, chat programs, and e-mail, it is much easier to fall into surfing around the web or chatting with friends and family on a chat program." The ease of access and availability of the Internet provides an easy distraction and causes students to procrastinate in completion of academic assignments. A student acknowledged that "Web-surfing has enslaved me."

One student remarked, "Although I love the computer, and while in some ways, it has saved me time, overall it has cost me time. For example, doing presentations on PowerPoint, scanning pictures, etc, takes more time than the old-style presentations." Students commented that the standardization of computer access had increased the professors demands for assignments; consequently, increasing the preparation time for assignments. Some students felt that they had learned many computer skills through trial and error, with no guidance or instruction. Just because students had a computer, professors assumed that they knew how to operate it. Students reported that "There are many times when professors think you know how to do stuff and you do not. We had basic computer training and that is all." This issue was addressed in more detail with a section for other comments. The students' consensus was that a course should be designed to familiarize students with their ThinkPad, to train them in the standard software load, and to develop computer expertise. It was recommend that this course be required early in each student's freshman year. There is not a direct link between computer access and computer understanding. Because of having a personal computer, many students did however recognize that through forced familiarity that they had developed a computer expertise that most college graduates do not have.

Implications

Students emphasized changes in the academic and social atmosphere at Wake Forest as a result of the computer initiative. Results of this study verify that these changes were positive toward technology. An overwhelming 95 percent of the students reported that they either "loved" or "liked" computers. It is important to note that this is a liberal arts university, which typically does not attract the "techie" type. Similarly, 88 percent of students rated themselves as average or better in computer expertise. The students incorporated the technology into all aspects of their lives, including academics as well as communication and entertainment. It became an integral part of their day-to-day activities.

Students recognized the benefits of equal access to technology, improved technical skills due to forced familiarity, and the cultural evolution of the new technological community. This new environment fostered academic success by establishing a comforting and supportive network between faculty and students. Rather than becoming a tool of isolation, as feared by many detractors, the ThinkPads have opened new channels for communication. Students are able to be in constant direct contact, both synchronous and asynchronous, with faculty. This contact and resulting improved conversation offer a more personal educational system. Students expressed appreciation of the ability of the ThinkPad to allow involvement and individual feedback from professors on a regular basis.

This new learning environment also promotes communication among students, as they share ideas and provide support. Because of standardization, students are able to rely on their peers' expertise to solve problems. Through collaboration, shared experiences, and problem solving, students develop closer relationships. Students' computer expertise and cooperative skills make Wake Forest University students highly marketable.

Overall the integration of the ThinkPads was very positive in many aspects. It saved students time and enabled them to create a higher quality of academic work. Students did recognize that with all the electronic diversions available like entertainment, games, music, and web browsing, students must develop self-discipline to stay focused on educational objectives. Balancing these issues is a problem that all youth face as our society evolves, as this campus has, into a techno-focused environment. Wake Forest students are better equipped to manage computer distractions, because they have experienced its easy accessibility and have developed a comfort level and balanced attitude.

As implemented at this university, wide scale "computerization" changes the social and educational climate and has a positive impact on campus life. This cultural evolution in not just limited to academic universities. Technology infiltrates all aspects of our lives. One student commented that "The world is becoming more and more wired. Computers and the Internet are a huge part of life now, and they will continue to allow a greater level of efficiency in life, and will play a pretty major role in most people's lives, regardless of if they have computers or not. I don't think that we could avoid this change if we wanted."

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Applying Technology to Restructuring and Learning: An Analysis of a Professional Development Intervention

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Abstract: The *Applying Technology to Restructuring and Learning* (ATRL) study was carried out over a two year period to document and assist 150 teachers in six schools during the process of creating constructivist learning environments (CLEs) supported by technology. The research component of this project involved an *intervention study* with a two-tiered research design. *Tier One* was a collective case study of the approximately 150 classrooms, located across six school sites, whose teachers participated in 72 hours of ATRL professional development. *Tier Two* consisted of six detailed case studies of individual teachers whose experiences represented the process and the practices they employed in creating a constructivist learning environment within their classrooms. This paper will summarize the findings from the *Teaching, Learning, and Computing* (Becker & Anderson, 1998) teacher survey regarding the impact of the professional development intervention that was provided for the teachers in the project.

The Intervention

Design and delivery of 36 hours of professional development each year (72 hours total) was carried out over the two years of the *Applying Technology to Restructuring and Learning* project. Sessions were designed to be highly interactive and to model the application of constructivist learning theory. Major emphasis was devoted to teachers' own prior knowledge about how students learn. Instructional strategies included inquiry, project-based teaching, authentic learning and problem-based learning. Sessions used various types of software that supported student-centered learning and focused on teachers' ideas for other ways of using these software applications. The design and development of the professional development sessions for the ATRL project evolved over a period of several months and strove to accommodate the unique characteristics of the teachers as well as their individual schools, a variety of computer skill levels, different learning styles, curriculum interests, and varying available hardware and software.

The Teaching, Learning, and Computing Teachers Survey was given to all of the participating teachers at the end of year two. It provided a comparison of the ATRL teachers to a national probability sample. As the participating teachers received professional development designed to assist them in creating constructivist learning environments, one might hypothesize that rankings on constructivist practice and use of technology would be higher than for the national sample.

Effectiveness of professional development

Several measures were used to assess the impact of the professional development however, the effectiveness of professional development was most evident in results of the *Teaching, Learning, and Computing Teachers' Survey.* Analysis of this comparison of these 102 teachers to the national sample regarding the effect of professional development is reported in Table 1 below.

TLC Item	TLC 98 national sample N=4,083	ATRL 2000 teachers N=102
Staff development/workshops have influenced their teaching practice	54.1%	76.8%
A change in their understanding of learning has influenced their teaching practice	54%	72.8%
Computer/technology opportunity and experience has influenced their teaching practice	50.7%	78.7%
The person who gives them the best ideas about teaching knows a lot about computers	21%	50%
Teachers now participate more frequently in professional development activities	42%	59.8 %
Teachers discuss staff development sessions afterward with other teachers	42.3%	52.4%

Table 1: Effects of Professional Development

Conclusions

As the above data show, professional development that modeled technology-integrated, constructivist practices appeared to have assisted teachers as they shifted from traditional to more constructivist approaches. Results are consistent with the findings of other researchers (*Education Week*, 1999) who report that up to sixty percent of teachers who had eleven hours or more of basic technology skills training and curriculum-integration training say they feel "much better" prepared to use technology. This is but a brief snapshot of what took place in this two year study. Results from the this two year study also showed that professional development needs to be combined with other internal and external support structures to bring about effective integration of technology use and constructivism in classrooms. A complete report of this study can be obtained from any of the authors.

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Just Another Evaluation Paper: Working Towards a Shared Methodology for Evaluation of Information Technology Courses in Teacher Education

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Abstract In response to a perceived increase in the amount of course evaluations being presented at conferences and appearing in the journals, this short paper seeks to characterise the methodology adopted during the evaluation of information technology courses forming part of teacher pre-service education. An attempt is made to discover the strengths and weaknesses of the most common procedures by the review of course evaluations readily available in the public domain. Elements of course evaluation are described in a short taxonomy under the main headings of curriculum effectiveness, learning effectiveness and cost effectiveness.

Too Many Course Evaluations

"It's all very well coming to these conferences but all you get is session after session of people presenting the results of student evaluations of their ICT courses. Is that all course leaders can do – ask the students? I think we should have one enormous 'poster' session where we can lock all the students' evaluations in one room and provide a key if anybody is remotely interested."

This is not perhaps a verbatim recollection of a colleague's sense of frustration at finding conference proceedings dominated by course evaluations, but it does serve to illustrate the potential threat to a balanced approach to course evaluation. Is there an over-reliance on gathering participants' perceptions in this context and if so, does it matter? Is the customer always right? This paper sets out to illustrate and characterise the most common sources of data for course evaluation in ICT, the methods of analysis applied to the data and the kinds of conclusions drawn from the work.

Gathering the Data

A straightforward method was used for gathering literature. Both the Eric and British Education Index databases were searched for references using criteria related to course evaluation, education technology and teacher pre-service education. Abstracts were searched for any indication that the title of the paper bore some relevance to the content and the most promising complete papers were then gathered. Analysis was made using the conceptualising, formulating and verifying elements of a methodology for using the Internet as a source for qualitative research (see Hughes, 2000)

The most striking characteristic of the evaluation of ICT (technology) courses in teacher education, is a reliance on students' self reported attitudes. Attitudinal surveys, with and without contextual information appear to have been and to remain the first and only recourse for course evaluation.

An Emphasis on Student Evaluation

Most published reports are concerned with a post-course evaluation (Boylan et al, 1994; Bauer, 1998) and student satisfaction (Bechtelheimer and Tamashiro, 1987). Some analyses provide information which looks to co-relate factors taken from pre and post-course questionnaires (McDermott, 1985; Savenye, 1993) and these examples look to find shifts in student self-esteem, confidence, professional self-perception and attitudes to using technology in the classroom (Cannon, 1996; Bauer, 1998; Brush, 1998)

Student evaluations are used to help reconstruct courses (van Rennes and Collis, 1998) or to assist in the development of guidelines for the development of distance learning courses (Cochenour and Reynolds, 1998). It is not always clear from the literature accessed during the present study what is the purpose of the evaluation. Neither is it clear what use was to be made of any conclusions that were drawn. Whatever use is made of the evaluation the use of students' perceptions provides a very reassuring picture. Evaluations are almost invariably positive and in some cases glowing.

The reliance upon students' self reported perceptions and reactions may extend to the comparatively unstructured context of the trainees' or learners' diaries and journals (Badley, 1986). Diary data may potentially be perception-rich and less open to the charge that questionnaires are likely to pre-position possible responses and so 'miss out' on some interesting and valuable information. However, there are concerns about the use of journals. Information from diaries is usually in a format that is difficult to analyse. On balance, although such instruments as diaries and journals are useful examples of contextual information, by themselves they are unlikely to capture elements of course evaluation that we need to address.

Some further clue as to what those elements should be are provided by Fucaloro and Russikof (1998) in their study to develop an assessment model for an on-line course. The model was applied to examine the effects of on-line instruction on teaching and learning by examining factors of faculty-student contact, speed and type of tutor feedback, student time on task and the range of learning styles offered. A second set of factors was centred around observable characteristics of the participants: the shift of technological skills, the chosen preferences of participants, and the extent to which students were actively involved in their learning. Finally, the evaluation looked at the demands on the faculty: staff workload, the technical support required for participants, and the demands of a reflective teaching approach.

The present study has examined an apparent over reliance on students' own perceptions of the value and impact of ICT courses leading to professional qualifications. The following taxonomy seeks to indicate what the present author considers to be the purposes and aims of course evaluation. At this stage no further discussion of appropriate methodologies is offered. However, subsequent papers will consider how these elements of course evaluation are best achieved.

Elements of Evaluation

- Achievement of Expected Outcomes – Curriculum Effectiveness
  - Shift of technological skill
  - Ability to apply principles of course into practice
  - Changes in students' confidence to be appropriately critical of their own and others' practice.
- Effect upon Students Experience – Learning Effectiveness
  - Availability of a range of learning styles
  - Opportunities for and outcomes of tutor/student contact and feedback
  - Student outcomes as a positive function of time on task
- Effect upon the work of the Faculty – Cost Effectiveness
  - The workload of the Faculty: in-service training and an erosion of other scholastic activity
  - Course demands on IT provision
  - Impact upon the delivery of other courses offered by the Faculty

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*EDRS Availability.

Creating a Methodology for Using the Internet as a Source of Data for Qualitative Research in the Social Sciences

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Abstract *At a time of much increased use of the Internet as a source of data for research, there is concern about how best to do this. This short theoretical paper seeks to characterise some uses of web page data.. Can the Internet deliver what we are looking for and how will we know when we have found it? A methodology is suggested, drawing heavily upon 'Grounded Theory', and some principles of good practice are recommended.*

The Nature of Qualitative Research and Documentary Analysis

Researchers in the social sciences are more and more attempting to make use of the vast amount of information available on the Internet. This short paper is an early attempt to re-configure the way we think of conventional concepts of validity, authorship and the representation of reality. The Internet offers a resource with its own ethical and moral properties formed by a multitude of authors publishing in unstructured and unregulated ways. This attempt to explore how we 'move around' in the ethical space created by the Internet will necessarily be constrained by the fact that we are trying to invent a new language to uncover 'standards', i.e. agreements on how to manage information and interaction on the web.

The qualitative researcher is often concerned with finding patterns of meaning, perception and reaction evidenced in the language used by actors within either a 'live' social setting or the more deliberative context of the written word. Documentary analysis is generally non-intrusive, particularly in contrast to ethnographic approaches and may be considered strength of documentary analysis: the researcher is demonstrably not having any effect upon the social setting she is observing. Yet it may also be considered a weakness, in that the researcher is distanced from the reality of the setting, only gaining access through the report of others. Any methodology in this area must take into account the possibility of authorship being open to similar criticisms as with any unquestioning reliance upon oral history (Seldon and Peppworth, 1983)

By analysis of the content and nature of the language used, an attempt is made to reveal the significance and meaning of what is observed. Notions of validity and bias in the data are important in documentary analysis, particularly where the content is considered as an attempt at persuasion (Sparks, 1992). So if it is the case that researchers will be increasingly accessing the many millions of pages stored on web sites and applying documentary analysis to that data, what should that form of analysis look like? How will it differ from the methodology most usually applied to text, images and the analysis of their meaning?

Why Create a Methodology?

What if we were to simply not bother with the Internet? By adopting research methods that preclude the collection of data of this sort, the researcher is doing more than simply excluding vital evidence from their study. They are also assuming a particular view of social activity and of provenance, one moreover that argues that as researchers we cannot grasp the nettle of sorting data in compelling and powerful ways. We would thus be assuming a way of thinking that reduces our human interaction with the information highways to the role of 'unwitting dupes' of ideas and attitudes beyond our comprehension and influence, and this will not do.

The creation of a supportable methodology in the context of the Internet is dependent in some way upon an acceptance of the limitations of our ability to generalise findings and create proven principles. Qualitative studies based upon access to large amounts of data are particularly vulnerable, when it comes to managing the data. Nevertheless, it is appropriate to set down a way of working that can support researchers in their planning. The procedures and principles of a methodology for qualitative research using the Internet are summarised in Figure 1. They are based upon the application of Grounded Theory in a context where selection and exclusion of material are primary procedures

Figure 1. Summary of the Procedures of a Grounded Methodology when using the Internet for Research

Process	Activity	Comments
Conceptualising	Search the Web to find exemplary material from a wide range of web sites and sources.	Check cross-references and access to a wide range of socio-linguistic and socio-representational material gender, age, economic status and culture.
	Collect data into an accessible file format and use open coding to create main headings.	Use both a 'manual' scan and an IT application. It is necessary to capture complete texts, figures and images
Textualising	Collect main data set using an intelligent agent and main headings.	The method used by the agent is part of the advised methodology. This should include a detailed analysis of strengths and weaknesses.
	Use 'manual' scans to exclude unpromising text and images.	Keep exemplars of material not included to indicate the 'position' of the researcher.
	Convert material into a form that can be easily 'read'.	Use of *hard returns* or similar to create units of text. Using common file formats to enable access.
Coding	Detailed coding using IT application.	Choose an appropriate application depending upon the developing structure of the codes.
	Establish a coder reliability study with a longitudinal aspect	Axial coding; possible relationships between categories are tested against data obtained in ongoing theoretical sampling.
Formulating	The main issues are explored and an interim analysis made. A core category is defined.	These will be conceptual links, models and provisional findings. At this point the core category is related to the coding paradigm and all other subsidiary categories.
	Develop observable characteristics of the analysis.	How would others replicate the searches, coding and analysis?
Complementing	Bookmark manager to maintain an active link with the data set.	Record the timing of data reviews.
	Check interim analysis by comparison of data with the observable characteristics.	Include updated data.
Verifying	Grounding the Theory	The emergent theory is grounded by returning to the data and validating the theory against actual segments of text or images
	Review categories	Do the coding, the search criteria and the reliability study address the purposes of the project?

In conclusion, an argument has been put forward that a development of grounded theory in the context of searching the Internet, provides a potent and robust method for constructing theory. It enables researchers to generate ideas that are true to the data and, because of its emphasis on inductive logic, closes the theory-data gap. Working with the Internet is time-consuming, complex and potentially frustrating. However, the advantages to the researcher of accessing such huge amounts of 'free' data, can do much to make more inviting the prospect of overcoming these impediments.

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Computer Confidence and Attitudes of College Students Attending a Notebook or Traditional University

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Abstract: This study attempts to determine how the use of a notebook computer impacts a student's computer confidence and attitude when compared to those of a traditional university student. This descriptive study used a survey research instrument to gather quantitative data concerning computer confidence and attitudes. Forty-six students at a notebook university and 64 students at a traditional university were surveyed during the summer semester of 1999. Data were collected on computer attitudes to determine students' perceptions of computer usefulness, and comfort or anxiety. The study found that notebook university students had significantly higher levels of computer usage, confidence, and positive attitudes than did students at a traditional university.

Introduction

Colleges and universities are studying ways to integrate technology and instruction. Administrators at two North Dakota higher education institutions feel that the prevailing technology model for higher education is no longer working. Brown (1997), Executive Director of the Associated Colleges of Central Kansas, and former Vice President of Mayville State University and Valley City State University, believes knowledge of current technology is a basic tool for learning and success in the workforce; therefore, every student needs access to the hardware and software. Notebook universities share this same goal.

In order to be competitive, students should have equal access to computers both at home and school. Many students already have home computers, but some others do not. Providing each student with a notebook computer is the most equitable solution for problems of access. Giving computers to every student levels the field for all students at the university. In addition, since universities are finding it difficult to provide access to the computer labs faculty members want to use, notebook computers alleviate scheduling problems for courses involving required computer use.

Notebook universities are looking at not only new methods of teaching but also new methods of enhancing student learning (Chaffee, 1995). Information resources are becoming fundamental in daily classroom activities. The notebook computer can be used in the classroom as a conduit to information. Students are able to examine the information they have collected and to synthesize the data; they can then evaluate both the value of the information they have gathered and the technique used to gather it. Students who collect their own data partake in active learning. Active learning increases knowledge retention and synthesis. When a student has a notebook computer available twenty-four hours a day, active learning is facilitated.

Four recent studies measure attitudes toward computer notebook use. Brown (in press) found that 20 to 25 percent of university classes across the nation use e-mail, and 10 to 15 percent use presentation software. At two notebook universities in North Dakota, 54 percent of the faculty used technology in their courses. In 1993, 48 percent of the faculty of these two universities rated themselves high in utilization of information technology. By 1996 two-thirds of the faculty reported high utilization for instructional purposes.

In 1997, Holleque, Professor of Education and Psychology at Valley City State University, determined that a notebook computer environment had a positive effect on students' perceptions of computers. By the end of one semester, 92 percent of the students surveyed reported a mostly positive attitude toward having a notebook computer. In addition, 91 percent of the students were at least somewhat

confident about using their computers. Finally, 97 percent of the students reported using their computers on a daily basis.

A survey at the University of Minnesota-Crookston (UM-C) found students used the notebooks for much more than writing papers and taking notes. In 1996, 90 percent of the students at UM-C said they used the notebook computer for e-mail; 80 percent used notebook computers to do research on the Internet; 75 percent of the students used the notebook computer to communicate with their professors and to work with other students on projects; and almost 50 percent used the notebooks for graphics and presentations. In the same survey, 75 percent of the students said the notebooks increased "the amount and quality of learning" at UM-C. Ninety percent of the students stated that the notebook computer helped them build the technology skills they needed in their careers (Osborne, 1997).

In a fourth study, conducted by Rockman et al. (1997), an independent research organization, for the "Anytime Anywhere Learning by Microsoft Corporation" and the "Notebooks for Schools by Toshiba America Information Systems," found teachers', parents', and students' positive attitudes for the notebook computers used in the schools had a direct effect on students' motivation and engagement, time on task, and sharing of work. The study showed that 70 percent of the teachers involved in the notebook computer project had a high degree of enthusiasm for the notebook computers in the classroom. Ninety percent of the teachers used the notebook computers for word processing, 74 percent for presentations, 61 percent for Internet, 46 percent for spreadsheets, 35 percent for skill remediation, and 29 percent for databases and record keeping.

The purpose of this study is to attempt to determine how the use of a notebook computer will impact a student's computer confidence and attitudes when compared to those of a traditional university student. It is a descriptive study using a survey research instrument to gather quantitative data on experience and confidence. The survey will cover areas of computer expertise including word processing, Internet and communication applications, spreadsheet, and data management software. In addition, data were collected concerning computer attitudes to determine students' perceptions of computer usefulness, and comfort or anxiety levels.

For the purpose of this study, the following terms have been defined: Notebook Computer: A portable computer that has a flat screen usually weighing less than six pounds which is small enough to fit into a briefcase. In terms of computing power, notebook computers are equivalent to desktop computers. Notebook computers come with batteries enabling them to run without the need of an external electrical power source. Notebook University: A campus where all students and faculty are issued a notebook computer (as defined before). Students and faculty have 24-hour access to a computer. Classrooms feature student tables with electrical and network connections. Computer labs at these institutions have become obsolete because any classroom on campus is, in essence, a computer lab. Traditional University: A campus that does not issue notebook computers to students and where class-related computer activities take place in a computer lab.

This study was undertaken to determine how computer confidence, and attitudes are affected when comparing notebook campuses and traditional universities. The data in this study will be of interest to individuals who are exploring the idea of implementing a notebook campus. The results are intended to add to the total knowledge about notebook campus implementation and its effect on students.

The Study

The objectives of the study were to answer the following questions: (1) Do notebook university students have higher computer confidence and attitudes when compared to students from a traditional university? (2) Do students who own a home computer at a traditional university have computer confidence and attitudes equivalent to students from a notebook university? A survey was used to measure student's experience, confidence, and attitudes to answer the above research questions.

The participants were students from two state universities sharing similar foundations as normal schools that developed into more comprehensive universities. One is located in the upper Midwest and follows the notebook model; the other is located in the lower Midwest and follows a traditional model.

A survey was used to measure students' computer confidence, and attitudes. The survey was based on existing surveys. The survey contains the following categories: Background Information, Computer Experience, Computer Confidence, and Computer Attitudes.

The students were given the survey in various courses during the summer semester. The questionnaire was constructed so that the students would need no longer than 10 minutes to complete it. The students were informed about the goals of the study. The participants were assured that their responses were voluntary and would be anonymous. The students were also informed that their names would not be associated with any individual scores nor would their names be identified with any results of the study.

All of the replies for computer confidence and attitude questions used a 4-point Likert scale (strongly disagree = 1; strongly agree = 4). T-tests were performed to compare means in computer experience, confidence, and attitudes between students at notebook and traditional universities. The t-tests were then repeated to compare experience, confidence, and attitudes between students attending a traditional university who owned a home computer and notebook university students. A final set of t-tests was carried out to compare experience, confidence, and attitudes between students enrolled in computer classes at a traditional university and the entire notebook university sample student population.

Findings

A total of 108 students completed the survey. Among this total, 46 students attended a notebook university, and 62 students attended a traditional university. The sample populations were represented by students from two fields, business and education. At the notebook university, 76% of the students declared an education-related major, while 24% of the student population declared a business-related major. Within the traditional university, 84% of the students surveyed listed education as a major, while 16% of the students declared business. Of the sample population at the notebook campus, 78% were female, and 22% were male. Sixty-three percent of the sample population of the traditional university were female, and 37% were male. The grade levels of participants at the notebook university included 43% seniors, 40% juniors, 13% sophomores, and 4% freshmen. In the traditional university, the sample population reported 40% seniors, 39% juniors, and 21% sophomores. Employment of the students at the notebook university was 78%. This rate was comparable to the 73% of the students holding employment in the traditional university.

The purpose of the present study was to determine how the use of a notebook computer would impact a student's computer experience, confidence, and attitudes when compared to a traditional university student. The analysis is organized according to the individual research objectives.

Does the average notebook university student have higher computer experience, confidence, and attitudes when compared to a student from a traditional university? T-tests were used to compare means in computer experience, confidence, and attitudes between students at a notebook university and those at a traditional university. A t-test compared computer confidence between students at a notebook and a traditional university. This analysis showed that in three areas of confidence--word processing software, Internet and communications software, and spreadsheet software--notebook computer students had significantly higher scores. There was no significant difference between notebook and university students with respect to database management software.

Areas of Confidence	Notebook University (N=46)		Traditional University (N=62)			
	Mean	Sd	Mean	Sd	t	p
Word Processing Software	38.24	2.82	34.21	5.12	4.820	.000*
Internet Communication Software	32.67	2.70	26.60	4.77	7.759	.000*
Spreadsheet Software	24.39	4.44	17.32	6.93	6.052	.000*
Database Management Software	18.13	7.79	15.87	7.74	1.496	.138

*$p < .01$.

Table 1. Computer Confidence (Traditional University-Notebook University)

A second t-test was used to compare a notebook and traditional university student's computer attitudes. Computer attitudes were divided into the categories of usefulness and comfort/anxiety. The analysis showed that a notebook university student had significantly higher scores in computer usefulness and comfort (Table 2).

Computer Attitudes	Notebook University (N=46)		Traditional University (N=62)			
	Mean	Sd	Mean	Sd	T	p
Usefulness	42.11	2.96	38.42	5.07	4.409	.000*
Comfort/Anxiety	28.91	3.43	23.77	4.84	6.147	.000*

*p < .01.

Table 2. Computer Attitudes (Traditional University-Notebook University)

Do students who own home computers at the traditional university have equivalent computer experience, confidence, and attitudes when compared to students from a notebook university? As in the previous section, t-tests were used to compare means. Thirty-nine students in the sample population of the traditional university, or 63%, owned a home computer. The analysis of computer confidence between notebook university students and computer owners at a traditional university showed three areas of significance. Notebook university students have higher confidence in word processing software, Internet and communication applications, and spreadsheet software. There was not a significant difference with respect to database management software (Table 3).

Areas of Confidence	Notebook University (N=46)		Traditional University – Computer Owners (N=39)			
	Mean	Sd	Mean	Sd	t	p
Word Processing Software	38.24	2.82	35.87	4.61	2.903	.005*
Internet Communication Software	32.67	2.70	27.33	4.75	6.489	.000*
Spreadsheet Software	24.39	4.44	19.59	5.78	4.326	.000*
Database Management Software	18.13	7.79	17.46	7.74	.402	.688

*p < .01.

Table 3. Computer Confidence (Computer Ownership)

A second t-test in the second research objective compared computer attitudes between notebook university students and computer owners at a traditional university. The notebook university student had significantly higher attitudes toward computers, including both the areas of computer usefulness and comfort (Table 4).

Computer Attitudes	Notebook University (N=46)		Traditional University – Computer Owners (N=39)			
	Mean	Sd	Mean	Sd	t	p
Usefulness	42.11	2.96	39.97	3.70	2.95	.004*
Comfort/Anxiety	28.91	3.43	25.15	4.20	4.544	.000*

*p < .01.

Table 4. Computer Attitudes (Computer Ownership)

Conclusions

The study found that notebook university students had significantly higher computer usage in all areas than students at a traditional university or than students who owned computers at a traditional university. Computer use was also significantly higher for notebook university students in the areas of word processing and spreadsheet software when compared to students who were currently taking computer classes at a traditional university.

Whether comparing notebook university students to the traditional university population as a whole, to traditional students who are currently taking a computer class, or to traditional students who own their own computers, notebook university students display higher confidence in word processing software, Internet and communication applications, and spreadsheet software. Figure 1 provides a graphic representation of computer confidence with regard to notebook and traditional universities.

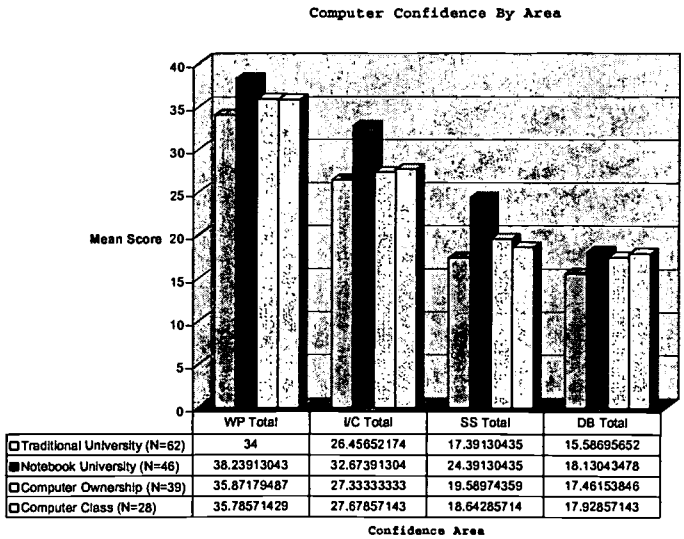

Figure 1. Confidence by Area.

When comparing computer attitudes, this study showed that students who attended a notebook university have significantly higher scores in the areas of computer usefulness and comfort in using computer technologies than traditional university students, computer owners at a traditional university, or students who were currently attending a computer class at a traditional university (Figure 2).

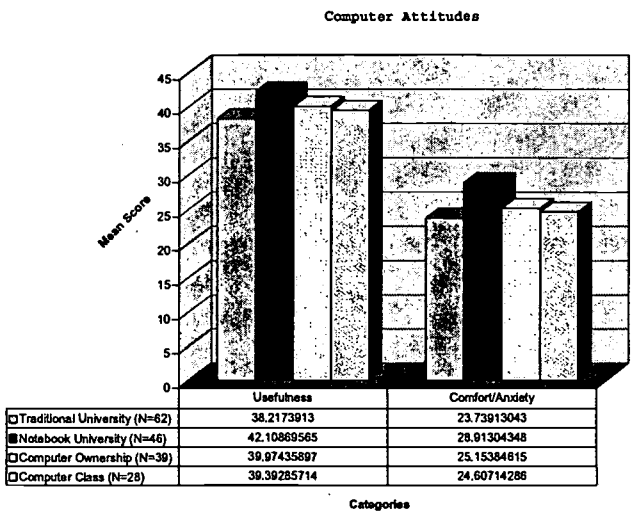

Figure 2. Computer Attitudes.

Recommendations

Several recommendations are made for future research.

1. The effects of experience and its relationship to confidence and attitudes should be studied in the context of the notebook university and the traditional university.
2. The scope of a future study should be enlarged to examine if notebook university students use the computer to be more productive in their educational pursuits.
3. In future research efforts, the survey instrument for computer experience should collect data beyond the use of computers for word processing, Internet and communication applications, spreadsheet software, and database management software.
4. In future research efforts, the survey instrument for computer confidence should include an additional category for presentation software.
5. In future research efforts, a larger sample size including multiple institutions should be used to allow for generalizations.
6. Future research should examine the modeling of computer use by faculty at notebook and traditional universities to determine its relationship to computer use, confidence, and attitudes of the respective student populations.
7. Future research should explore why computer use is significantly higher for notebook students than for traditional university students.
8. A study should focus on the different training methods used by universities that may contribute to computer experience, confidence, and attitudes.
9. Computer performance between notebook and traditional university students should be studied.
10. Additional research should be done to explore and identify other factors that contribute to the implementation of the notebook computer model.

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Science Concepts, Technology, and Higher Order Thinking Skills- What's the Connection?

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Abstract: Using the scientific process involves ample opportunity for complex higher-level thinking. Integrating technology into the unit can support and enhance these same critical thinking skills. This qualitative study was designed to examine students' understanding of a science problem involving human habitation of wetlands, woodlands, and grasslands. Four fourth grade students and their teacher were observed during a six-week period in which they spent two hours a day in a technology immersed classroom. Researchers observed how students used technology to proceed through defining, investigating, and drawing conclusions about the problem. Student interviews revealed how useful they felt technology had been for completing each stage of the process. Teacher interviews revealed how she believed technology was supporting and enhancing students' complex thinking. For the purposes of this study, the scientific process has been limited to the following four main stages: identify the problem; collect information; analyze information; and draw/present conclusions.

Peer-Status and Self-Efficacy: Effects on Technology-Based Small Group Interactions

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Abstract: Computers use in many U.S. schools is shifting from individual to group-based learning environments. This development is forcing a reevaluation of traditional uses of computers as tools for tutoring individual students. Teachers are beginning to recognize the potential for computers to serve as a medium for group-learning situations. This study examined some of the factors that influence interactions as students work in learning groups on a computer-centered activity. Twelve groups of three high school students each worked together around one computer to solve a mystery presented in a problem-based learning program. Prior to the activity, participants' self-efficacy was assessed and their peer-status was determined relative to the other members in their group. The preliminary results of this study indicate that high self-efficacy and high peer-status positively influenced individual participation. These results suggest that these teachers should attend to these individual student characteristics when forming student groups for technology-based learning situations.

Introduction

As the use of computers in our society increases, so does the need for research on effective ways to incorporate uses of computers into classroom learning. Teachers have typically used computers to present individual learning activities in lab settings. However, as more computers are integrated into classrooms, this dynamic is changing. Teachers are starting to view computers not just as tools for tutoring individual students, but as a potential medium for cooperative learning activities. When using computers in small-group learning situations, teachers must not assume that cooperative learning will automatically occur. The environment must be structured to promote cooperation and interpersonal interaction among group members and stimulate cognitive growth (Johnson, Johnson & Stanne, 1985). Examining the factors that influence the effectiveness of the interactions that occur in a cooperative-learning group will help teachers understand how to create a more effective cooperative learning environment. Some of these factors include a) how the group functions, b) the task structure, and c) individual characteristics of students (Hooper, 1992; Webb & Palincsar 1996). This study examines how two individual student characteristics (self-efficacy and peer status) influence group functioning in a computer-centered task that is structured to promote cooperative interaction.

Several features are important in developing tasks that support cooperative interaction. One important factor that affects cooperation in small groups is whether members share a common goal (Webb & Palincsar, 1996). It may prove more effective for group members to function independently or competitively when the goals of individuals within the group differ. The goals that are established for the group, and thus whether the group functions cooperatively, are largely determined by the task structure.

Ill-structured tasks tend to elicit cooperative interaction (Cohen, 1994). Ill-structured tasks are less clearly defined than well-structured tasks. Where well-structured tasks tend to have one "right" answer, ill-structured tasks require group members to reiteratively process the task or problem definition, to generate

several problem-solving approaches, and to analyze all the viable solutions (Gallagher, Stepien & Rosenthal, 1992). These processes force group members to interact at a highly mutual level, that is, cooperatively.

One model of cooperative group learning that provides an ill-structured task with common group goals is problem-based learning (PBL). PBL is a student-centered pedagogical strategy in which students try to solve ill-structured problems set in authentic contexts by reflecting on their experiences and sharing experiences with others (Hmelo & Ferrari, 1997). A key component of PBL activities is the opportunity for participants to engage in cooperative small group problem solving.

The characteristics of individuals within a small learning group may have a powerful influence on the nature of the group interactions. Social status is one characteristic that teachers consider when grouping students. Social status may be influenced by several factors including ethnicity, socio-economics, and gender (Cohen, 1982). Less obvious status characteristics that should also be considered include academic status and self-efficacy (Cohen, 1997; Busch, 1996). However, it is not clear *how* these characteristics influence group interactions. More effective grouping strategies could be used if teachers had a better understanding of the effects of status and self-efficacy on technology-based small group interactions. This study was an examination of the influence of self-efficacy and peer status on small group interactions during a computer-centered PBL activity.

Methodology

Setting and Participants

Participants were students in a private high school in a medium-sized western city. Thirty-six students with 3.0 or higher grade point average were randomly selected from one section of a ninth grade Spanish class and one section of an eleventh grade Spanish class. Eighteen of the participants were male; the other 18 were female. All participants were in the middle- to upper-middle class socioeconomic status. The 36 participants were randomly assigned to one of 12 same-gender or mixed-gender working groups of three students each. Three groups were all females, three groups were all males, three groups were two females and one male, and three groups were one female and two males to counterbalance gender across the groups.

Materials

Computer Software

The PBL activity involved developing a solution to The Mystery of Machu Picchu, a problem-based hypertext program developed by the lead author. Each group of students worked at a laptop computer with an external mouse. The objective of the program was to have the students choose a theory to explain the demise of the culture that built Machu Picchu. Students were required to use supporting evidence (gathered from informational resources in the program) to support their choice. Thus, students were assigned a common goal and the program provided an ill-structured problem—several viable theories that could be supported through information in the program were provided for the students.

The main screen of the program introduced the mystery of Machu Picchu to the students and indicated that there were several possible theories as to why Machu Picchu was built and what happened to it. Students were asked to determine which of the possible theories was most likely after exploring several different paths along the Inca Trail on their way to Machu Picchu. Different paths provided information that supported different theories. Hyperlinks to the Theories screen and to the Inca Trail screen were on the main screen. The Theories screen listed five possible theories. From there, students could link back to the main screen or to the Inca Trail screen.

The Inca Trail screen contained a graphic image map linking to five different sections: (a) Location of Machu Picchu, (b) Inca Customs, (c) Inca Construction Techniques, (d) Inca Artifacts, and (e) Tour of Machu Picchu. All sections contained from two to eight related subsections. Each of these subsections contained graphic maps and textual descriptions. Students could link back to review the information on the main screen or the Theories screen from any section or subsection screen.

Case sheet

Two column case sheets and pencils were provided for note taking. The first column of the case sheet was divided into five sections (one for each theory) with space to write supportive evidence found in the program and to note the section and subsection of the Inca trail where the evidence was found. The second column provided space to make notes about how the evidence in the first column supported a selected theory.

Self-efficacy test

A self-efficacy measure was adapted from the English version of the General Perceived Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) and the Computer Self-Efficacy Scale (Eachus & Cassidy, 1998). This assessment was used to determine general self-efficacy toward learning and self-efficacy toward using computers. A series of 23 statements regarding how students handled difficult situations, their feelings about learning and school, and their feelings about computers were presented. Participants rated each statement on a scale from one to four (1 = not at all true, 2 = hardly true, 3 = mostly true, and 4 = exactly true). Higher scores correspond to higher self-efficacy. The highest possible score was 88.

Peer-status ranking

Peer-status ranking was assessed using a sociometric instrument developed by Cohen, Lotan and Catanzarite (1990). A series of 20 descriptive questions regarding the academic and social status of each groups' members were presented. Next to each question were all the names of the individuals in the respondent's group. The participants were then asked to circle the name of the group member who most accurately fit each descriptive question. Respondents had the option of selecting him or herself as well as the other two members of the group.

Video equipment

A video camera was mounted on a tripod approximately 10 feet from the group to record interactions during the activity.

Procedures

The research was conducted in two sessions. During the first session students took the self-efficacy test and rated themselves and the other students in their group in terms of academic and social status. This session took approximately 20-40 minutes.

The second session was conducted with one three-person group at a time. Each group worked on The Mystery of Machu Picchu PBL computer program in an empty classroom. Before starting, the researcher gave the students instructions that they were to work together to solve the problem presented in the program, and to take notes on their case sheets as they progressed through the program. The problem and instructions as to how the users of the program were to go about solving the problem were presented in the program. Each group of students worked through the program with little intervention from the researcher. While students worked they took notes on their case sheets when they found supporting evidence. The groups were free to talk among themselves. Each group was given approximately 35 minutes to work through the program. These sessions were videotaped to record the group interactions during the process of completing the task. The researcher also recorded general and task-specific observations made during the activity. Participation, attentiveness to the task, the types of questions and responses, the amount of both task and non-task verbalizing, and mouse control were recorded and later categorized.

Analysis

To investigate the effect of an individual group member's self-efficacy and peer-status on group interactions, the participants' pre-activity questionnaire results were compared to the videotaped interactions during the activity. Each participant's score on the self-efficacy scale was totaled and individuals were given a self-efficacy rank within the group relative to other group members' scores.

The second part of the pre-activity questionnaire asked the participants to circle the name of the group member (including him or herself) who most accurately fit each of 20 descriptive statements regarding academic and social status. The number of times each name appeared on any of the three lists was totaled for each group. The individual whose name appeared most frequently received the highest peer-status ranking; second and third place rankings were assigned accordingly.

Videotapes of group interactions were analyzed to categorize each group member's actions and interactions during the activity. Transcriptions from the videotapes of each of the group's interactions were qualitatively coded into the following categories: 1) questions, 2) responses, 3) initiation of concepts, 4) elaboration, 5) building on elaboration, 6) directing, and 7) disagreements. All on-topic questions were coded as questions. All responses to on-topic questions were coded as responses. When an individual came up with a new idea without prompting from other members of the group, that statement was coded as initiation of a new concept. Statements that elaborated on (a) something that was read or (b) their own idea were coded as elaboration. Statements that elaborated on another group member's idea or statement were coded as building on elaboration. Giving instruction or directing other members in how to act or think was coded as directing. When a group member disagreed with another group member's idea, the statement was coded as disagreement.

Preliminary results from these data suggest that both self-efficacy and peer-status positively influence an individual group member's participation in group interactions. 50% of the time, the individual asking the questions in the group had the highest self-efficacy score and peer-status ranking of the group. Concepts were initiated 57% of the time by the individual with the highest self-efficacy score and 50% of the time by the individual with the highest peer-status ranking. Building on elaboration, the most frequently coded type of statement, came from the individual with the highest peer-status ranking 58% of the time and from the individual with the highest self-efficacy score 50% of the time. These findings suggest that students who are confident in their abilities and hold higher social status within a group show more willingness to present new ideas and build on and develop their peers' ideas in PBL computer-based learning group-environments.

These data also suggest that self-efficacy may have more influence on an individual's confidence to disagree with another group member than peer-status. Fully 75% of the disagreements with another group member's ideas came from the individual with the highest self-efficacy score. However, the student who disagreed never had the highest peer-status ranking. Perhaps those individuals with a high peer-status ranking were afraid to openly disagree with the other members of their group for fear of disrupting the group dynamic and potentially loosing their peer-status. Students with high self-efficacy scores who disagreed consistently had lower peer-status ranking. These students may have had the self-confidence to express their disagreements without the fear of losing peer-status.

Finally, in each of the three groups with the greatest within-group difference between self-efficacy scores the individuals with low self-efficacy scores had the least total participation of all students in the study. This suggests that when there is a large disparity in self-efficacy, individuals with low self-efficacy may be intimidated when paired with individuals with much higher self-efficacy and hesitate to fully participate in group discussions.

Conclusions

The preliminary findings from this study suggest individual characteristics such as self-efficacy and peer-status may play an important role in how PBL-based cooperative learning groups interact. Self-efficacy and peer-status were found to influence student involvement relative to initiating new ideas and elaborating on others' ideas, while challenging ideas through disagreement appears to be positively related to self-efficacy and negatively related to peer-status. The findings also suggest that the characteristics of each of the individuals in a group may influence each other's participation. Pairing very low self-efficacy

students with very high self-efficacy students may have a negative influence on low self-efficacy students' participation.

As teachers begin to move beyond traditional drill-and-practice implementations of computers, these results can provide helpful information for teachers who want to use computers as a context for problem-based cooperative learning activities. Self-efficacy and peer-status appear to be important factors in shaping the interactions that take place in group learning contexts. It appears that including a student with high self-efficacy and peer-status would increase the likelihood that new ideas would be presented and elaborated. Further, including a student with high self-efficacy who does not hold the highest peer-status may increase the chances of disagreement—fostering a more critical and lively discussion. However, the range of self-efficacy and peer-status within a group should be limited so that all group members feel comfortable participating and interacting to complete the task.

In this study, we have begun to examine some of the factors that effect student interactions when using computers in PBL-based cooperative learning groups. Other topics that deserve attention include the influence of gender, socio-economic status, ethnicity, computer skills and prior knowledge. Issues of group dynamics are central to teachers' adoption of new ways of integrating technology into their instruction through cooperative project-based classroom instruction.

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Working Toward National Technology Standards: Teacher Use of Computers in the Classroom

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Abstract: Technology, when properly implemented, can bring a new dimension to education. In addition to automating some applications, it can be used "to help us do things in education that were heretofore impossible" (Thornburg, 1999, p.1). This paper focuses on the results of a survey of almost two thousand teachers. The survey focuses on the teachers' attitudes toward and use of computers in instruction, with specific emphasis on classroom uses. The study investigated the extent to which classroom teachers are prepared for meeting national standards through their use of technology for educational applications and instruction.

Introduction

In recent years, states and districts have increased expenditures to equip schools with computers and related technology (Quality Education Data, 1998). As a result of the significant investments being made in hardware, software, and infrastructure, there is a call for evidence regarding the effectiveness and appropriate use of technology in K-12 schools (Panel on Educational Technology, 1997). Many researchers have "realized that technology cannot be treated as a single independent variable, and that student achievement is gauged not only by how well students perform on standardized tests but also by students' ability to use higher-order thinking skills" (North Central Regional Educational Laboratory, 1999, p1). It also became apparent that with the acceleration in the pace of technological innovation, skills, such as problem solving with appropriate tools for learning, synthesizing information, and communicating are essential for today's students (Panel on Educational Technology, 1997).

Although technology cannot solve all of the issues facing education, there is substantial evidence that, when used effectively, it can promote an improvement in student achievement, including higher-order thinking skills (CEO Forum, 2000; Means, Blando, Olson, Middleton, Morocco, Remz & Zorfass, 1993). In an attempt to provide guidelines and expectations of technology use in education, several states have instituted standards related to competencies in the use of technology. One of the first national movements toward establishing standards for technology was initiated by the International Society for Technology in Education (ISTE). Through their leadership, a consortium of organizations representing major professional education groups, government entities, foundations, and corporations was formed to create a national set of standards to govern the use of computers in schools.

The first set of standards, the National Educational Technology Standards (NETS) for Students was published in 1998. It categorizes technology competencies into six areas: (a) basic operations and concepts, (b) social, ethical, and human issues, (c) technology productivity tools, (d) technology communication tools, (e) technology research tools, and (f) technology problem-solving and decision-making tools. Profiles are provided that detail technology achievement indicators at various stages in PreK-12 education. It is recommended that the skills be integrated into a student's personal learning and social framework by being introduced in the classroom, reinforced, and finally mastered. The standards are intended to be an integral tool for technology learning within the context of academic subject areas (ISTE, 2000).

Method

In order to investigate the degree to which teachers are using computers in the classroom, a survey was designed and administered to teachers in a large urban school (N=1665). The survey targeted the areas of teacher attitudes toward computer use, integration of computers into instruction, types of software used, and teacher confidence and comfort with computer use. Demographic information, including grade level and subject areas taught was also gathered. In the context of the NETS, the sections of primary interest for this study were those focusing on the integration of computers into instruction and teacher attitudes toward computer use.

The integration section of the survey was divided into three parts consisting of both the methods used and the extent to which teachers were integrating computers and technology in the classroom. Items included instructional strategies employed by the teacher in the classroom (e.g., individual and small group instruction), software used by both teachers and students to complete school related activities (e.g., word processors, spreadsheets, graphics programs), and teachers' personal use of computers (e.g., for fun/entertainment; as a communication or research tool).

Responses to items related to the integration of technology and types of software used were provided on a 5-point frequency scale (ranging from *Not at All* to *Every Day*). In the survey section targeting general attitudes toward the use of computers in the classroom, items covered student access to computers, essential skills for students, the incorporation of computers in the classroom, and the impact of technology on teachers. This portion of the survey contained 20 items reported on a 5-point Likert scale (ranging from *Strongly Disagree* to *Strongly Agree*).

Data were analyzed for differences between school level (i.e., elementary, middle, and high school) and subject area taught (i.e., English, math, science and social studies). The Chi Square test of independence was used to compare the amount of time spent on integrating technology into the classroom by teachers across both school level and subject area. The teaching modes included in the survey were representative of standards for students in the NETS. A series of ANOVAs were conducted to examine differences in affinity and aversion to technology across school level and subject area. Affinity to technology, in this case, implies a positive attitude towards technology. Aversion, on the other hand, indicates a negative feeling towards technology. The use of software to complete school related activities was examined for both teachers and their students.

Results

School Level Differences

School Level Teaching Mode	Elementary	Middle	High
Small Group Instruction	32.05	20.92	18.50
Individual Instruction	60.72	30.36	32.08
Cooperative Groups	40.58	20.62	21.85
Independent Learning	76.61	35.11	40.76
Tutor	57.11	19.95	21.28
Promote Student Centered Learning	65.57	29.82	27.47
Research Tool	32.05	34.35	40.43
Problem Solving Tool	29.95	23.26	20.29
Productivity Tool	36.78	39.54	37.77
Classroom Presentation Tool	26.53	27.69	26.14
Communication Tool	59.35	54.34	48.23

Table 1: Percent of Use by Teaching Mode and School Level

Percents of computer integration at each school level are presented in Table 1. Statistically significant differences were evidenced among the levels for computer use for small group instruction, individual student instruction, cooperative groups, independent learning, tutoring, to promote student centered learning, problem-solving, and as a communication tool.

While statistically significant differences were found in eight of the integration items, the remaining three items (computers used as a productivity tool, as a classroom presentation tool and as research tool) evidenced no statistically significant difference across school level.

Subject Area Differences

The Chi-Square test of independence was also used to compare English, math, science, and social studies teachers' integration of computers in the classroom (Table 2). In these analyses, only middle and high school teachers were used because only these levels are subject specific.

Subject Teaching Mode	English	Math	Science	Social Studies
Small Group Instruction	10.16	13.16	14.94	11.49
Individual Instruction	23.44	21.93	29.89	12.79
Cooperative Groups	10.40	14.16	20.69	18.82
Independent Learning	29.92	26.32	41.38	28.24
Tutor	13.39	16.67	27.38	12.94
Promote Student Centered Learning	19.69	22.52	28.74	21.69
Research Tool	30.16	23.89	51.14	44.19
Problem Solving Tool	10.40	16.96	28.41	22.62
Productivity Tool	31.50	33.33	48.28	40.00
Classroom Presentation Tool	21.26	16.96	42.53	29.76
Communication Tool	49.21	49.12	59.09	53.57

Table 2: Percent of Use by Teaching Mode and Teacher Subject Area

Statistically significant differences were found across the subject areas when teachers used computers with students to tutor, as a research tool for students, as a problem-solving and decision-making tool, and as a classroom presentation tool. No statistically significant differences were evidenced between the groups when computers were used for small group instruction, individual instruction, in cooperative groups, independent learning, to promote student center learning, as a productivity tool, or as a communication tool.

Software Use

The means and standard deviations for teachers' software use by level are presented in Tables 3 and 4. The types of software used were divided into two groups, application software and instructional software. An examination of these means revealed that word processors and web browsers were used the most (nearly every day) in all school levels. In contrast, web publishing and programming tools were rarely used by any schools.

Level	Elementary		Middle		High	
Software	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Word Processors	4.20	.99	4.18	1.04	4.22	1.01
Spreadsheets	2.13	1.12	2.34	1.34	2.19	1.27
Databases	2.28	1.38	2.41	1.43	2.13	1.33
Desktop Publishing	2.48	1.22	2.23	1.14	2.15	1.27
Presentation Software	1.59	.87	1.75	1.09	1.71	1.03
Web Publishing	1.34	.80	1.25	.70	1.40	.86
Programming/Authoring Tools	1.27	.74	1.29	.74	1.35	.87
Web Browsers	3.41	1.43	3.47	1.48	3.46	1.53

Table 3: Application Software Used to Complete School Related Activities by Level

Level	Elementary		Middle		High	
Software	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Drill and Practice	1.57	1.10	1.50	.99	1.48	.93
Games	1.80	1.21	1.77	1.14	1.76	1.13
Simulations	1.34	.79	1.52	.98	1.46	.85
Tutorials	1.65	.98	1.63	1.00	1.61	.95
Integrated Learning Systems	1.30	.78	1.34	.86	1.21	.65

Table 4: Instructional Software Used to Complete School Related Activities by Level

In addition, the instructional software used the most was games and tutorials. It is important to note that instructional software was used significantly less than application software. Similar results were found when teacher use of application and instructional software was compared across subject area. These data are represented in Tables 5 and 6.

Subject	English		Math		Science		Social Studies	
Software	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Word Processors	4.31	1.01	4.04	1.13	4.37	.91	4.09	1.13
Spreadsheets	2.08	1.28	2.41	1.52	2.58	1.24	2.05	1.23
Databases	1.90	1.24	2.27	1.47	2.33	1.30	1.83	1.18
Desktop Publishing	2.40	1.34	2.02	1.09	2.39	1.23	1.91	1.18
Presentation Software	1.56	.85	1.73	1.16	2.09	1.12	1.81	1.16
Graphics	1.73	1.05	1.92	1.13	1.94	1.04	1.55	.79
Web Publishing	1.33	.76	1.30	.78	1.34	.73	1.32	.89
Programming/ Authoring Tools	1.23	.66	1.41	.94	1.33	.85	1.26	.75
Web Browsers	3.17	1.47	3.32	1.58	3.87	1.35	3.67	1.50

Note: approximate sample size = 410

Table 5: Application Software Used to Complete School Related Activities by Subject

Subject	English		Math		Science		Social Studies	
Software	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Drill and Practice	1.33	.70	1.54	1.07	1.55	.99	1.27	.63
Games	1.64	1.09	1.84	1.21	1.66	1.18	1.67	.98
Simulations	1.26	.58	1.49	1.00	1.92	1.09	1.33	.60
Tutorials	1.40	.74	1.59	1.06	1.85	1.05	1.47	.80
Integrated Learning Systems	1.15	.52	1.39	.91	1.21	.66	1.26	.74

Note: approximate sample size = 410

Table 6: Instructional Software Used to Complete School Related Activities by Subject

To examine students' software use to complete school related activities, a composite was created based on the classifications described above. When examined by level, teachers reported that the students in

elementary school used instructional software more than application software. This trend was not true for middle and high school students, who had a tendency to use application software more than instructional software. In contrast, when software use was compared across English, math, science and social studies classes, application software was used more frequently than instructional software.

Teacher Attitude Toward Computers

When differences in Technological Aversion were examined, the results of an ANOVA suggested a statistically significant difference ($F(2,1694)=5.57, p=.0039$) across school level (see Table 7). Follow-up tests revealed a statistically significant difference in Technological Aversion between the elementary and high school teachers (with means of 3.99 and 3.88, respectively). Although statistically significant because of the large sample, a difference of this magnitude (Cohen's $f=.08$) is considered trivial. No statistically significant difference was evidenced when school level differences in Technological Affinity were investigated ($F(2,1694)=2.83, p=.0593$. Likewise, no statistically significant differences were found in Technological Aversion ($F(3,410)=2.02, p=.1106$) or Technological Affinity ($F(3,410)=1.75, p=.1560$) across subject areas (see Table 8).

		Elementary	Middle	High	
Affinity	Mean	4.0767	4.0160	4.1101	F=2.83
	Standard Deviation	.5513	.6043	.6131	p=.0593
Aversion	Mean	2.0107	2.123	2.0342	F=5.57
	Standard Deviation	.5511	.6004	.6016	p=.0039

Table 7: Teacher Attitudes by Level

		English	Math	Science	Social Studies	
Affinity	Mean	4.0914	3.9419	3.9870	4.1004	F=1.75
	Standard Deviation	.5574	.5813	.6572	.6650	p=.1560
Aversion	Mean	2.1518	2.0638	2.0282	2.2316	F=2.02
	Standard Deviation	.6139	.5994	.5560	.6885	p=.1106

Table 8: Teacher Attitudes by Subject

Conclusion

When comparing elementary, middle and high school teachers, it was found that elementary school teachers were integrating computers into the classroom more frequently than middle and high school teachers, despite the fact that attitudes were comparable. Elementary school teachers reported using computers primarily for independent learning, student centered learning, individual instruction, and as a communication tool. When the integration of computers in the classroom was compared by subject area, among middle and high school English, math, science and social studies teachers, it appeared that science teachers were using technology more frequently. Most significantly, the science teachers used technology for independent learning, as a communication tool, as a research tool for students, as a productivity tool and as a classroom presentation tool more often than for other reasons. Also, English, math, science and social studies teachers used technology as a communication tool more often than for any other reason.

Application software is that which is used to complete an activity such as writing a paper or preparing a presentation. Instructional software, on the other hand, is software that is designed as a teaching tool. A game that teaches math skills and the simulation of a frog dissection are examples of instructional software. When the software listed on the survey was divided into these two categories, it was found that instructional software was used more often at the elementary level and application software slightly more often at the middle and high school levels. The specific application software used most frequently by elementary, middle and high school teachers was word processing software and web browsers. Teachers reported using these applications almost every day. On the other hand, the remainder of the application software and the instructional software were used

much less. Results were very similar when software use was compared by subject area. Web publishing and programming/authoring tools were the applications used least frequently (virtually not at all).

With regard to the NETS guidelines, it appears that the following components are being addressed in the schools that were surveyed: technology productivity tools, technology communication tools, technology research tools, and technology problem-solving and decision-making. Although not directly measured, it can be inferred from the reported use of these more complex applications that basic operations and concepts are also being covered. There is, however, still room for improvement. In the productivity area, only 40% of the schools are using computers as a productivity tool (across all levels). The largest use in this area (per subject field in middle and high schools) is found in science.

Using computers as communication tools ranks highest in the areas examined (across all grade levels), with over 50% usage at the elementary level. When examined by subject area, communication also exhibited large numbers, with over 50% in both science and social studies.

As a research tool, high schools were shown to be using computers more often than middle or elementary schools, although the difference was not statistically significant. However, even at the high school level, the total usage was less than 40%. When examined by subject area, science again ranked highest (50%), followed by social studies.

Problem-solving and decision-making scored lowest overall (with regard to the integration of computers across grade levels and subject areas). This can be a complex implementation of technology, and often requires sophisticated software or teaching strategies.

In summary, this research indicates that technology is being integrated in schools at various levels. As David Thornburg stated, "How you use technology in education is more important than if you use it at all" (1999, p. 1). With standards, such as the NETS, as guidelines, our students and our schools can gain increasing benefits from the technology investments in education.

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Multimedia Tools and Case-Method Pedagogy for Teaching and Learning

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Teacher educators face the challenge of preparing teachers to recognize and respond to educational problems as they arise in highly variable, often unpredictable contexts. Two recent innovations in teacher education offer promising possibilities for doing so: case-method pedagogy and multimedia tools for teaching and learning. The purpose of this research was to explore how these innovations interacted in CaseNET to help preservice teachers learn to address problems as they emerge in K-12 classrooms.

CaseNET is a set of Web-assisted professional development courses for educators that combines the use of case methods and Web-based technologies. CaseNET provides preservice and inservice teachers at approximately 20 universities in four countries and 15 school districts in the United States and three other countries opportunities to improve their professional problem-solving skills. Participants in CaseNET use a variety of technologies including videoconferencing, electronic journals, and online discussion groups to learn to analyze multimedia cases. Throughout a fourteen-week academic semester, participants learn to analyze cases using a specific five-step problem-solving strategy (McNergney, Herbert, & Ford, 1994; Herbert & McNergney, 1995, McNergney & Herbert, 1995) and practice this strategy when analzying a set of multimedia teaching case studies.

Teaching case studies might be described as stories, vignettes, or "slices of real life." These cases present predicaments from practice that demand some kind of action (Gideonse,1999). They illustrate reality in its intricate complexity and often include important contextual evidence. Although based on reality, cases condense facts or elaborate on real events to create succinct analytic puzzles. Cases illustrate life in the classroom as it is, not necessarily as it should be. Learning with cases provide preservice and inservice teachers with opportunities to practice problem identification (Merseth, 1996). The skills developed through case methods are useful in a variety of settings. Experience with various types of cases also helps professionals develop a repertoire of defensible solutions for commonly occurring problems (Kleinfeld, 1992; Merseth & Lacey, 1993).

This study investigated the efficacy of a particular problem-solving method on participants' experiences with a multimedia case. The sample consisted of 33 preservice teachers participating in CaseNET at two institutions of higher education (Group One), 26 preservice teachers from these institutions of higher education not participating in CaseNET (Group Two), and 34 other students enrolled in arts and sciences from these institutions of higher education who were neither CaseNET participants nor preservice teachers (Group Three). Problem-solving proficiency, as demonstrated by participants' three-page written case analyses, was determined by a panel of professional educators, or judges, who were prepared to use an instrument measuring participants' abilities to: (1) identify educational issues, (ISSUES); (2) consider events in the case from different points of view, (PERSPECTIVES); (3) identify professional knowledge (personal, empirical, theoretical) relevant to issues in the case and raise questions about other potentially useful knowledge, (KNOWLEDGE); (4) propose actions for addressing a variety of issues, (ACTIONS); and (5) speculate about the consequences of such actions, (CONSEQUENCES).

Participants in the study assembled in groups of about 15 in computer labs where they were asked to read and analyze a case presented in hypertext and multimedia format called "Here to Serve." The case tells the story of a middle school technology coordinator who is challenged to address the needs of mainstreamed students with special needs, attend to the professional development of teachers under her authority, and deal with the many other tasks her position demands. Information useful for analyzing the case was embedded in descriptions of the characters and events occurring in the case and in ancillary materials contained in a resource area linked to the case. After reading the case, participants submitted a three-page analysis that was then rated by a panel of judges.

In examining the generalizability of the judges' ratings, analyses were considered the objects of measurement. Judges were considered random facets and subscale scores were considered fixed facets. The design of the study was participants' written analyses (p) crossed with judges, (j) who were nested within subscales (i), p x (j : i). Using GENOVA, the generalizabilty coefficient was sufficient to propose adequate dependability (g=.77).

Scores indicating participants' problem-solving performance were calculated and a comparison of these sub-scale scores and a total scores was performed. Participants' subscale scores were calculated by summing the points participants received from both judges on each of the subscales on the judges' rating instrument (issues, perspectives, knowledge, actions, and consequences). The subscales reflected each participant's performance on the individual steps of the five-step method.

Judges' ratings were summed to yield the total score. A direct discriminate function analysis was performed using the five variables as predictors of membership in the groups. Variables were ISSUES, PERSPECTIVES, KNOWLEDGE, ACTION, and CONSEQUENCES. One discriminant function was significant. With a combined $x^2_{(10)} = .81$, $p<.01$. After removal of the first function, there was no strong association between group and predictors. The loading matrix of correlations between predictors and discriminant functions suggests that the best predictors for distinguishing between CaseNET participants and those in the other two groups was the rating participants' analyses received on the subscale KNOWLEDGE, ISSUES, and CONSEQUENCES. Group One had higher scores on this variable (M=17.79) than Group Two (M=14.73) and Group Three (M=14.26). Variables loading less than .50 were not interpreted.

The total scores reflected participants' performance on all the subscale items combined. Group scores obtained for participants' total scores were significantly different among groups ($F_{(2, 90)} = 57.91$, $p<.01$). A Tukey post hoc test revealed that there were differences between Group One (M=71.06, s=4.37), and Group Two (M=63.54, s=3.01) and Group Three (M=62.24, s=3.07), but not between Groups Two and Three.

Results suggest that preservice teachers in CaseNET were able to learn the problem-solving strategy and apply it when analyzing a multimedia case study. Participants in this group identified problems, applied professional knowledge, and anticipated consequences more proficiently than did the participants in the other groups.

At least since John Dewey (1910) promoted the joining of education and real life, teacher educators have tried to help preservice teachers develop reflexive teaching strategies that are adaptable to many learners. Teacher educators have provided opportunities for preservice teachers to learn from one another in college and university classrooms and from more experienced colleagues in K-12 schools. Now, multimedia technology offers teacher educators new ways to provide realistic educational experiences for teachers.

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Computer Use in ESL: Case Studies and Action Research

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Abstract: With the onset of the twenty first century, utilizing computer technology in school curriculum has become not only a reality but a necessity in preparing students for effective transition into today's society. In addition, with the multicultural composition of today's student population, computer technology can become a facilitative force in teaching students who originate from culturally diverse homes. The purpose of this article is to provide a brief history of how computer technology has been used in ESL classrooms. Then, a few case studies and some action research are presented as a glimpse into current ESL classroom environments where technology is being used to varying degrees.

Introduction

As predicted in John Naisbitt's (1982) pivotal work, "Megatrends," 'high tech-high touch,' (p. 35) has become a reality in today's society. At least the increased use of technology in schools and in homes has become a reality. With the changing demographics occurring in the United States, and the consequential shift in the student populations' needs, both have presented newfound challenges to today's teachers.

The presence of language minority students in public schools has been significant. As stated by Diaz-Rico and Weed (1995), "minorities now constitute the majority of public school students in fifteen of the country's largest school systems" (p. 221). More specifically, Diaz-Rico and Weed stated that "California is the nation's most racially diverse state with a greater percent of Asian and Latino residents than any other state" (p. 220). Due to this cultural diversity, the California Commission on Teacher Credentialing (1997) has tailored its standards to meet the needs of this student population by requiring teachers to be culturally sensitive, particularly in the area of language instruction.

In addition, all teachers are trained to incorporate technology in their curriculum. In states that have culturally diverse populations, teachers can meet several instructional goals simultaneously by using computer technology to facilitate English language instruction. The first goal is to individualize teaching to meet each student's unique needs. The second goal is to incorporate computer technology into the curriculum. The third goal is to improve English language instruction through more frequent use of the reading and writing skills. All of these goals can be accomplished by using software that requires reading and writing in English. Instruction can be provided at each student's ability level once each student's initial instructional level is determined with a diagnostic test, which is administered by the computer. Once appropriate placement is determined, then each student may begin practicing his or her reading and writing skills, usually within the context of pictures, stories, puzzles, etc.

So, how do teachers of English as a Second Language (ESL) take advantage of technology in their classrooms? What problems have they encountered? What do they think of using computer technology in instruction?

To answer the above questions, the authors conducted case studies and action research in 2000. The paper focused on the teachers' use of computers in the classroom. Terminology related to ESL included ELL (English Language Learners), bilingual education, and minority language education. The authors did not intend to differentiate these terms; therefore, they used the general term "ESL" for discussion throughout the paper.

The paper is comprised of three main components. It starts with a discussion of instructional methodology; then, using computers in the ESL classrooms; followed by case studies and action research. Lastly, the authors provide recommendations on employing computers in the ESL classroom, in addition to, useful Internet resources.

Instructional Methodology

In the last few decades, Teaching English as a Second Language (TESL) methodologies have been changing from the Grammar Translation Method, to the Direct Method, to the Audiolingual Method, and finally to the use of the Communicative Approach. Different technology has been utilized at different time periods. Lately, computers have become a common instructional as well as learning tool in schools. In this section, the authors will first introduce the development of TESL methodologies and then will present examples of computer use in ESL instruction and its advantages.

Development of TESL Methodologies

Prior to the mid-twentieth century, TESL methodologies, such as the Grammar Translation Method, were influenced by structuralists and characterized by the narrow linguistic view. The objectives of the Grammar Translation Method were to teach the rules of grammar and to translate sentences into a target language (Howatt, 1984). With this method, students could translate, read, and write well but had problems with oral communication.

Arising as a reaction to the Grammar Translation Method, the Direct Method viewed speech as more important than written language (Butare-Kiyovu, 1991). Learners did not have to memorize the rules but had "direct practice in speaking and reading through imitation and repetition" (Butare-Kiyovu, 1991, p. 147). However, the examples in the exercises were examples used by an "ideal speaker-listener." With this method, learners encountered problems communicating in real life situations.

In the 1940s and 1950s, the Audiolingual Method, supported by behaviorist psychologists, was commonly used (Savignon, 1983). In this method, language learning was habit formation. With audiotapes, students practiced patterns and drills repeatedly, by which they expected to master the language skills. They memorized and considered language use as automatic, not creative.

From the 1960s and 1970s, people became more concerned with communication (Hymes, 1971; Halliday, 1973; Lessard-Clouston, 1992; River, 1987; Kramsch, 1993; DeVillar & Faltis, 1994). Moskowitz (1978), Asher (1977), Curran (1976), and Gattegno (1972) stopped repetition and memorization as sole techniques of language learning and injected meaning into the classroom (Yalden, 1983). They stressed that language should be for communication. Consequently, interaction began to play an important role in second language learning (River, 1987; Kramsch, 1987).

Classic Examples of Using Computers in ESL Classrooms

During the 1980s, computers entered classrooms in increasing numbers, and much educational software, including software for ESL education, was developed. Computer-Assisted Language Learning (CALL) became a topic that interested many ESL educators. CALL professionals viewed computers to be a useful tool in ESL. By using computers, they argued, teachers could provide information through different venues, and through multiple exposures enhance language acquisition for ESL learners.

The English Department at the University of Texas at Austin used real-time computer conferencing in English, ESL, French, German, and Portuguese classes. Bump (1990) conducted research on English literature students and found that reticent students, i.e., women, minority students, and shy learners, tended to participate in the discussion more readily and more often than in the regular classroom. The conferencing classroom became non-threatening. In addition, the students' written messages expressing their thoughts and feelings became the focus of the learning experience. The instructor became more of a facilitator, rather than a person who offered correct answers.

Wong (1993) conducted research to explore the effectiveness of dialogue journal writing between ESL students and their instructors via E-mail at the University of Oregon. The results indicated that the students in the E-mail group wrote more per writing session than the students in the pen-and-pencil group. The instructor also wrote

more per writing session in response to the students in the E-mail group than she did to the students in the other group. The instructor also produced more language functions. E-mail was found to increase the amount of interaction between the students and the instructor. In addition, the students in the E-mail group and the instructor showed positive attitudes towards E-mail.

These studies indicated that the technology eased anxiety of minority students, encouraged students to produce more language functions, fostered interaction between instructor and students, and lifted the social status of minority students. In short, computers were found to be advantageous for second language instruction.

Using Computers in the ESL Classrooms

To investigate the degree in which computer technology is utilized in the ESL classroom, the authors asked the following questions: Do ESL teachers take advantage of the technology, if so, how? What do they think of using computers in ESL instruction?

Case Studies

The participants involved in the case studies were three ESL instructors in public schools as well as in community colleges. One of them (teacher A) is teaching in an elementary school, one (teacher B) in a high school, and one (teacher C) in a community college. Prior to teaching in the community college, teacher C taught ESL in a high school for 10 years. Two of the participants have been teaching in ESL classrooms for more than 10 years, and one of them has been teaching for less than 5 years.

Each of the participants first completed a survey and then was interviewed. They shared from their experiences how ESL teachers used computers in classrooms and what problems they had encountered.

All of the participants mentioned that, (due to ESL students' limited language proficiency,) they had to use a variety of teaching methods to enhance students' comprehension. For example, they spoke slowly, frequently repeated what they said, and used objects or body language to help students understand. These additional considerations were particularly useful when incorporating computer use into the various lessons.

In regard to computer use, the elementary teacher reported that ESL teachers conducted language arts classes in learning centers where computers were located. They used educational software such as Reader Rabbit to enhance students' learning. The high school teachers had students conduct research using the Internet. They mentioned that they did not have computers in their classrooms, but instead had access to a computer lab. This limited access discouraged ESL teachers from incorporating computer technology into their classrooms. Similar to the high school teachers, the community college instructor interviewed stated that computers were also not commonly used in her instruction due to limited access to a computer lab. Nevertheless, whenever her classes had access to a computer lab, the students used the A+ Learning Skills Program and the Weaver Reading Program and found the programs to be beneficial.

What problems have they encountered when using computers? Listed below were problems they addressed:

(1) Lack of practice time:
(2) Unmotivated administrator and faculty:
(3) Lengthy protocol for student access to the Internet:
(4) Limited access to computers and the Internet:
(5) Lack of adult supervision:
(6) Out-of-date and/or poorly maintained computer hardware and software:
(7) Inadequate funding:

Despite the problems that the teachers addressed, all of them had positive attitudes toward using technology in ESL instruction. They mentioned that the most significant advantage of using computer software was the self-pacing feature. Students can work at their own speed and at their individual levels. The teachers believed that computers could enhance learning and should be employed in ESL classrooms. In addition, teachers stated if the various problems cited were addressed expeditiously, more technology would likely be used in ESL classrooms.

Action Research

The participants involved in the action research were students in a graduate level Computer-Assisted Language Learning (CALL) course at a university. A total of 14 students were in the class. Data of five of them was included in the research because the five participants have been teaching ESL classes in either public schools or community college in the United States (USA). Two of the participants have been teaching ESL for more than 10 years and three of them less than five years.

Data analysis was based on data collected from students' information sheets, class observations, class discussions, and students' performance in class. At the beginning of the quarter, the students filled in the information sheets, and the instructor used the information to identify students' computer knowledge prior to the course.

The data indicated that ESL teachers were not familiar with computer applications. According to the class discussions, most of ESL teachers simply used word processing in their instruction, and some of them used Internet search. The class observations and students' performance also indicated that the participants were not familiar with using computers in instruction.

The participants addressed similar problems as the ESL teachers of the case studies, for example, limited access to computers, a large number of malfunctioning computers, heavy workload, lack of practice time, and inadequate funding. Although they seldom used computers, they had strong desire for learning computer applications and using them in their classrooms. The participants revealed their positive attitudes toward using technology and willingness to implement technology in their classrooms.

Recommendations

The participants of the case studies shared various problems they encountered while using computers. Surprisingly, the researchers found that one problem was not previously mentioned by the participants in the case studies but in the action research: ESL teachers' unfamiliarity in computer use. The lack of familiarity might have caused ESL teachers not to use computers in classrooms.

To help teachers familiarize themselves with the use of computers, it is recommended that schools or school districts encourage ESL teachers to participate in technology training. As an added incentive, stipends or pay raises may be provided based on degree of teacher participation. Information about technology training can be found at California Technology Assisted Program (CTAP) website (http://rims.k12.ca.us/ctap) and university websites. The CTAP website also contains much information about technology resources and curriculum standards.

If teachers find the protocol of distributing and accounting of Internet use permission slips too time consuming, perhaps a trusted student assistant, teacher's aide, or parent volunteer would be willing to track the outgoing and incoming permission slips. Many school districts prefer to openly communicate with parents regarding various curricular issues such as the appropriate use of computer technology in the classrooms. Conversely, parents want to be assured by school districts that premium measures are being put into place to prevent student access to inappropriate websites. This understanding and agreement can be mitigated with permission slips once schools have access to the Internet. Although time consuming, the minutiae involved surrounding the distribution and collection of Internet use permission slips appears well worth the effort.

Students' access to computers seemed to be a problem for many teachers. In a classroom, teachers often only had one to four computers. It is suggested that teachers creatively utilize the limited number of computers. For example, if a teacher only has one computer in a classroom, he/she may use it to prepare teaching materials, track student academic progress and attendance, or communicate with parents. If he/she has two to four computers, she may group students and have students conduct collaborative work on a research project based on information downloaded from the Internet. If he/she has more than four computers, he/she might be able to construct class activities using computers for a spelling competition, or to create a choral reading, or to write a class newsletter.

If teachers and students do not have access to computers in their own classrooms, and instead have access to computer labs, then, computer time may need to be scheduled before school, after school, and during lunch. This could be accomplished in addition to a regularly scheduled time slot on a weekly basis. Having a computer club meet during lunch would provide additional computer time for students as well.

The elementary teacher in the case studies addressed the problem of supervision. If adult supervision is needed at computers in a classroom, it is recommended that a teacher recruit parents or college volunteers, who

would be willing to provide assistance to students. By doing this, parents and community members may be included in the children's learning.

As to websites running slowly due to the large number of students simultaneously accessing the same website, one may use software like Web Buddy (http://www.dataviz.com/products/webbuddy/) to solve the problem. The software allows users to download websites and use them off-line. Currently, Web Buddy has been discontinued because the latest web browsers such as Internet Explorer have replicated its benefits. Whichever software a teacher uses, it may be beneficial for instructors who employ the Internet in instruction. In addition, while teachers download websites, they may select websites appropriate to students.

In regard to computer maintenance, it may be worthwhile to hire a technology specialist to remain on site. This individual would maintain and upgrade all computer equipment. In addition, he/she could provide computer training to the faculty. If the computer specialist does not have educational expertise, it is recommended that the computer specialist collaborate with the teachers who have computer knowledge and together provide training to other teachers. Of course, hiring such a specialist requires appropriate funding.

To increase the quantity of computer equipment, and, therefore, student access, the school district should allot money, specifically earmarked for computer technology, to each school on an annual basis. It is recommended that administrators, teachers, and computer specialists collaboratively construct a strategic plan. They can apply for state or federal grants that cater to culturally diverse school districts that exhibit a need for financial assistance in providing appropriate programs for their student population. They can also establish partnerships with corporate entities and institutions or conduct fundraisers with businesses like supermarket chains. The funding and strategic plan may eventually provide computers to classrooms, so ESL students can utilize technology to improve their literacy skills on a daily basis.

The case studies and the action research in this study provide an interesting look at the challenges that come with incorporating computer technology into today's schools. It is recommended that additional research involving a larger number of ESL teachers be conducted to examine issues related to computers and ESL education. In addition, broadening the scope and investigating the use of technology, not only computers, in ESL education is recommended.

Internet Resources

The Internet contains a great deal of resources. Listed below are websites beneficial to ESL instructors and students. The website http://www.aitech.ac.jp/~iteslj/quizzes/grammar.html contains many self-study quizzes for ESL teachers and students to use. English club at http://www.englishclub.net/reading/index.html is a good website to learn English through, for example, English readings. Students may select short stories based on their reading levels—elementary, intermediate, and advanced. Teachers may find lesson plans and handouts for classes. Teacher's Page of Lesson Plans at http://libits.library.ualberta.ca/library_html/libraries/coutts/lessons.html also provides ESL teachers with various lesson plans. One can also find many resources at the National Capital Language Resource Center http://www.cal.org/nclrc/index.htm, including articles related to performance testing and technology in language classroom.

Another worthwhile website to investigate is http://www.bedfordstmartins.com/exercisecentral/ Each student can take a diagnostic quiz, and then choose various activities for practice. Each student is required to indicate the instructor's email address, whereby the instructor can access each student's performance on his or her self-selected practice activities.

ESL Partyland http://www.eslpartyland.com provides a wealth of information for ESL instructors and students. Students may take interactive quizzes and participate in various discussion forums and chatrooms. Teachers may view many ESL lesson plans and conduct electronic communication with ESL professionals. The website http://esl.about.com is beneficial for ESL students because it offers interactive quizzes that link to lessons that explain language structures. ESL Café at http://www.eslcafe.com and http://www.etanewsletter.com provide teachers with ESL classroom activities and discussion forums. English Baby http://www.englishbaby.com targets teenagers and contains many English slang and idioms.

Listening Lab http://www.esl-lab.com contains listening quizzes that can be beneficial for ESL learners. ESL Through Music http://www.geocities.com/ESLmusic allows teachers to exchange ideas with other teachers who use musical lesson plans. Some websites help students learn English via games, for example, http://www.nanana.com/wordgames.htm and http://members.aol.com/Jakajk/ESLLessons.html. The ESL Study Hall http://gwis2.circ.gwu.edu/~gwvcusas contains many animated pictures that motivate ESL students. A teacher

can find reviews of ESL software and books at http://www-writing.berkeley.edu/chorus/call. The site may save ESL teachers much time in search for useful software and books.

Conclusion

With the onset of the 21st century and its incorporation of computer technology, schools are required to provide relevant learning experiences for our increasing diverse student population. The case studies and action research of this paper revealed that ESL instructors, unfortunately, seldom used computers in instruction. They encountered many problems including lack of practice time, unmotivated administrators and faculty, time consuming protocol, limited access to computers and the Internet, lack of adult supervision, out-of-date or poorly maintained computer hardware and software, and inadequate funding.

Despite the problems, ESL teachers had positive attitudes toward using computers in classrooms. They believed that computers were beneficial and could enhance students' learning. To assist ESL instructors in employing computers, the authors provided recommendations and resources. It is hoped that ESL teachers may continue using technology and resources available to them to help ESL students. With technology and dedicated ESL educators, we believe that ESL students will have equal opportunities in learning that will enable them to make significant contributions to our society.

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The Changing Role of the Teacher: Case Study

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Abstract: Modern technology is changing the role of the instructor from an information-giver to a facilitator. As facilitator, the teacher guides the learners through the learning process and encourages the students to be active in their learning. The experience of independent learning may encourage the students to continue the learning process on their own in other fields and in the future. This presentation reports how the author encouraged students to be resource providers and trained them to be self-learners and self-trainers in an educational multimedia course. Class observations and students' feedback revealed that the teaching methods and new role of the instructor had a positive impact on students' learning.

Introduction

Instructors are facing tremendous challenges nowadays. They have been the main information givers and center of the classroom for the past decades. However, their role is shifting due to modern technology. Consequently, they can no longer be the information giver; their students may obtain information from a variety of resources via various channels. According to the report released by the National Council of Accreditation of Teacher Education (NCATE) in September of 1997, teachers should develop a new understanding, new attitude, new approach, and new role (NCATE, 1997). Tom Carroll, director of Preparing Tomorrow's Teachers to Use Technology (PT3) grants of the US Department of Education, vividly described the changing role of teachers at the annual convention of Society for Information Technology and Teacher Education (SITE) 2000.

Carroll (2000) advocated that a teacher should take the role of a learner. A teacher is an expert learner while a student is a novice learner. Novice learners may become expert learners as time progresses. As an expert learner, the teacher should facilitate learning for novice learners and let them become instructional resource providers. Creating a learning community that consists of expert learners, novice learners, parents, and members who may foster the learning process is a teacher's responsibility. He (She) should facilitate interaction and learning within the learning community and to further expand the community by involving members of other communities.

Hence learning no longer refers to learning from a teacher. A student may learn from other students or any member of the community. A student who does not know one area may be expert in another area. Thus a student may be a receiver at one time while he (she) may be a provider another time. A student may also self-learn from available resources, for example, the Internet. Learning becomes multifaceted and dynamic, and resources become essential in the learning process.

In addition to Carroll, Oliver (2000), an invited speaker at World Conference of Educational Multimedia, Hypermedia, and Telecommunications (EDMEDIA), also supported the idea of using students as instructional resource providers. In his speech, he further explained how he treated his students as resource providers and how his students contributed to the teaching materials. Similar ideas were echoed at two presentations at the convention, Leh (2000) and Santema & Genang (2000). The author of the paper was one of the presenters and was pleasantly surprised to see the idea simultaneously spring up on three different continents, North America (USA, Leh), Europe (Netherlands, Santema & Genang), and Australia (Oliver). This notion might be an indicator of a current global educational trend.

In this paper, the author will describe how she played the role of a facilitator and encouraged her students as educational resource providers in an Instructional Technology course. She will also report her students' opinions towards their learning in the course.

The Case Study

The case study was conducted in a graduate course called "Advanced Computer Applications in Education". The goal of the course was to familiarize students with a variety of authoring multimedia software programs. Since this was the only course directly dealing with such applications in the academic program, the author structured the course as a multimedia survey course in which students studied a variety of applications rather than focused on a specific computer program.

She assessed students' skills at the beginning of the course. On a survey, students identified their skills of using the following seven computer-based application software: Webpage development tool, HyperStudio, PowerPoint, PhotoShop, Premier, Authorware, and Director. The students circled one of the following—"don't know", "good", "very good", and "excellent"—which best described their skill levels.

The author reported the survey results in class. She intended to help the students use the information to complete their course assignments: developing a HyperStudio project, creating a webpage, integrating PowerPoint in instruction, and offering a technology training session. Course assignments emphasized integrating technology into content areas, independent learning, and learning from each other. Described below is how the students learned from each other in the "Technology Training" assignment.

For the assignment, the students selected their team members (no more than three members in a team). Each team chose and learned one of the software applications mentioned above. Overview of software and step-by-step instruction of using some of the software were illustrated in a course textbook. After selecting the software program, the students constructed a training plan for a 60 to 90 minute training session. In the training session, they were supposed to teach their classmates the use of the application software they selected. The training plan had to contain (1) assessment, (2) time length, (3) content outline, (4) evaluation, and (5) training materials like handouts or evaluation sheet if applicable. They met with the author to discuss their training. During the meeting, they had to be prepared to answer questions like what their trainees' prerequisite skills were, what they would cover in the training, which criteria they used to decide on the content in the training, and how they would evaluate the success of their training session. The students were aware that they could ask for help from the instructor (the author) at any point of time.

Finally they delivered the training to the entire class. The author observed the class and recorded classroom interaction. She also took notes how the trainers could make the training better. After the training, the author first asked the trainers to self-evaluate their training. She then asked the trainees to critique the training session by providing good points and suggestions for improvement. She asked the trainees to provide oral input in class so that the trainers could receive instant feedback and response. She conducted the discussion and concluded with her own critiques. The trainers also received written feedback afterwards from the trainees and the instructor.

Findings

During the quarter, the author observed the class and interviewed students about their learning experiences in the course. At the end of the quarter, the author interviewed the students and also had them fill in a survey expressing their opinions about the course. The responses were analyzed and categorized. The results revealed that the teaching methods used in the course were deemed to be successful.

The teaching methods highly motivated the students. The students were enthusiastic about choosing a training topic and being actively involved in the learning process. Some of them chose software they were familiar with but more than half of them selected software that they knew little about. When asked why they selected the software foreign to them, the students answered that this would be a good opportunity for them to learn new skills. One said, "I wanted to learn this software for a while. Selecting this topic may push me to learn it." They learned beyond the textbook. Two of them rented a videotape on Macromedia Director. Three of them bought a book and together studied Adobe PhotoShop. The students mentioned that they enjoyed learning with their partners. They also expressed their frustration when they explored software; for example, the steep learning curve of studying Director frustrated them. Despite the frustration, they cherished the learning experience and thought that they learned a lot from their peers and other resources.

The teaching methods generated students' meaningful, active, and constructive learning. For the training plan, the students constructed their own instrument to assess the trainee's skills, decided on training content, and determined how to evaluate their training. They mentioned that instructional design models, for example Dick and Carey's model, made much more sense when they went through the process. They expressed that they spent much

time on the course, much more than what they spent on a regular course. However, they liked the experiences. They felt that they were the masters of their learning and were able to claim ownership of their work. They mentioned that this learning experience would influence how they learn and how they teach in the future. They would search for resources that could foster their learning and try to play the role of a facilitator rather than an information giver in their own classrooms when appropriate.

The teaching methods encouraged the students to think critically. The author required the students to critique their classmates' training sessions. She noticed that the students could easily say, "you did a great job!" Nevertheless, they had difficulty in addressing points of improving a training session. By requiring the students to specify good points and provide recommendations for improvement, they practiced to think critically. At the end of the quarter, the author noticed the improvement that the students made on critique.

The teaching methods increased the students' self-confidence. Before taking the course, the students often complained that they did not know how to use certain software, for example, webpage development tool, because the instructors did not teach them. The students seemed to count on the instructors and did not feel comfortable of learning by themselves. At the end of the course, the students expressed that the course increased their confidence in learning technology on their own. They mentioned that, if they could learn software with their partners and successfully provide training to their classmates in this course, they should be able to do the same elsewhere. They became comfortable of being self-learners.

Conclusion

Technology advancement is shifting our education paradigm. The role of the instructor is changing from an information-giver to a facilitator. Students no longer passively receive information but may be instructional resources in class. Given opportunities, they may be self-learners and self-trainers.

In a multimedia course, the instructor employed teaching methods allowing her to be a facilitator and her students to be self-learners. It was found that the course motivated students, fostered students' active, meaningful, and constructive learning, encouraged students' critical thinking skills, and increased students' confidence. Class observations and students' feedback revealed that the teaching methods and new role of an instructor had positive impact on students' learning.

As a university professor in Instructional Technology, the author might have experienced the education paradigm shift and its impact on the role of an instructor earlier or faster than instructors of other subject areas might. However, the changing role is a trend. Every instructor should be open to the idea and explore the possibility and experiment with the opportunity.

As NCATE stated in 1997, teachers need to develop a new understanding, new attitude, new approach, and new role. Every instructor should be open to the changes and further create a learning community in which instructors, students, and community members may contribute, benefit, and generate meaningful learning experiences. One can only look forward to participating in the dynamic learning and expect its positive impact on our society.

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Does Technology Really Make a Difference? – Perspectives from Teacher Education Students

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Abstract: This study analyzes how computers can be used more effectively in teaching in learning. The purpose of this study is to find out how the use of technology makes a difference in learning in a class designed for teacher education students. Data was gathered through a survey that asked students to reflect on their learning experiences immediately after a lesson that utilized computers. The study shows that technology makes a difference in teaching and learning. The students reported that technology made the lesson more meaningful, allowed them to be more creative, and they often learned a lot more than what was intended by the teacher. The use of computer technology in the class also gave the students an excellent way to experience true cooperative learning. The results can influence the design of future lessons that integrate technology in Teacher Education.

Introduction

Computers are increasingly being used in educational settings. Teachers are constantly striving to become more technologically literate. In my own work as a Teacher Educator, I have made a conscious effort to design lessons using technology that allow students to experience a new way of learning and teaching (see Litton, 1999a; Litton, 1999b). New teachers often use methods they have experienced. Consistent with their experiences in their own schooling, many new teachers still see their primary purpose of teaching as transmitting information. McDiarmid, Ball, and Anderson (1989) state that "students typically begin their teacher education programs with the view that teaching is telling and learning is accruing information." (p. 223). Thus, it is important to design lessons that allow students to experience a different way of learning. Using technology in teacher education classes provides a promising way to help students see that there are other models of learning and teaching (National Council for Accreditation of Teacher Education, 1997).

This study is part of my on-going project to analyze how computers can be used more effectively in teaching and learning. The purpose of this study is to find out how the use of technology makes a difference in learning in a class designed for teacher education students. Specifically, I explored the following questions:

a. How does the use of computers help teacher education students learn?
b. Aside from content knowledge, what do teacher education students learn when they use computers in a class?
c. What are some problems that students encounter when they use computers for learning? How do the students solve these problems?

A clearer perspective of what students actually learn and how they learn can help educators develop principles for designing effective lessons using computers.

Background

Technology is used in teacher education programs in a variety of ways. The review of literature shows that the use of computers is most helpful to teacher education classes because it helps promote

interaction. Using technology in teacher education classes also allows students to use the technology in a meaningful way.

The most common use of technology in teacher education is the use of electronic mail (email). Email allows new teachers to interact with other professionals. Thomas, Clift, and Sugimoto (1996) conducted a study using email in teacher education. They wanted to find out how email functions as an environment for learning. Furthermore, the authors wanted to find out how the participants perceived the effectiveness of using email to promote learning. The authors concluded that electronic mail was an asset for meeting course requirements and for maintaining contact between students and teachers.

Although the use of email in teacher education classes is only beginning to be articulated, using email provides a promising way to increase dialogue and critical thinking among novice teachers. In order to ensure the effectiveness of email or other web-based discussions tools, Nonis, Bronack, and Heaton (2000) state that facilitators should address three key issues. First, both instructors and students should be aware of an agreed upon intended consequence for the discussion. Participants need to always be aware of what needs to get accomplished. Second, facilitators of on-line discussions must be "cognizant of the essential attributes of effective on-line discourse" (Nonis et al, 2000, p. 6). These essential attributes include convenience, familiarity, accessibility, meaningfulness and focus. Web base discussions will be effective if participants are able to access the technology without too much difficulty and are familiar with the technology and the rules for using the technology. Dialogues must also be meaningful and focused on content rather than on the technology. Thirdly, after the establishment of a discussion group, the instructor should make sure that facilitative structures exists to promote dialogue. Facilitators should create structures in the dialogue that allow students to connect the discussion to their own lives, encourage collegiality and ownership.

Another common use of technology for teacher education is the use of multimedia (Abell, Cennamo, & Campbell, 1998; Hatfield, 1996; Mazur & Bliss, 1998). Multimedia is used to create case studies that allow novice teachers and experienced teachers to talk to one another about teaching methodology. Case studies are at the heart of Mazur and Bliss' (1998) Common Thread Case project (CTC). The project incorporates video conferencing and electronic mail in the interaction. Through the interaction, a community of learners is created and teaching practices can be transformed. Mazur and Bliss (1998) state that in order for multimedia to be a successful tool for interaction, three dimensions must be included. The first dimension is the *instrumental dimension.* The information contained in the cases must provide rich information that is appealing to both novice and experienced teachers. The second dimension is the *relational dimension.* The technology must contain tools that teachers can use to elaborate on issues that are raised. The questions, interests, or concern of the users influences the structure of the program. The last dimension is the *communication dimension.* The technology must allow users who are studying the same cases to interact with one another. In so doing, "teachers can revise ideas, capitalize on the experience of others and engage in the critical discourse essential to the development of professional communities." (Mazur & Bliss, 1998, p. 109).

Teacher educators have also used technology for the creation of electronic portfolios. Reed and Cafolla (1999) discuss some of the benefits and challenges of using electronic portfolios. The authors implemented the use of electronic portfolios in a preservice teacher education class. The portfolios that were created could be posted on the World Wide Web. Students attended seminars and were given a template that they could complete and modify as they created their portfolios. The researchers discovered electronic portfolios encourage students to be more reflective and responsible for their learning. The project, however, also proved to be time consuming. Furthermore, financial and technical support from the institution was needed if the project was to continue. Most importantly, however, the use of electronic portfolios allowed the preservice students to use technology in a project that was relevant for them.

K-12 schools and Teacher education programs have collaborated successfully to prepare new teachers to use technology. Hruskocy, Cennamo, Ertmer and Johnson (2000) found that such collaborative efforts increase the motivation to use technology by all stakeholders (new teachers, mentor teachers, K-12 personnel, and university personnel), change learning styles, and have interpersonal benefits. New teachers who use technology in the classrooms of mentor teachers also are able to demonstrate how technology can be used to complement existing effective teaching practices (Johnson-Gentle, Lonberger, Parana, and West, 2000).

Methodology

In my Education class (Sociocultural Analysis of Education), I use technology in various lessons. After one particular lesson towards the end of the semester, I ask the students to reflect on the class that they just experienced. The students write down their reflections in a simple questionnaire that I developed. I ask the students to reflect on what they learned, how the use of the computers helped them learn, and the problems they encountered when using computers in the class. The feedback I receive from the students helps me determine if the use of computers made a difference and I often use the reflections as a guide to design future lessons. For the present study, I analyzed 119 questionnaires that I collected over a period of seven semesters.

The technology activity in this particular class was used to learn about Sociocultural theory. Aside from learning the major components of Sociocultural Theory, a goal of the lesson is for teachers to realize that it is important to see their students' prior knowledge as a resource rather than as a liability. This is an important concept to learn especially when teaching students of culturally diverse backgrounds.

Procedure: 1) Divide the class into 6 groups. Ask the students who are experts in PowerPoint to raise their hands. These students should be in separate groups. 2) Provide a brief overview of PowerPoint. Using a pre-formatted disk, demonstrate some of the features of PowerPoint. Highlight how to create new slides, change colors, and animation. Tell the students they each group will make a presentation using PowerPoint and all groups will be required to use animation in their presentations. 3) Tell the students that they will be creating a presentation on an aspect of Sociocultural Theory. The six terms that the class will explore are Lev Vygotsky, Sociocultural Theory, Schema Theory, Cooperative Learning, Zone of Proximal Development, and Constructivism. Each of these terms will be given to a group in a disk. They will need to perform a search on the web on the term that is given to their groups. 4) Give the students ample time to complete their presentations. If one group finds information that they feel another group should be given, then they should pass on that information. 5) After the students have created their presentations, ask the groups to present their slide shows. The professor should help the students make the connections between each term in between presentations. 6. At the end of the lesson, the teacher will ask the students to talk about the practical applications of Sociocultural theory to teaching.

Results

Does the use of technology make a difference? According to the students who completed the survey, technology did make a difference in their learning. Many of the students who completed the survey stated that the use of computers helped them better understand the topic for the class because it allowed them to experience the learning theory using computers. Without the use of technology, the theory that was being taught in class would have just remained an abstract theoretical construct. Using computers made the topic more relevant for the students. One respondent echoes this thought when she states, "The use of computers was very helpful in understanding Sociocultural theory, because I just did not hear about it, I actually did it". Another student says, "[Working with computers] helped solidify the new knowledge because I had an active role in presenting it".

Technology makes a difference learning because using technology provides a meaningful way for students to work cooperatively. The cooperative atmosphere allowed all students to contribute to the learning task. A student says, "I learned that each of us has something to give to the group". Students who self-identified as having low computer skills, were not intimidated by the learning task because of the presence of other students in the group. One student said, "It [technology] was instrumental in making us work together as a group and drawing on the strengths, knowledge, and interests of all in the group to achieve our mutual goal".

The students who completed the survey stated that technology made a difference because it allowed them to be more creative. One student stated he was willing to try out more things when he created his presentation with the use of the computer. The students also found the presentations to be more entertaining and sustained their attention even more. Computers also allowed students to "experiment,

explore, and learn". The students felt they could continue creating products until they developed one that they really liked.

The results of the survey show that when using computers, students tend to learn more than what the teacher intended. Some of the learning outcomes could not even be anticipated. I wanted my students to leave the class with a good understanding of Sociocultural Theory. Aside from learning the various components of the theory, the students stated they learned how to conduct research on the Internet, create PowerPoint presentations, and effective ways of designing and implementing a cooperative learning lesson. During the class session, it was always interesting to see students discovered various aspects of PowerPoint that were never presented to them formally. The students also reported learning how to use computers for teaching.

During the lesson, the majority of problems reported by the students were technical problems related to the software. Some of these problems include, saving work, creating animation, cutting and pasting pictures from the Internet. Some of the students also reported tension as a result of working cooperatively with others. One student says, "We sometimes differed on what we wanted to include on the slides such as the color, font, and style". Many of the students stated they solved the problems by working within their groups and asking other groups. Others solved problems through trial and error or experimentation and exploration.

Most importantly, a majority of the students in the survey stated that they would be more willing to use computers in their teaching. The experience with technology in this lesson allowed them to see the benefits of technology. The study reinforces the concept that new teachers often teach the way they are taught. If we expect new teachers to use technology in their classrooms, they need to experience computer-based learning in their Teacher Education classes.

Conclusion

Effective technology lessons in teacher education classes create authentic learning experiences. Such lessons could encourage new teachers to use technology once they begin teaching in their own classes since they know first hand that one can learn using technology. The study shows that technology does make a difference in the learning experience of teacher education students. Teaching with technology allows students to see an alternative way of teaching and learning. In order to create more effective lessons using technology, I suggest a few guidelines:

a. When students have varied competence levels with technology, it is important for them to work in cooperative groups. Students who are more confident and experienced can assist and teach students who are less confident or less experienced.
b. Lessons must encourage active involvement by all participants. The lesson should encourage students with different computer abilities to participate.
c. Lessons must meet the needs of students with advanced and beginning computer skills. Students with beginning skills must feel that they have something to contribute and the lessons should not encourage advanced users to dominate a group.
d. Technology lessons must address issues that are meaningful to the teacher education students at the moment. Students need to see how technology is important to their own learning before they can use it to improve the learning experiences of their future students.
e. When working with technology, teacher education students need to create something that they will personally need. Students are more interested in a project when the end product is clearly defined. However, teacher educators must allow room for creativity, exploration, and experimentation.
f. Technology lessons should allow teacher education students to experience varied ways of learning and teaching.

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Assessing Technology-Assisted Use of Information

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Abstract: This paper presented a two-year experience of assessing college students' use of information from different resources, including the methods, processes, instruments, results and some issues of the assessment. The assessment processes started from analyzing the goals of learning, defining the outcomes, then selecting or developing instruments, and the last, collecting data and analyzing results. A "qualitative-and-quantitative" (Q-Q) assessment package was developed and used, where we used portfolios to record the learning process and quantitative scores to measure the learning of specific skills. The Q-Q assessment procedures were employed into six classes during the past two years. This experience suggested that assessing the use of information and technology related outcome was a process rather than some one-time tests. The Q-Q procedures also provided a structure to develop an assessment model that should apply to other fields of information technology assessment.

Background

Due to the wealth of information resources, the Web is becoming a widely used research tool. By 1996, there had been a rapid proliferation of World Wide Web pages, estimated at over 20 pages per hour (Caverly & Broderick, 1996). Since then, this rate has kept increasing; thousands of pages are available on the Web, providing information on almost every imaginable topic (Tate & Alexander, 1996; Gilbert, 1996; Caverly & Broderick, 1997; Leshin, 1998; Morgan, Batovsky, Bennett, & Schrock, 1999; & Miller, 1999). Now, "it is growing at a rate of 20 million new pages a month" (Maddux, 1999). The over-exposure of information brings out a critical issue to the college students—whether they can effectively use the information for their studies; and a critical task to the instructors—what would be the appropriate way to assess the use of information. This paper presents a two-year experience of assessing college students' use of information from different resources.

The assessment was performed in an undergraduate course titled "Using Information Effectively in Education", which was the required course for all the undergraduate students in the College of Education, and was offered 15 to 20 sections each semester to prepare college freshmen for their studies in this information age.

Defining the Use of Information

The goal of this course was to improve students' skills and techniques of (1) searching and finding information on certain interested educational area, (2) evaluating the information, (3) managing the information, and (4) communicating the information. The use of information was defined as a combination of these four aspects. Therefore, assessing the "use of information" was undertaken in these four dimensions. In each of the four dimensions, students used certain technology tools, which makes the use of technology part of the "use of information" as well as part of the assessing content.

To ensure that we could assess the specific aspects and effectiveness of using information, we first defined the outcomes from the four dimensions. First, in searching and finding information, students learned to use a series of on-line tools, including library system, on-line databases, Web search. They were supposed to find information (articles, reports, ed/gov documentations...) from our university library system, from ERIC, EBSCO, WILLSON, and from other Web sites. Second, in evaluating information, students learned to develop a set of information evaluation criteria and use it to evaluate at least 40 pieces of information. They used spreadsheet to analyze and summarize the evaluation. Third, in managing information, students learned to develop a research portfolio and create a database to manage the information. Fourth, in communicating information, students learned the skills of telecommunication to work in team or within the class; they learned presentation tools such as PowerPoint to share the information with class; they created Web pages to post their findings; they also write a research paper, which they considered a medium to communicate information with a large audience or more readers.

Assessing the Use of Information

By analyzing the outcomes, we found that the nature of assessing technology-assisted use of information, in the current setting, was to assess a learning process as well as the learning of specific skills. This determined the "qualitative-and-quantitative" nature of the instruments—the instruments should include qualitative procedures to analyze the learning process, and quantitative measurements to analyze the learning of specific skills. Research suggested that portfolios have been widely used as the formative assessment capacity, measuring performances and learning process (Winograd & Gaskins, 1992; Camp, 1993; & Dwyer, 1993), and demonstrating what a student is capable of doing (Salvia & Ysseldyke, 1998). Therefore, in this study, the qualitative procedures were measured by four portfolios that recorded the learning process through the entire semester: (1) information search portfolio, (2) technology portfolio, (3) information evaluation portfolio, and (4) research portfolio.

Each portfolio was tailored for a specific purpose and the contents of the portfolio were consistent with the purposes for collecting work. The information search portfolio included six items/tasks/skills, providing the information of how well students used the search skills, as well as the coverage range of information in the on-line databases. The technology portfolio consisted of 12 techniques, reflecting capabilities of using technology to search, evaluate, manage, and communicate information. The information evaluation portfolio recorded the procedures that showed how students' evaluation skills were improved, the results of the evaluation tasks provided a pattern of qualities of information from different Web resources—which had a great potential to initiate another Internet information evaluation study. Finally, the research portfolio demonstrated, via 14 tasks, the development of critical thinking skills and the process of conducting educational research.

Furthermore, quantitative scores were used to measure (1) the specific tasks/skills within portfolios, (2) team presentation, and (3) individual research paper. The results served as quantitative data.

Q-Q Assessment Structure

This measurement suggested a "qualitative-and-quantitative" (Q-Q) structure to assess technology-assisted use of information. Using this structure and the Q-Q package, the authors obtained various sets of data from six classes during a two-year period. The Q-Q assessment procedure later was adapted to other instructional technology courses, such as Computer Based Instruction, Web Based Instruction, and Technologies in Reading; and found out to be effective for both students and the instructor. It is the hope of the authors that the Q-Q assessment procedures initiated the first step toward the development of an instructional technology assessment model; further studies are to be conducted to implement and test the model.

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CREATIVE USES OF DIGITAL TECHNOLOGY: DEVELOPING VISUAL LITERACY AND ICT CAPABILITY

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Abstract: The panel addresses the progression in practice and understanding in the development of visual literacy and ICT capability using digital media in seven projects over a period of five years. These projects were conducted as collaborations between artists, teachers, pupils, undergraduate students and university researchers working in primary and secondary schools within the core and extended curriculum. The participants explored the ways in which visual literacy and ICT capability could be supported and extended in a range of relevant and meaningful contexts. The work is analysed from two perspectives – an artist focusing on children's learning and expression of visual literacy and teacher educators focusing on the development of ICT capability within meaningful learning environments.

INTRODUCTION

How do we approach research into the creative uses of digital technologies and evaluate what we have learned from the progression of practice and understanding through our experiences in recent years? The three members of the panel and authors of this paper share a commitment to the promotion of the development of visual literacy and information and communication technology (ICT) capability in children and young people. A practising artist and two teacher educators represent different practices and priorities in researching this process which provide stimulating and provoking perspectives on the growth of our understanding of issues in the area.

Over a period of five years the authors have been involved in the co-ordination, implementation, research and theorising of a range of projects in which digital technologies have played a role in creative expression, dialogue and critique in the visual arts. (References to a range of associated publications and websites are given at the end of this paper.) In reviewing these projects it has been possible to identify progression in a number of key themes relating to the nature of visual literacy, the contribution of ICT, the development of ICT capability, conceptual frameworks of subject knowledge in art and ICT, links with contemporary culture, interactions between artists, teachers, mentors and students, models of resource management and evaluation of pupils' learning in art and with ICT. The paper and panel presentation address these issues, demonstrate and contextualise key themes by reference to examples of the work made by children and young people and discuss research questions which can underpin further project developments and collaborations.

THE PROJECTS

The projects, which have been written up and presented in a number of formats and forums, are described briefly below. The asterisks indicate those projects which had a specific research focus. The research paradigm was interpretive and hermeneutical adopting ethnographic methods and a grounded approach to analysis and interpretation.

**The Glebe Project 1995*
Focus: The observation and description of elements of visual literacy, the contribution of ICT to the activities and changes and challenges to pedagogy.

Context: The 24 primary pupils involved were eight and nine years old, working outside their usual classroom activities with a digital artist and a researcher, using a scanner and image manipulation software. The outcomes were presented with multi-media authoring software. The project lasted three months.

The Bristol Internet Project 1997
Focus: The collaboration between children in separate schools through the exchange and development of visual ideas
Context: Six and seven year old children in two primary schools in the city of Bristol worked with two artists who also worked in each school. Digital cameras, image manipulation software and e-mail were used to capture, develop and exchange images and text messages. The project lasted eight weeks.

**TheAccess Project 1998/99*
Focus: The development of visual literacy as a dialogue in making meaning. Collaboration between practising teachers and an artist.
Context: Three teachers in three primary schools worked with their classes of children aged from eight to eleven years. Using the artists' work as a starting point, ideas were explored in a variety of media. Digital cameras, image manipulation software were used to capture and develop images. The project lasted an academic year.

**Art on the Net 1999/2000*
Focus: The development of the role of artists in residence collaborating with practising teachers.
The contribution of digital technologies to art processes. The development of models of access to resources.
Context: Artists and Art teachers in four secondary schools worked with pupils from fourteen to eighteen years old. The artists all used a range of digital technologies within their work which encompassed sculpture, photography, video and performance art. The project lasted a year and was reviewed and exhibited a year later.

Ultralab VI Form Project 1999
Focus: The use of multimedia technologies to document and publish art work undertaken for Art Advanced Level examination. The role of 'multimedia mentors' working with school students.
Context: Seventeen and eighteen year old students from one school worked with undergraduates on a Multimedia Degree Course. The work was undertaken at Ultralab away from school. The project lasted eight months.

**MMM: Media and Messages Multimedia Project 1999/2000*
Focus: The use of multimedia technologies to relate the art curriculum to contemporary art practice. Changes in the expectations in the teaching and learning environment.
Context: Secondary art teacher and university researcher planned and prepared. Fourteen and fifteen year old students worked within the art curriculum and examination preparation. The project lasted a year.

Genes and Makeup 1999/ 2000
Focus: An art/science collaboration to provide opportunities for young people to use multimedia technologies to explore future identities in relation to genetic engineering.
Context: Two artists and a scientist worked with a group of 8 fourteen and fifteen year old students. They worked away from the school at Lighthouse, the Brighton Media Centre. The project lasted a year.

KEY THEMES – LITERACY AND CAPABILITY

Visual literacy
The early project, The Glebe Project, recognised 9 elements of children's experience and expression reflected in their work and evaluation. These elements – narrative, content, audience, colour, text, design, approaches to the technology, affect and ways of working – went beyond those described in the English National Curriculum for Art and encompassed wider cultural influences and affect. It also identified a range of pedagogical practices and processes in which the artist and children were engaged when supporting and facilitating the work. Subsequent projects developed this approach to visual literacy as a

cultural practice by highlighting the nature of the dialogue which developed between the work and the maker who drew upon a range of influences and techniques in order to make meanings and develop visual, expressive ideas.

The contribution of ICT
ICT can be described as embodying four characteristics which interact with each other to provide opportunities and experiences which are distinctive in the use of these technologies – interactivity, provisionality, capacity & range and speed & automatic functions. (DfEE, 1998) A range of digital technologies was used for the construction, capture, manipulation, integration, projection and display of meaningful images incorporating visual art, sound and movement. The capacity for interactivity and provisionality in the use of the technologies supported the process and dialogue as the students expressed and developed their ideas, evaluated and reviewed the outcomes and displayed and discussed their work with a wider audience. Whilst the projects focused on the context of expression and learning in the art curriculum, not the technology as a medium or a tool, the characteristics of ICT played a significant role in the process and the priority of policy and funding of resources for the projects.

The development of ICT capability
ICT capability has been described as the ability to participate in a rapidly changing world of technology; use ICT tools to find, explore, analyse, exchange and present information responsibly, creatively and with discrimination; employ ICT to enable access to ideas, experiences, people, communities and cultures; and make informed judgements about the use of ICT and its implications for home and work. (DfEE, 1999) The term 'capability' encompasses far more than ability with particular ICT techniques and implies an active, informed and critical approach to using technology appropriately and purposefully. The development of ICT capability within formal schooling structures can range from the teaching of specific techniques to the use of ICT to support teaching within a subject area. The projects demonstrated the situated, contextualised nature of the ways in which students drew upon and developed their experience and expertise of using ICT. These embedded experiences highlighted tensions within the organisation of the students' ICT experiences in the school, raising questions about where ICT was 'taught' and whether students required specific ICT techniques or support in developing approaches to working with new technologies in a range of different contexts.

'Is this art?' - conceptual frameworks of knowledge of art and ICT and links with contemporary culture.
Each project highlighted students' responses to their understanding of the nature of their activity. Many did not consider the work to be 'art' as it related to their experiences within the more traditional art curriculum. The outcomes of the work were broadly described as 'media studies', 'drama', 'ICT' and 'playing', whilst the connections between the processes in which they were engaged and the variety of tools and techniques employed were often not considered to be 'art'. Issues were raised about the perceptions of art within the school curriculum, its relationship to the impact of digital technologies in wider culture and teacher knowledge of and access to contemporary practice with and through ICT. Students demonstrated a range of levels of the use of ICT which related to both their confidence with the tools and their active choices about the appropriate media in which to express and develop their ideas. A strong theme in much of the work was the personal nature of the expression of meanings.

Interactions between artists, teachers, students and mentors.
A significant aspect of all the projects was the range of interactions between the participants and the ways in which they shared and developed their knowledge of visual literacy and ICT capability. One approach observed was an open shifting and sharing of roles between students, teachers, artists and mentors to provide support and challenge in techniques, process, evaluation and audience. Another type of interaction highlighted tensions between practitioners and teachers in terms of role expectations, subject knowledge and pedagogy. Such tensions provided opportunities for discussion and action in trying to resolve the issues to reflect and model different ways of working. Questions were raised about 'what knowledge?', 'whose knowledge?' and the description of a 'community of practice' within a curriculum which enabled students and teachers to work with practising artists and multimedia specialists in a variety of settings, spaces and times.

Models of access to resources
The projects raised important practical and political questions about the allocation, organisation and management of ICT resources in models appropriate to learning and teaching processes within different subject areas. The National Grid for Learning Initiative in the UK has provided resources for networking capability in schools. The local management of these ICT resources does not always, however, reflect the needs and working practices of subjects, particularly Art. Many of the resources have been placed in central suites shared between all curriculum areas, rather than placed in subject departments and made available with space and software appropriate to the curriculum area, thus perpetuating an approach to ICT capability which focuses on decontextualised techniques and skills. The projects demonstrated the need for flexible and appropriate models of access to both physical resources and networks of support and professional development.

Evaluation of learning and teaching
The discussion of formative and summative assessment of the process and product of art in the curriculum highlights a number of issues of exchanging ideas, supporting process, identifying criteria for assessment and engaging in evaluative judgements. These discussions arose from the nature of the work itself and the working practices developed within the collaborations, but the issue was particularly pertinent in the school phase of 'high stakes assessment', that is, external examinations. The assessment and examination systems within schools define boundaries and gateways to particular choices and do not always reflect the knowledge and processes of practitioners. Within the projects which involved students undertaking work for examinations there were discussions of the nature of art and the type of work expected by external assessors and the degree to which students could explore new ideas and new media without 'penalty'. Some UK examination boards now recognise digital work with screen-based media, but the debate is ongoing as understanding develops within the profession.

The contribution of research
The overview of the work in this particular group of projects reflects a wide range of contexts, participants and areas of focus. It describes a variety of activities and interactions taking place within many different contexts. It is interesting to consider the ways in which the questions for research and enquiry which underpinned the projects have evolved and inform subsequent projects. The questions have changed in focus from enquiries into the expression of visual literacy and the development of dialogue, to the nature of the collaborations between students, teachers and practitioners and the different settings in which they can be developed. Enquiry into the particular contexts of the case studies has also identified some common themes, raising issues which reflect deeper questions and tensions in such work. These include questions about ways of knowing, expressing and analysing ideas - what knowledge?, whose knowledge?, how can it be expressed and developed? What role does ICT play in these debates? Is technology a tool, a medium, a catalyst or a new lens through which to view these questions? What is the impact of ICT in contemporary culture and how the art curriculum might play a more proactive role in the education of young people? What are the challenges to pedagogy and professional development highlighted by such collaborations? How do studies such as these provide rigour and evidence to inform decisions by practitioners and funders in future initiatives? What are the connections between being visually literate and ICT capable in the broader sense of being creative and confident learners, inspired to work with spirit and imagination; to make decisions which might be collaborative and difficult? No one case study or survey can provide easy answers to these challenging questions, but it is timely to consider the role of research in providing both a stimulus for new work and a space for reflection and critique. Patterns and processes can be observed in the 'bird's eye view' which indicate promising directions for further exploration and analysis.

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URLs

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http://www.lighthouse.org.uk/

Ultralab and Plume School outcome:
http://www.ultralab.ac.uk/projects/plumev2/

Classroom Community in Post-Secondary Classes: An Examination of Traditional and Distance Learning Environments

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Introduction

Many schools, particularly post-secondary schools, are moving toward increased use of technology to deliver courses and programs at a distance. Several models are presently in use, such as broadcast television, video and audio teleconferencing, and asynchronous learning networks (ALNs) -- people networks for anytime - anywhere learning via the Internet. An important outcome of this emphasis on delivering courses at a distance is the generation of interest among educators concerning the nature of distance learning environments and the learning possibilities achievable through technology. One aspect of this interest concerns the building and nurturing of a community of learners whose members are often physically separated from each other.

The purpose of this study was to determine how sense of classroom community develops in a higher education learning environment and to determine if there are differences based on type of learning environment (traditional or distance education). The distance education environment examined was an asynchronous Blackboard-based integrated distributed learning environment.

Method

Subjects

Students attending education, leadership, and science classes at two universities in a large urban area served as subjects for this study. The sample consisted of 452 undergraduate and graduate students, with 83 enrolled in distance education courses and 369 enrolled in traditional courses.

Instrumentation

The Sense of Classroom Community Index (SCCI) (Rovai & Lucking, 2000) was used to measure classroom community. It consists of a self-report questionnaire of forty items. Each item includes a statement followed by a Likert scale of potential responses: strongly agree, agree, neutral, disagree, and strongly disagree. The SCCI possesses a very high Cronbach alpha internal consistency ($p = .93$).

Design

A quasi-experimental approach was used for this research. Twenty-three groups were examined. Each group consisted of an intact class, ten distance education classes and 13 traditional classes. A state university presented 12 classes and a private university presented 11 classes. The groups were measured on sense of classroom community during the second class meeting (pretest), except for the Blackboard-based asynchronous courses, which were measured during a three day interval at the end of the first week of the course. All classes were again measured at the middle of the semester (posttest). The subjects were not presented any special treatment other than the scheduled courses in which they were enrolled.

Statistical analyses consisted of descriptive statistics, a Pearson product-moment correlation between class size and sense of classroom community, and a series of dependent t-tests to analyze the differences between pretest and posttest measurements across all classes.

Discussion and Findings

The relationship between class size and pretest was low ($r = -.284$, $p < .001$) while the relationship between pretest and posttest was not significant. These results suggest that students first entering a class feel a lower sense of community in larger classes, but by the middle of the semester the size of the class is no longer related to sense of classroom community.

Pretest sense of classroom community was higher for courses taught at a distance (M = 121.98, SD = 19.76) than traditional courses (M = 113.16, SD = 15.85). However, at the posttest, courses taught at a distance (M = 120.43, SD = 22.15) reflected a lower sense of classroom community than traditional courses (M = 131.69, SD = 19.80). An analysis of individual courses revealed that classroom community increased in all traditional courses and significantly so for most cases. However, only three Blackboard courses reflected increased sense of classroom community at the posttest (two were significant), while all others showed lower levels of classroom community (five of seven were significant).

An analysis of message patterns in the Blackboard-based courses was conducted in order to obtain evidence to help explain why three Blackboard-based courses experienced increases in sense of classroom community while seven experienced decreases in classroom community. The variable that appears to explain these differences is teacher immediacy. Teacher immediacy is the verbal and nonverbal communication that takes place in the classroom, such as smiles, head nods, use of inclusive language, and eye contact. Blackboard-based courses lack the non-verbal communication. Consequently the focus of the message analysis was on an analysis of instructor messages. This analysis showed that the instructors in the three Blackboard courses that experienced increases in classroom community posted on average 36.60 messages per week to the Blackboard discussion board, while the instructors of the seven Blackboard courses that experienced drops in classroom community posted on average 3.14 messages per week. An analysis of message contents revealed that the instructor message contents of three instructor immediate courses tended to be empathetic, mentioned self, family, or spouse, or had a cooperative tone, while for the remaining Blackboard-based courses the message contents tended to be factual.

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The Uses of Computers For Instruction in the Classroom: A Comparison of Teachers' and Principals' Perceptions

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Abstract: This study surveyed teachers and administrators in 50 schools in a large school district in South East Texas. The purpose of this study was to compare teachers and principals in their perceived uses of technology for instructional purposes in the classroom. The teachers and principals were asked to rate the extent to which technology is used in their classrooms for the following purposes: a) drill and practice b) problem solving c) world wide web searches d) compositions e) newsletters or desktop publishing. They were also asked to indicate the frequency a typical student uses the computer in their classrooms. The computer was used significantly more often for the lower level skill of drill and practice than for worldwide web and desktop publishing. The principals perceived that students were using the computers more frequently for the higher-level skill of worldwide web use than the teachers reported.

Introduction

A survey of the literature in education points to the critical role of the principal as instructional leader in the school (LaRocque & Oberg, 1991; Henri & Hay, 1995). Pellicer, Anderson, Keefe, and McCleary, (1990) state that "...instructional leadership is likely the most important function in a school for creating a productive and satisfying environment" (p. 41). At the same time much of the current literature points to the need to reform our public schools (Sarason, 1997; Goodlad, 1997; Matthews, 1997; Wadsworth, 1997). As many States and communities across the country are learning, transforming industrial-age schools into information-age schools is easier said than done (Dyrli & Kinnamon, 1994).

The key to ensuring the success of technology in schools is the way in which technology is integrated into the school's curriculum. As Kinnaman (1994) observes, successfully integrating technology into education requires basic changes to our current model of schooling; anything less sells short both the value of today's technology and the future of education. School principals must understand the importance of technology for improving school management as well as its implications for improved instruction. Technology holds great promise for personalizing learning opportunities (Drake & Roe, 1999).

Technology is the means to increasing learning efficiency. Technology can be used to better display information, increase access to information, improve information sharing, and organize better class presentations. Technology is not a panacea for educational problems, but by combining technology with applicable learning models, the overall quality of education is enhanced. Students raised in an age of technology demand student-centered learning. Educators must discover and develop how to implement new technologies into the learning environments and focus efforts on facilitating learning (Adams & Jansen, 1997). Principals must accept the challenge to create supportive conditions, which would foster innovative uses of computers. Principals must respond to the public demand for increased use of technology to prepare our students to meet the expectations of the society in which they will participate.

Resistance to Technology

Schools are still limited in their ability to take full advantage of computer technology because of cost, lack of teacher preparation, and inadequacy of the school's infrastructure. Even schools that were built fairly recently do not all have an adequate power supply, and few schools have telephone lines in every classroom (Loveless, 1996). A national survey conducted by the U.S. General Accounting Office (1995) found that in 46% of schools the electrical wiring would not handle the power requirements of computers. That finding helped explain why more than half (52%) of the schools surveyed did not have access to a computer network (Seyfarth, 1999).

Principals must be prepared to deal with teacher resistance to technology being integrated into the curriculum. Many teachers perceive technology as another burden of responsibility added to the already overwhelming load of a teacher (Hartzell, 1996). Principals have to be prepared to provide extensive teacher training in the integration of technology into the curriculum (Weiss, 1994). Principals need to create an environment conducive to maximizing technology integration into the curriculum. A faculty that becomes comfortable with the ideas of technology will more easily integrate it into the curriculum.

Principals need to solve the dilemma of how to provide appropriate technology training for the entire faculty. Dyrli (1996) recommends a number of key elements for a successful staff development including: offering a variety of options, emphasizing skill development, providing hands-on experiences, tailoring programs to local realities, using genuine teaching examples and providing supporting materials. Principals need to be aware that if the teachers are not the focus of the technology training, then technology will fail (Guhlin, 1996). Teachers have to feel involved in the process of integrating technology into the curriculum. This involvement will ensure that the teachers take personal ownership for this responsibility. Once personal ownership has been established, it is easier for the teachers to work toward goals because they now have more purpose and meaning. The main thing to remember is whatever training the teachers have, it is crucial that it applies to them as professionals as well as individuals.

There are teachers and administrators who believe the lack of available money for technology is a problem when trying to integrate technology into the curriculum. It is important for principals to keep in mind that research shows that the amount of money available to a school district is not related to the innovative uses of computers. Exemplary teachers work in a representative range of communities and schools. However, they tend to be found in settings where school and district resources have been used to create supportive conditions (Becker, 1994).

Some researchers (Milone & Salpeter, 1996), have found teachers that use the computer for typical tasks, such as creating instructional materials and performing administrative tasks, perceived their computer use as having a positive impact on their work, making them more professional, more creative, better informed, and generally better educators. It is important therefore for principals to accept the challenge to create supportive conditions that would foster innovative uses of computers. After one prepares the faculty in the professional development plan for integrating technology into the curriculum, one must give the faculty the access to the computers during instruction time and planning time.

Teachers as Computer Users

The literature on teachers as computer user is complex and there are many different levels of reporting. The curriculum needs of elementary and secondary levels as well as the various preparations and backgrounds of teachers makes the understanding of computer uses more involved and difficult to study. Several authors about the use of computers in schools claim that the personal computer is the latest educational technology to fall short of its original promise (Loveless, 1996). The author goes on to claim that although United States public schools now possess 5.8 million computers, roughly one for every nine students, they are not widely used in classroom instruction. In neighboring Canada Stats Canada (1999), reports that, more than 9 out of every 10 students at the elementary, intermediate and secondary levels in Canada attended schools had access to the Internet for educational purposes. However, principals reported a number of obstacles to fuller use of computer technology in the classroom, the biggest of which were a lack of computers and lack of training opportunities for teachers. Principals of schools representing about two-thirds of students cited a need for more computers as well as more time for teachers to prepare courses that require the use of computers and to explore ways to use the Internet. In addition, these principals said teachers needed more training opportunities to upgrade their computer knowledge and skills.

Loveless (1996) argues that the most popular explanations for lack of computer use fix blame on recalcitrant bureaucracies and stubborn teachers. By enlisting technology in the cause of educational reform, computer advocates overlook some of the real obstacles to the use of computers in classrooms. These obstacles are rooted in organizational constraints of the school system and the essential nature of teachers' and students' work. We need to examine the world of teachers and students to uncover how their interactions limit the computer's impact on schooling and describes how these limitations are viewed. Computer advocates must separate their agenda from other reform agendas. Loveless (1996) states that the campaign to promote computer technology in the schools should stress three elements: (1) developing a strong technological infrastructure through investments in adequate school facilities; (2) using computers to make teachers' work easier and more efficient, not to redefine teaching; and (3) employing computers to increase student academic achievement, not for changing current ideas of valued knowledge.

Hoffman, (1996) points out that of the many barriers to integrating technology into classrooms, unmotivated teachers, inadequate access, lack of training, and lack of appreciation are critical. Principals can help by providing more administrative support, staff development and technical support, equipment availability, technology-use plans, technology coordinators, appropriately maintained equipment and facilities, program assessment, and broad decision-making participation. Liu, MacMillan, &Timmons (1998) observed secondary school students' use of computers for learning and identifies limited use of computers for learning by students, dependency of students on teachers for integration, and constraints of teachers on students in terms of teachers' difficulties and attitudes toward computers.

Baines, Deluzain,& Hegngi, (1998) studied teacher use of computers in Georgia and report that 96% of teachers profess to use technology, but found that only 4% of teachers actually integrated technology in their instruction. The majority of schools had few computers, fewer Internet-ready computers available for student access, and teachers who had never received any training concerning how to use computers. Most teachers lacked even a rudimentary knowledge of the Internet; many could not explain how to turn on a computer. The reality of public school classrooms contrasts sharply with the rhetoric and possibilities of using technology effectively in schools as exemplified by some interesting, high-tech classrooms. The disparity between reported and actual use of computers in instruction is an issue that should have great concern for principals.

Cuban (1998) claims that public school teachers make limited, unimaginative use of new technologies, despite having equipment available. This is partially the result of teachers' attitudes toward computers in the classroom, conflicting beliefs about the purposes of schools, and teachers' feelings about rapidly changing technology. Cuban and Kirkpatrick (1998) in determining weather the use of computers in a classroom are effective were able to categorize activities as computer-assisted, computer-managed, and computer-enhanced instruction.

Cuban (1999) in further analysis of the situation goes on to point out that teachers vary considerably in their classroom use of information technologies. At one end of the spectrum of use there are many star performers who, in the early 1980s, learned programming and fixed personal computers when they crashed. Such teachers he categorizes as serious users. These users he describes as the teachers who bought a home computer and, in subsequent years, between home and school, prepared classroom materials, compiled grades, used email, and constructed Web sites for their classroom or school. Such serious users have their students working daily on classroom or lab computers, multimedia projects, and other uses of technology. Were computers to disappear, such teachers would be upset because they have incorporated the powerful machines into the very fabric of their lives in and out of school. He classifies the middle of the spectrum as occasional users. These teachers took a beginning computer course, even purchased one for home, and, after three or four years, have found the computer a useful addition to their classroom repertoire. They use computers to prepare grades, attendance reports, and handouts for class. For instruction, these teachers place the computer in the same category as a videocassette or overhead projector "a useful tool". Were computers to become suddenly unavailable, such teachers would adapt without missing a beat because the technology had been marginal. The last category Cuban (1999) is the non-users at the end of the spectrum. He describes these teachers as the ones who may have taken a course and may even have a computer at home or possibly use the computer for administrative tasks, but seldom or never boot up a computer in their classrooms. Were computers to disappear from schools, students would note little difference in how and what these teachers taught.

These categories of teacher use of computer use for instruction should be useful for principals as they prepare professional development sessions for their teachers' growth plans. It is not unlike the concerns that business marketers have while trying to market their computer products. Moore (1999) in his best selling book on marketing and selling high tech products to mainstream customers is able to show on a bell curve that the categories are: innovators, early adopters, early majority, late majority and laggards. These categories are not unlike Cuban's (1999) and just as marketers have to plan special strategies to sell their products, principals should plan special strategies to have teachers integrate technology into their teaching. School administrators must take seriously the need to provide a viable program in communications education to prepare students for the next century and to avoid the emergence of a deprived social class consisting of those who cannot use computers (Martinson, 1998).

Purpose

The purpose of this study was to compare teachers and principals in their perceived uses of technology for instructional purposes in the classroom.

Subjects

Surveys were administered to teachers and administrators in 50 schools in the in a Southe East Texas School District. Of the 500 teachers and principals surveyed, 466 returned a completed questionnaire resulting in a response rate of 90.32%. The sample was made up of 87% teachers (n=404) and 13% administrators (n=61). The major demographics of the schools and subjects are shown in Table 1 below.

Table 1. Description of Schools and Subjects Participating in the Survey

Location of School:	Suburban	68%
Urban	30%	
Rural	2%	
Size of School:	30 or less teachers	9%
	31-50 teachers	50%
	51 or more	39%
% of Students on Free Lunch:		
Grade Level Of Subjects:	Elementary	70%
	Middle School	20%
	High School	10%
Ethnicity of Subjects	White	82%
	Black	4%
	Hispanic	15%
	Asian	Less than 1%

Instrument

The researchers developed a 24-item survey instrument. Items 1-11 were used to gather demographic information on the schools, teachers and principals. The remaining 13 items included 8 items related to the amount of training, implementation and support of computers in the classroom; 5 items asked respondents to rate the extent to which computers were used for specific purposes. The response format was primarily closed using either a 4- or 5-point Likert –type scale. In this paper, we will compare teachers' and administrators perceived uses of computers in classroom instruction.

Procedure

Teachers and principals in 50 schools were provided a survey and cover letter by a graduate student in one of the researcher's courses in the principal certification program. No names were used on the survey to ensure confidentiality and anonymity. The graduate student collected the surveys.

Analysis

The mean ratings by teachers and principals for each of the five uses were rank ordered. These rankings are displayed in a table. In addition, a 3(level) x 5 (use) mixed design ANOVA with repeated measures on the final factor was used to compare the mean ratings of the teachers and principals.

Results

The rankings of perceived uses of computers for instruction in the classroom by both principals and teachers are displayed in Table 1 below:

Table 2. Rankings of Teachers and Principals of the Perceived Use of Computers for Instruction in the Classroom

	Teachers		Principals	
Uses	**Mean Score**	**Rank**	**Mean Score**	**Rank**
Drill and practice	3.36	1	3.34	1
Problem solving	3.17	2	3.30	2
Worldwide web	1.73	5	2.84	4
Compositions	2.22	3	3.07	3
Desktop publishing	1.78	4	2.66	5

1 = Highest Rated Use

Based on a 5 point scale: 1 = Never, 2 = Once a month, 3 = Occasionally, 4 = Several times a week, 5 = Daily

The rankings are quite similar across the groups. The only differences were in the relative ranking of the use of worldwide web and desktop publishing. An inspection of the mean ratings of frequency, however, indicates some differences between the groups. This analysis was done using the ANOVA.

The results of the 2 (position) x 5 (Uses)) mixed design ANOVA with repeated measures on the final factor used to compare the teachers' and principals' perceived uses of computers in the classroom indicated the following. The main effect for use was significant [$F(4, 449) = 43.95$, $p < .001$]. There was also a significant main effect for position [$F(1, 449) = 27.35$, $p < .001$]. There was also a significant interaction of effect for position X barrier was found [$F(4,449) = 10.22$, $p < .001$].

Selected post hoc comparisons indicated that the computer was used significantly more often for the lower level skill of drill and practice than for worldwide web and desktop publishing. Since the majority of the subjects were elementary-level educators, this is a predictable finding. Interestingly, the principals perceived that students were using the computers more frequently for the higher-level skill of worldwide web use than the teachers reported with means of 2.85 and 1.73, respectively. (This places the perceived use by principals somewhere between "occasionally" and "more than once a month" while teachers responded somewhere between "never" and "once a month"). Although not significant, in all other cases except drill and practice, principals assumed more frequent usage. The interaction effects of a repeated measures design are complicated and less meaningful.

Discussion

Overall, principals and teachers were fairly consistent in their rankings of the uses of technology in the classrooms. Interestingly, both ranked the lower level skill of "drill and practice" as the most used. Although "problem solving" was ranked second highest in usage, it became clear to the researchers that respondents viewed this

as either mathematics drill and practice or students using popular problem solving software games independently. These findings appear to confirm Cuban (1998) contention that teachers do not actually integrate technology into their instruction and make somewhat limited and unimaginative use of technology despite having equipment available. It was encouraging to see that computers were used in composition slightly more than once a month on average. Since many classrooms still do not have online capabilities, it is not surprising that the use of the worldwide web is limited. Lack of appropriate screens for student access no doubt enters into this limitation in many schools. Another finding from the study suggests that for all uses, principals assume a higher level of usage than teachers reported. Although these differences were not always significant, the pattern was consistent. As Adams and Jansen (1997) suggest, principals must accept the challenge to create supportive conditions, which foster innovative uses of computers. Subsequent analyses by the researchers will examine the effect of level of teacher on the uses of technology. Preliminary examination of the data suggests that high school teachers use computers less frequently for drill and practice and more frequently for composition and desktop publishing than their elementary and middle school colleagues.

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Barriers to the Use of Computers in the Classroom: A Comparison of Teachers' and Principals' Perceptions

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Abstract: Principals need to encourage the use of technology in learning. The barriers to the use of computers in the classroom as perceived by teachers and principals is important. This study found the rankings for teachers and principals on barriers were identical. The highest-ranking problems for both groups were lack of time and lack of computers. None of the barriers were seen as major problems. Results of a mixed design ANOVA indicated a significant main effect for barriers, no significant effects for either level of educator or interaction of level and barrier were found. Selected follow up post hoc comparisons using Tukey's HSD were used to identify significant differences among the barriers for each of the two groups. There were significant differences in the mean ratings for the "Lack of Time" and the "Lack of Administrative Support". Both groups rated the lack of time as significantly more of a problem than lack of administrative support.

Introduction

There is a very definite demand from the public that our schools must be more current and appropriate for students (Rose and Gallup, 1998). Educators are being told they are not keeping up with the real world. Business leaders are complaining that schools are not producing enough qualified workers. Researchers (Fullan, 1996; Goodlad, 1997; Sergiovanni, 2001) have begun to question whether we are meeting the varied educational needs of all students. There is a growing demand from the public to ensure that our schools are adequately preparing our students for the challenges that an increasingly growing technology demands.

Students raised in an age of technology demand student-centered learning. Educators must discover and develop how to implement new technologies into the learning environments and focus efforts on facilitating learning (Adams & Jansen, 1997). The key role principals' play in schools is well documented and acknowledged (Buckner, 1997). Technology is a key tool in building a learning community within a school (Speck, 1999). The leadership responsibility of the principal is to encourage the use of technology in learning.

Principals need to be prepared to deal with teacher resistance to technology being integrated into the curriculum. They have to provide extensive teacher training in the integration of technology into the curriculum (Weiss, 1994). Many teachers perceive technology, as another burden of responsibility added to the already overwhelming load of a teacher (Hartzell, 1996) A faculty that becomes comfortable with the ideas of technology will more easily integrate it into the curriculum. As with all issues involved in collaboratively building an effective school environment, it is important that teachers and principals understand each other's perspective. Since so many resources are currently being allocated for technology, it is critical that budgetary decisions are based on commonly agreed upon needs and that there is planning to address perceived barriers.

Purpose

The purpose of this study was to compare teachers and principals in their perceived uses of technology and barriers to their use in the classroom.

Subjects

Surveys were administered to teachers and administrators in 50 schools in a large school district in South East Texas. Of the 500 teachers and principals surveyed, 466 returned a completed questionnaire resulting in a response rate of 92.20%. The sample was made up of 87% teachers (n=404) and 13% administrators (n=61).

Instrument

The researchers developed a 24-item survey instrument. Items 1-11 were used to gather demographic information on the schools, teachers and principals. The remaining 13 items included 8 items related to the amount of training, implementation and support of computers in the classroom; 5 items asked respondents to rate the extent to which computers were used for specific purposes. The response format was primarily closed using either a 4- or 5-point Likert –type scale. In this paper, we will compare teachers' and administrators perceived uses of computers in classroom instruction.

Procedure

Teachers and principals in 50 schools were provided a survey and cover letter by a graduate student in one of the researcher's courses in the principal certification program. No names were used on the survey to ensure confidentiality and anonymity. The graduate student collected the surveys.

Analysis

The mean scores for each of the barriers for both teachers and principals were rank-ordered. In addition, a 2(position) x 5(barriers) mixed design ANOVA with repeated measures on the final factor was used to compare the teachers' and principals' perceived barriers to computer use in the classroom. Selected post hoc comparisons using Tukey's HSD were made based on significant main effect for barrier.

Results

Table 1. Rankings of Teachers and Principals of the Perceived Barriers to Use of Computers in the Classroom

	Teachers		Principals	
Barrier	**Mean Score**	**Rank**	**Mean Score**	**Rank**
Lack of Computers	2.38	2	2.33	2
Lack of Software	2.16	3	2.04	3
Lack of Admin. Support	1.32	5	1.05	5
Lack of Training	1.75	4	1.73	4
Lack of Time	2.47	1	2.42	1

The rankings of perceived barriers to computer use in the classroom by both principals and teachers will be displayed in a Table. Interestingly, the rankings for teachers and principals were identical. The highest-ranking problems for both groups were lack of time and lack of computers. None of the barriers were seen as major problems.

The results of the 2 (position) x 5 (barriers) mixed design ANOVA with repeated measures on the final factor used to compare the teachers' and principals' perceived barriers to computer use in classrooms indicated the following. The main effect for barriers was significant [$F(4,454) = 80.34$, $p<.001$]. No significant main effect was found for position [$F(1, 454) = 1.11$, $p>.05$]. Likewise, no significant interaction of effect for position X barrier was found [$F(4,454) = .82$, $p>.05$].

Selected follow up post hoc comparisons using Tukey's HSD were used to identify significant differences among the barriers for each of the two groups. Among both teachers and principals, there were significant differences in the mean ratings for the "Lack of Time" barrier (means of 2.47 and 2.42, respectively) and the "Lack of Administrative Support" (means of 1.32 and 1.05, respectively). Both groups rated the lack of time as significantly

more of a problem than lack of administrative support. Again, it should be noted that neither of these barriers was regarded as a major problem.

Conclusions

Based on the results of the survey, it appears that principals and teachers in a large urban school district are in close agreement as to the magnitude and relative ranking of perceived barriers. By identifying "lack of time" and "lack of computers " as highest rated barriers, these educators can move forward to discussions of how to work together to resolve or ameliorate these barriers.

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A Blended-Technology Approach to Distance Education Course Delivery

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Abstract

For several years Continuing Education and the Department of Education at Eastern Michigan University have used an Interactive Television (ITV) videoconferencing system to deliver a graduate course in Education. The course is Educational Research Techniques a graduate-level course required for students in several degree programs. Students are mostly teachers in K-12 systems located in or near three Michigan cities, Flint, Ypsilanti and Jackson. Initially, the ITV system (supplemented with printed materials) was the only distance learning technology deployed. However as the limitations of using a single technology became clear, a blend of delivery technologies were used. The additional technologies include online conferencing, occasional mailed videocassettes of course lectures, a PBS-produced telecourse, and printed coursepacks.
Student satisfaction levels were measured for the blended-technology approach as a whole. Academic achievement of course goals and objectives was measured, and compared to academic achievement by former students in that same course taught by that same instructor in face-to-face and interactive television (only) delivery formats.

Results found high levels of student satisfaction with regard to use of the blend of technologies and satisfaction levels were found to be much higher when asynchronous technologies such as online conferencing were used to supplement the synchronous ITV sessions. Deployment of the online conferencing technology allowed students to timeshift and participate in the discussions in accord with their own schedules.

Academic achievement was measured by two exams, participation in online and ITV class discussions, one short paper and a submitted research proposal consisting of three components; a) a problem statement, b) a review of related literature and c) a methods/procedures section which focused on research design and measurement strategies. The instructor found overall student performance to be virtually identical with performances of students in the same course delivered either in a traditional face-to-face format or via interactive television. However the levels of discussion that were conducted via the online conferencing option were substantially higher than those conducted in the ITV environment and higher than those in past face-to-face courses taught by the instructor.

Why A Blended Technology Approach?

There is an adage that states when all you have is a hammer, everything looks like a nail. Unfortunately, this statement typifies the approach taken to distance education course development by many colleges, universities and schools. In many cases, a single distance education technology has been implemented by the institution, and faculty members are expected to make all course and program objectives and learning activities conform to the attributes and characteristics of that technology.

For example, for the past several years two-way interactive television (ITV) has been among the most frequently-implemented distance education technologies. Faculty members are scheduled to teach courses via ITV and sometimes (but not always) provided with professional development opportunities

to allow them to learn to use the technology. Typically, the only supporting technology that is used with ITV systems is the fax. Other distance education delivery systems such as on-line/Internet computer communications, videocassettes, and telephone audioconferencing, are often ignored and not made accessible to ITV faculty members.

The results have been predictable. Students and faculty members found that the ITV system worked well for facilitating learner achievement of *some* course goals and objectives, but was an abysmal failure for other course goals and objectives. Overall, student and faculty satisfaction levels with ITV systems have often been lower than anticipated. This is typically very disappointing to the institution s administrators who had supported substantial expenditures on ITV infrastructure and implementation.

In some instances this result is being met with a throw the baby out with the bath-water response, with some faculty members, students and administrators concluding that distance education is flawed as a concept, and cannot lead to user satisfaction and/or high levels of academic achievement. Distance learning practitioners in other institutions have concluded that it is the ITV delivery system that is lacking, and are advocating delivery of distance education courses via on-line/Internet technologies. Unfortunately total dependence on on-line/Internet delivery has the same critical flaw as ITV course delivery, i.e., it is a single-technology approach and any single technology will be appropriate for *some* instructional goals and objectives and inappropriate and ineffective for others.

This pattern has led some distance education course designers to conclude that what is needed is a multiple-technology approach to distance education course and program delivery. In the multiple or blended technology approach, the organization makes a wide range of distance education technology options available to faculty members and instructional designers who plan the delivery of distance education courses. For each course, the instructional or learning objectives and the characteristics of the learners form the basis for the technology application decisions. Thus a learner-focused and outcome-driven model for instructional delivery replaces the technology-driven model that is currently typical. With this logic in mind, many distance education planners argue that replacing technology-driven models with a learner-focused, outcome-based blended-technology distance education model will result in increased learner satisfaction and increased attainment of learning objectives by students.

The Technology Toolkit

The technologies which are essential to the success of a blended-technology approach to course and program development are often described as comprising the distance education technology toolkit. They typically include interactive television/video teleconferencing equipment and facilities, on-line/Internet course delivery hardware and software, video production facilities, access to nationally-produced and typically leased video-based telecourses, audioconferencing hardware and software, audio production equipment and printed materials production equipment (Figure 1). Distribution infrastructure is also essential, e.g., a system for duplicating and mailing videocassettes to distance learners). Professional development processes to help faculty learn to optimally utilize all components of the technology toolkit must also be planned and implemented.

The Course Development Team

Traditional courses and single-technology courses are often planned and delivered by a single assigned faculty member acting in isolation. However, the blended-technology distance learning course requires integration of several technology subsystems necessitating participation by representatives from each subsystem. This requires an active involvement in the course planning and implementation process by a planning group or team acting in concert. This distance education course development team will typically be comprised of faculty members, instructional designers, technicians familiar with

all equipment, librarians and support staff members. The need for including the librarian as a member of the instructional development team results from the team s need for knowledge of the content of specific databases and information websites and access strategies for getting the most from them (Wiltse, 1997).

The team analyzes the learners characteristics, including their access to and ability to use communication technologies, entry level knowledge and skills relative to course objectives, and ability to function effectively in distance education environments. With this analysis in mind, decisions are made with regard to course goals and objectives (outcomes) and the learning activities that will be used to assist learners in achieving them. Then, distance education technologies are selected to facilitate the application of the learning activities. This decision-making processes considers the critical attributes of each technology (e.g., synchronous versus asynchronous, ability to display video motion and images, etc.) with regard to their ability to facilitate critical learning activities. Access to the desired communication/learning technologies for specific course times and situations is then arranged, and the course is delivered, deploying each technology at its strength in facilitating the required communication patterns.

If the blended-technology approach to distance education course planning and delivery is truly a more effective model than single-technology implementation, then educational institutions will need to become much more comprehensive in their approach to infrastructure development and professional development. They will also need to encourage and support the use of course development teams, and focus careful attention on the scheduling of their communication technology systems. In short, they must commit to a new approach to distance education system development. To be seriously regarded, such a change must be based upon empirical evidence.

Conclusions

The highest levels of satisfaction are congruent with the analysis that the distance education student is typically a mature, employed student who has family and work responsibilities that make the opportunity to timeshift instruction very attractive. Videotaped lectures can be viewed at the student s convenience, and as often as the student would like. Similarly, e-mail correspondence can be accessed in accord with student schedules. It is interesting to note the high level of satisfaction with the students receiving course materials in a timely fashion. This is a testimonial to the importance of this logistical concern, and to the careful planning and attention to this component provided by the Director of Distance Education and the clerical staff assigned to the project.

Additional Conclusions and Recommendations

1. Distance education delivery systems will continue to grow in number and improve in quality. They are harmonious with other societal changes such as the demand for services delivered anywhere, anytime and in the format you want. They are arguably superior to traditional face-to-face instructional delivery systems in facilitating emerging employer-demanded skills such as a) self-directed learning, b) problem-solving/critical thinking, c) working in teams, and d) communication skill enhancement. They are also often aligned with constructivist pedagogical trends and learner empowerment, and support a focus on learning rather than teaching.

2. Many traditional faculty members and institutions are in the process of making the change from a focus on teaching to a focus on learning and in relinquishing control of instructional processes

3. Single-technology distance education systems will be replaced by multiple or blended technology distance education delivery systems. While many higher education institutions are resisting this change until the single technology models demonstrate their cost-effectiveness, eventually it will be clear that investments in the entire technology toolkit are critical if an institution wants to participate in the delivery of effective high-quality distance education courses and programs. One positive by-product of

the blended-technology instructional delivery system is the recognition that several courses could share certain limited-supply technologies. For example, the blended-technology approach could function effectively while using the interactive television system only five or six times in the twelve-week to fifteen-week semester. This means that one or two other courses could, if scheduling agreements could be reached, use the same interactive television infrastructure during that same time-of-day and day-of-the-week. This has the effect of expanding the capacity of the interactive television infrastructure by a factor of three without adding any new equipment.

4. Institutions will increasingly perceive the necessity of investing in high-quality professional development for distance education faculty members. Unfortunately, many will recognize this need only after student and faculty satisfaction levels are in a crisis state. Those who wait for the satisfaction crisis to hit will face a long road in the restoration of credibility for their distance education courses and programs.

5. Learners are accepting the requirement that they be technologically literate as a prerequisite for participating in the instructional process. Just as learners have accepted that certain minimum reading levels are necessary for them to benefit from instruction, they are now recognizing that they must also have a baseline of technology utilization skills. Some student-centered institutions are assisting these learners by providing comprehensive entry assessment of students technology skill levels and providing thorough student orientations that address technology application skill-gaps.

6. Successful application of a blended-technology approach requires collaborative efforts among representatives of several departments within an educational institution. Some members of these teams may report to different deans. It will be a challenge for many traditional educational institutions to generate sufficient collaboration to operationalize the blended-technology approach. Frankly, these units are often competitive and not used to cooperating with one-another. Team-building might often be the important first-step for educational institutions attempting to implement a blended-technology approach to distance education course and program delivery.

7. There is much to learn about optimally using the communication tools that comprise the blended-technology approach. Much work needs to be done to determine which conferencing software is optimally suited for which purposes: Similarly, the question of relative advantages of synchronous vs. asynchronous communication patterns will need to be carefully studied. Finally, the question of whether any of the instruction in a program or course needs to be site-based with students fulfilling a residency requirement is a critical issue to many program and curriculum designers.

8. There is a need for more pilot-tests of distance learning delivery systems. This process will provide an opportunity for planned growth based on data and cumulative experience. The alternative is to continue to add infrastructure haphazardly with the hope that successful applications will be developed. It is a common technology-explosion error to invest resources into hardware and software without corresponding investments into developing processes for its effective utilization.

9. It is the instructor s perception that students who participated in this pilot exhibited growth in their ability to engage in self-directed learning, problem-solving, teamwork and communication skills. Employers have long argued that these skills are critical to workplace success, and are therefore important skills for all curriculum areas. This growth is characteristic of learners experiences in distance learning programs and may be one of the more important reasons for exposing students (even on-campus students) to distance learning environments.

10. Distance learning is currently growing at a relatively slow pace. However, when a critical mass of an innovation or cultural change is reached, there is often a rapid acceleration in the rate at which the

innovation is diffused and permeates the culture. There is evidence that distance learning will fit this pattern, and that the explosive growth period is rapidly approaching. When that phenomena hits, those institutions who have established a solid delivery base and sound practices will flourish.

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Scoring Activities on Integrating Technology Into the Curriculum During Pre-Service Training Using a Bloom/ACOT Scale

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A small, private college teamed with a suburban, public elementary school to use pre-service teachers to assist in integrating technology into a fifth grade curriculum. Eight pre-service Education students were assigned to instruct fifth graders on how to use multimedia technology in an innovative fifth grade curriculum which employed field experiences, cross disciplinary skill activities, and computer multimedia writing. We sought to see how these technology activities scored on Bloom's Taxonomy (Bloom, 1956) and selected fourteen activities for scoring. The observed activities of the pre-service students were:

1. Basic hands-on learning of word processor, spreadsheet, data base, and Hyperstudio.
2. Constructed data files to understand application.
3. Constructed draft lessons to teach basic application commands to students.
4. Basic hands-on learning of pre-service students on how to adapt applications to project use.
5. Constructed draft lesson plans to guide fifth graders in using applications for notes, budgeting, analysis.
6. Planned, organized, and supervised fifth graders lab experience.
7. Taught fifth graders to use the ClarisWorks word processor to keep a journal of their activities.
8. Taught fifth graders to use spreadsheet to construct a budget and estimate savings from coupons.
9. Taught fifth graders to use data base to manage the different food product categories.
10. Taught fifth graders how to access the Internet to research food products and topics on nutrition.
11. Taught fifth graders how to use Apple QuickTake 150 digital camera to take pictures.
12. Pre-service students used video camera to make movies later incorporated as Quicktime movies.
13. Assisted fifth graders in developing ideas about shopping, organizing these ideas in a virtual reality supermarket, and expressing idea in a multimedia/hypermedia presentation.
14. Final work product presented as presentation before local District Board of Education.

Since Bloom's scale does not specifically address developmental progression in technology, we selected an ACOT (Apple Classroom of Tomorrow) scale to accompany Bloom. Just as Bloom's scale points to higher cognitive operations, the ACOT scale, developed by researchers at Apple Computer (Dwyer, Ringstaff, & Sandholtz 1991), ranks the development of increasingly sophisticated uses of technology in instruction. By combining the two scales, we constructed a scoring instrument for cognitive behavior and technology activities providing a context for examining the relationships. The corresponding relationships of Bloom and ACOT categories, as we see them, are:

ACOT Stages	Behavior	Bloom's Taxonomy	Behavior
Entry	Little inclination to change mode of instruction.	**Knowledge**	Basic recall or recognition of facts.
Adoption	Adopt technology to support traditional approaches.	**Comprehension**	Ability to receive and use information.
		Application	Using information in concrete situations.
Adaptation	Venture beyond traditional approaches.	**Analysis**	Ability to break down or use elements or parts.
Appropriation	New instructional patterns and questioning of old patterns.	**Synthesis**	Ability to work with pieces to combine in a new pattern or structure.
Invention	New pedagogical approach developed by teacher.	**Evaluation**	Ability to make quantitative and qualitative judgments about information learned.

We classified (Table 1) and tallied (Table 2) the fourteen activities by Bloom/ACOT stages. The positioning was influenced by our knowledge of the literature and interpretation of the descriptions of activities occurring at different Bloom and ACOT developmental levels.

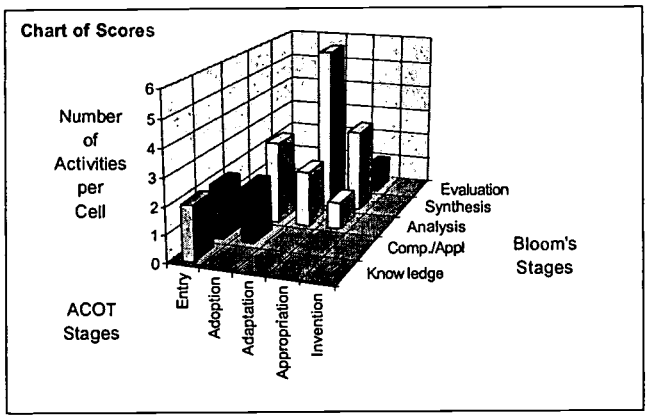
Table 1 Identifying and Placing Graduate Student Activities - Scores of Responses

Bloom's Stages ——>		Knowledge	Comp./Appl	Analysis	Synthesis	Evaluation
ACOT Stages	Entry	#1, #2	#2, #3			
	Adoption		#2, #3	#2, #3, #4		
	Adaptation			#5,#6	#7,8,9,10,11,12	
	Appropriation			#6	#6, #13, #14	#14
	Invention					

Table 2 No. Of scores

Bloom's Stages ——>		Knowledge	Comp./Appl	Analysis	Synthesis	Evaluation
ACOT Stages	Entry	2	2			
	Adoption		2	3		
	Adaptation			2	6	
	Appropriation			1	3	1
	Invention					

The chart below shows Table 1 and 2.



Our Bloom/ACOT scale showed that many of the activities reflected our students gaining a conception of computer use in new instructional patterns. We see the value of classifications on the scale, while not empirical data, as guides to planning pre-service activities in technology integration (Apple Computer, 1995). Future studies are needed to develop and strengthen the model. The authors recommend that pre-service students be given pre and post program surveys for correlation to and support of the classification of activities on the Bloom/ACOT scale.

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Investigating the Benefits of an Educational Technologist in Middle School environments: A Qualitative Study

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Abstract: This paper is a report of a study conducted of a federally funded technology innovation grant, C*R*E*A*T*E for Mississippi. Qualitative techniques were used to examine the benefits of school based Educational Technologist in increasing teacher knowledge and integration of technology. Preliminary results indicate that teachers do benefit from the Educational Technologist. Teachers feel more confident in their use of technology, use more technological resources in planning and implementing their lessons, and are integrating technology into their lessons.

Introduction

Schools are gaining more and more access to technology. However, research indicates that teacher knowledge and integrated use of technology is not increasing proportionate to the technology available in the schools (U.S. Department of Education, 2000). A possible cause for this discrepancy may be the lack of training, support, and time that teachers have to learn how to effectively integrate technology into day-to-day classroom learning (U.S. Department of Education, 2000). A consortium of schools and other partners was funded through a Technology Innovation challenge Grant by the U S Department of Education to support technology integration. Four diverse middle schools were chosen from one congressional district to participate in the first year of the C*R*E*A*T*E for Mississippi project. The schools were chosen for their

innovative insight and potential to infuse technology into learning. The administration at each chosen school named four core teachers to directly participate in the C*R*E*A*T*E for Mississippi project. The core teachers at each school were expected to interact with members of the C*R*E*A*T*E for Mississippi project and to help disseminate technology innovations to other teachers in their school and district. To address the lack of technology training, support, and time that middle school teachers have to integrate technology, core teachers participating in C*R*E*A*T*E for Mississippi were provided one hour per day of release time to use for planning and professional development. The position of educational technologist (ET) was created to assist the core teachers, other teachers, administrators, and students in the school in educational technology.

The educational technologist (ET) is responsible for providing support to core teachers, other teachers, administrators and students in the use of technology in all phases of learning. The ET is also expected to orchestrate the improvement of student learning and academic achievement through the effective use and integration of technology. This research was conducted to investigate the benefits of the educational technologist in increasing teacher knowledge and integration of technology.

The Study

Researchers in the four different schools conducted this qualitative study. The research data was collected through interviews, observations, and created documents, such as lesson plans and presentations.

Release time was studied at each school. Formal documentation of release time as well as observations during release time and interviews with teachers regarding release time was used to verify and study the use and benefits of release time at each school.

Researchers working both individually and in teams observed interactions between the core teachers and the educational technologist. Observations were also made to document the interaction of the ET with other teachers within the school and interactions between the core teachers and other teachers within the school.

Interviews were held with the educational technologist, core teachers, and other teachers. These interviews were informal and conducted with individual researchers as well as with teams of researchers. Interviews helped document the infusion of technology into the school culture. The attained information documented the relationship development between the educational technologist and members of the school community (i.e. teachers, administrators, and students).

The researchers also collected documents. Lesson plans developed by the teachers that integrate technology were evaluated for meaningful technology infusion and for evidence of the educational technologists' support and assistance in the development. The schools' curriculum plan and technology standards were examined for changes and improvements following the influence of the educational technologist

The observations, interviews and permanent products were used to form a cohesive description and explanation of the work performed by the educational technologist in each school.

Findings

Magnolia Middle School

The core teachers at Magnolia Middle School (pseudonyms will be used for all schools and teachers in this research) decided to take their release time one hour after school each day. Records indicate that core teachers work a minimum of five hours a week after school developing lesson plans which integrate technology, planning for technology integration, and learning new software to integrate into lessons. However, observations and interviews revealed that core teachers were not consistently working for one hour after school each day. Rather, the core teachers were managing their release time to accommodate day-to-day needs. For instance, if a core teacher was working on locating Internet sites to use with an upcoming lesson, that teacher did not necessarily log off and leave one hour after school was dismissed. Instead, the core teacher may search for sites, follow links, and investigate sites for periods of time up to three hours after school. Additionally, if a parent needed to visit with a core teacher after school

or if a staff meeting was called for after-school hours, the core teacher may not stay the additional hour after the delay to complete his one-hour of release time. In each instance though, the core teacher kept up with time and spent a minimum of five hours per week on technology related activities. Observations of classroom activities, critiques of lesson plans, and interviews with core teachers and administrators indicate that the core teachers at Magnolia Middle School made very productive use of their release time.

Magnolia Middle School made unique arrangements for the position of their ET. Magnolia Middle School administrators did not feel they had any appropriate candidates to fulfill the duties of the ET. Hence, the role of ET was split between two individuals already on staff at the Magnolia Middle School. A journalism/technology teacher assumed the role of half-time ET, taking on the responsibilities of teacher technology support and technology integration. An administrative intern also assumed the role of half-time ET, taking on the responsibilities of technology curriculum development and in-house technology training for the staff.

The half-time teacher, halt-time ET has been observed to have a very good relationship with the core teachers. Her interactions with the core teachers, though limited, have been positive. The teacher ET teaches five classes per day and seems to have very little time to interact one-on-one with the core teachers. The core teachers do, however, seem to be independent, highly motivated individuals who do not require a lot of support from the teacher ET. The teacher ET has been noted to provide technical assistance to at least one core teacher.

The administrative ET has not been observed to have a strong relationship with the core teachers. The administrative ET has been observed to be pulled away from many of her ET duties by her administrative duties. Her administrative duties do not seem to permit much time to interact with the core teachers or with other teachers in the school. The administrative ET has attempted to maintain interaction with all the teachers by publishing technology tips via email to all the teachers every week. She also regularly invites all the teachers to request any assistance she can provide to them.

The teacher ET has been observed to have a very good relationship with other teachers in the school. The teacher ET has been noted to interact more frequently with other teachers in the school than with the core teachers. The teacher ET has provided technical support to other teachers, as well as as-needed assistance and training in such areas as sending attachments with email and finding feared lost. The teacher ET has also provided other teachers with researched Power Point presentations to use with lessons they teach. The time the teacher ET saves other teachers within the school (i.e. finding web sites for them and making Power Point presentations for them) has enabled other teachers within the school to integrate more technology into their lessons.

Interactions between the core teachers and other teachers within the school have been noted to be very positive. The core teachers have willingly shared lessons that they have developed during their release time. The core teachers have been noted to provide software training and technology support to colleagues who wish to implement their lessons, but who do not have the technological savvy. These other teachers have voluntarily stayed after school to get training and support from the core teachers without receiving any monetary compensation.

The researchers have noted positive changes in the use and infusion of technology in both the planning and teaching process at Magnolia Middle School. The core teachers, confident in their technology use and self-motivated, have recently added more technology use in their lesson planning process and have infused more technology into their lessons without the direct aid of either ET. However, each ET has been observed to have an impact on the technology use and infusion of other teachers in the school who may not be as confident or self-motivated as the core teachers.

Hilltop Middle School

The core teachers at Hilltop Middle School decided to take their release time during the school day. The administration at Hilltop Middle School hired a first year teacher as a half-time teacher, half-time coach to fulfill the teaching responsibilities of the core teachers during their release time. Therefore, the core teachers at Hilltop Middle School have their regular planning period each day in addition to an extra planning period of release time made available through the grant. The core teachers at Hilltop Middle School use their period of release time for planning technology infused lessons, researching internet sites for resources to use in lessons, and setting up technology for student use (i.e. setting up probes, bookmarking internet sites, preparing documents with linked sites for students to explore, etc.). The core

teachers at Hilltop Middle School have faced some obstacles with their release time during the school day (i.e. the loss of their classroom during their release time, inflexible time frame to complete release time work within).

The ET for Hilltop Middle School was hired from a Technology and Education position at a high school in another district. Early in the academic year, interactions of the ET with the core teachers seemed to vary from good to a bit strained. The core teachers were noted to be somewhat dependent on the ET for guidance, support, and training. As the academic year has progressed, the interactions of the ET with the core teachers have been observed to be reserved with some and even strained with others. The ET responds to the core teachers' request for help in finding resources to integrate and infuse technology into their lessons, however, it has been observed that the core teachers do not use the ET as efficiently as the role was intended. For example, the core teachers do not call on the ET to assist with classroom exercises involving technology or to help train students in the use of technology used in the classroom.

Other teachers at Hilltop Middle School have been observed to have a good relationship with the ET. The ET readily makes herself available to the teachers for assistance, support, and training in educational technology. She also assists the technology coordinator in technical problems with computers within the school. Other teachers within the school seem to be comfortable calling on the ET for assistance and they appear to be confident in her ability to guide them.

Interactions between the core teachers and other teachers within the school have been observed to be limited. The sharing of information noted at Magnolia Middle School has not been evident at Hilltop Middle School. Likewise, the core teachers seem to somewhat resentful of the assistance of the ET to other teachers within the school. Additionally, some resentment has been noted from other teachers within the school toward the core teachers due to the extra planning period they get through release time each day.

Researchers have noted some positive changes in the use and infusion of technology into the lessons planned and taught at Hilltop Middle School. The teachers at Hilltop Middle School have had more access to technology than any of the teachers at the other schools. In the past, much of the technology available to the teachers at Hilltop Middle School sat dormant in the classrooms. The ET has provided training, support, and encouragement to the teachers to empower them to make better use of their resources. The researchers have observed increasing use of technology by the teachers, but for planning and for teaching.

Valley Middle School

Release time at Valley Middle School, like release time at Hilltop Middle School, is during the school day. During each core teacher's release time, the ET works one-on-one with the core teacher providing her with training in computer skills, help in locating websites for lessons, and assisting with lesson plan development. The core teachers decided on this release time format.

The ET at Valley Middle School was a teacher in the school system before accepting the position of full-time ET for the school. Researchers have observed a strong relationship between the core teachers and the ET at Valley Middle School. Interactions between the core teachers and the ET are very positive with the ET spending time in the classrooms assisting the teachers with lessons that integrate technology by working with groups of students in the classroom.

Other teachers at Valley Middle School have also been observed to have positive interactions with the ET. The ET has conducted professional development workshops for all of the teachers in the school. Researchers have noted that other teachers recognize the ET as an important resource person for troubleshooting and addressing their technology concerns.

Valley Middle School is a small, rural school with one teacher responsible for a content area for all the Middle School grades. Given the small size of the school, the core teachers are the only content area teachers for the Middle School grades. That is, all the middle grades teachers are core teachers. Interactions between the core teachers and other teachers at the school have not been observed or noted.

Researchers have observed that the ET at this school has proven herself and the position as vital to the growth in technology use by the teachers and students. This is a very small school with veteran teachers; change is slow to come. The change of teachers' practices has been evident in very small ways. The ET at this school has encouraged teachers to learn basic computer skills and shown them how to use technology in their lessons. Researchers have observed the teachers' excitement about their newly acquired

skills. Yet, the researchers have noted a reluctance of the teachers to use their new knowledge with their students.

Leesburg Junior High

The school administrator decided the release time for teachers at Leesburg Junior High. Release time for the teachers is scheduled for one hour after school. After school hours were decided for Core teachers because teachers were already scheduled for two planning periods during the day. The planning periods were built into the school schedule before the release time for C*R*E*A*T*E for Mississippi was considered. Because the teachers work separately after school, there is no collaboration with the ET during release time. Release time documentation kept by the ET indicate that teachers use their release time to find technology resources to integrate into their classrooms, planning technology infused lessons, and searching for sites that will be useful for lesson enrichment. The researchers have noted that the teachers approve of the after school arrangement because of the flexibility that the hours offer.

The ET at Leesburg Junior High was hired from a technology coordinator position in a nearby school district. Previously, the ET had extensive professional experience in the community college and business sectors. The ET and the core teachers at Leesburg have not been able to establish a working relationship. The teachers are located in the main school building and the ET is located in a building separate from the teachers. The teachers do not readily seek assistance from the ET and have worked independent of the ET throughout the entire project.

The ET has yet to establish a relationship with the other teachers in the school. This may be attributed to the fact that the ET is located in a separate building. The ET does not make an effort to establish relationships outside of the building in which she is housed. The teachers do no go to the technology building unless they have a class scheduled for the computer lab located there. However, the ET does have a good relationship with the technology coordinator. The ET shares office space with the technology coordinator and this arrangement further fosters the relationship between them.

The core teachers interact positively with the other teachers within the school. There has been evidence of the core teachers sharing information with the other teachers about technology integration and lesson plan ideas. There have been cases where the core teachers have taken extra time to train other teachers on software in an effort to help the other teachers in their quest to integrate technology into their classrooms.

There has been evidence of changes in teacher use of technology from the beginning of the project to the present. During the previous school year, none of the four core teachers used the computer lab for their class sessions. This year, three core teachers have utilized the computer lab. One teacher who had previously been very uncomfortable using technology has used the computer lab this semester and has also trained another teacher on the technology skills that she has acquired. Researchers note that these changes occurred because the teachers are self-motivated. The ET had very little impact on the changes that occurred with these teachers.

Conclusions

The researchers have noted greater levels of positive interactions between the ET, the core teachers, and other teachers when the ET has a background similar to the teachers in the school. When the ET has teaching experience at the grade level of the teachers, there may be a greater level of understanding of the needs of the teachers and the students that the ET is attempting to assist.

The ET was noted to be more successful at interacting with both the core teachers and other teachers in the school when the ET was housed in the building with the teachers. This may be because the ET was more assessable to the teachers. The close proximity of the ET to the teachers may lead to the building of relationships in which the ET can better understand the needs of the teacher and the teacher will better trust the ET to provide appropriate assistance.

All of the core teachers have expressed positive reactions to the release time made available to them through the grant. The more independent, self-motivated core teachers were noted to be successful with after school release time for planning and infusing technology into their lessons. This may be due to the flexibility afforded to them for planning around interruptions and the ability to accommodate the

varying times required exploring and navigating various software and Internet sites. Less confident teachers were noted to benefit from one-on-one daily assistance from the ET. This may be due to the support and encouragement that the ET is able to provide.

The researchers have noted varying degrees of success in technology learning and technology infusion into learning environments in this study. The schools in this study have experienced various benefits from the ET. It is noted that some schools benefited more than others, however, all schools in this study have experienced an increase in the technology used by teachers in the planning process and in the technology teachers have infused into learning experiences in the classroom.

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Scientific and Technology Learning: Enhancing the Attitudes Toward Technology for Middle School Girls

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Abstract: Middle school girls, selected from several rural and urban school districts in northeast Louisiana, participated in a three-week program at The University of Louisiana at Monroe (ULM). Pre and post-attitude surveys as measured by the Computer Attitude Questionnaire were compared to assess the effectiveness of the program. The analysis measured the effects of attitude changes in the following categories: interacting with the WWW, a word processor, a database application, and e-mail. Significant changes in attitudes in three of the four categories were observed. Positive attitudinal changes were observed in the areas of the WWW, word processing, and e-mail.

Introduction

Living in the information age has increased the complexity of our forms of communication, especially in education (Casey, 1997). The forms of communication and access afforded by the Internet have helped to define cultural assumptions and realities in relationship to technology. Studies focusing on gender in conjunction with practices relating to technology offer an important insight for studying the impact of the union of technology and culture. From these abundant studies many researchers have focused on the imbalance in education particularly at the upper elementary and middle school levels. Whitley (1997) states that computer use, in our society, has been portrayed as more appropriate for boys than girls. The design and delivery of technological knowledge through educational software, web designed sites, and computer games appeal more to boys than girls (Kiesler, Sproull, & Eccles, 1985; & Swanson, 1997). Computer use in schools has traditionally been linked to 'masculine' subjects such as science and mathematics rather than traditionally 'female' subjects such as liberal art and literature (Hawkins, 1985). After conducting various studies on gender equity the American Association of University Women (AAUW) Executive Director Janice Weinman (1998) refers to the technology plight as "the new boys' club in our nation's public schools", while Janese Swanson, senior vice president of the Girl Tech Web site, states, "Shying away from technology not only restricts girls from certain life choices and successes, but also limits the potential for their future products, inventions, and discoveries – a disservice to the entire society" (Swanson, 1997).

Research has reported various explanations for the disinterest of girls with certain subject matters such as computer science, mathematics and science. Researchers have included factors such as, the societal views of an appropriate female career, the lack of female role models in these areas, gender bias in the classroom setting at this critical time in the female life, and gender stereotyping in computer software. The NSF/ Girls Research Opportunities in Computing (Girls R.O.C) project was designed to address these issues by conducting an intense three-week summer program that would encourage enthusiasm by providing female role models such as ULM computer science faculty and majors, a non-competitive environment and group research. The program provided both formal and informal activities for the girls in areas of computer science, computer application, Internet research, listserv activities, data mining, along with a variety of classroom and hands-on activities that exposed them to ways that computers are used in research, business, and the home.

The Study and Conclusions

The selection of the 24 participants for the program was from incoming eighth and ninth grade girls from predominantly rural school districts in northeast Louisiana. The girls were selected using several criteria that

included a written essay, transcript of grades and a recommendation from a counselor or teacher. Special consideration was given to minorities and students with disabilities. This study consists of the pre and post survey results for 19 of the initial participants that finished the three-week program. The five participants that left the program and their five replacements were omitted from this study due to lack of either the pre or post testing survey results.

The research instrument used to assess the attitudes of the participants was the Computer Attitude Questionnaire (CAQ) (Knezek & Christensen, 1998). Emphasis was placed on the questions from the CAQ that addressed the issues relating to the WWW, word processing, database application, and e-mail. The pre-survey was conducted online with the girls on their arrival at the university, and a post- survey was conducted on the last day of the program. A paired t-test was used to perform the comparison of the before and after attitudinal responses relative to these areas for the group of participants. Table 1 lists the results of the paired t-test that evaluated the research hypothesis of what changes in attitudes did participants exhibit as a result of their participation in the three-week program.

Topic	*Means*		*T value*	*P value*
	pre-survey	*post-survey*		
WWW	3.9579	4.5868	3.9192	0.0010
Word Processing	3.4421	4.2000	3.7510	0.0015
E-Mail	4.1842	4.6140	2.8566	0.0105
Database Application	3.2982	3.6667	1.9647	0.0650

Table 1. Results of paired t-test

The participants' attitudes toward the WWW, word processing, and e-mail were significantly improved after the three-week program. The 19 participants collectively had an average of 3.95796, 3.4421, and 4.1842, respectively for these areas prior to the workshop. After the three week intensive study the average attitude improved significantly to 4.5868 (p=0.0010), 4.2000 (p=0.0015) and 4.6140 (p=0.0105), respectively. Even though the participants' attitudes toward database application did not reveal a significant change at the 0.05 significance level, it could be declared significant at the 0.0650 level. The average attitudinal responses for database application were 3.2982 and 3.6667, respectively for the pre and post survey.

From this study, it can seen that the Girls R.O.C. Program did have a positive impact upon its participants. Whether this impact will sustain over time is another question. The girls will return to ULM three times throughout the 2000 fall term to work on science fair projects with the project directors. The CAQ will be given each time to monitor any changes in attitudes toward technology along with the participants' attitudes toward school.

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Session 419

The Effect of Multimedia Training on Teacher-Centered Vs. Student Centered Classroom Behaviors

As we enter the 21st century, the questions remain: Are teachers creating active learning environments that enable student to become independent learners and creative problem solvers?

One tool that helps teachers shift the control of learning from teacher to students is the use of multimedia in the classroom. Multimedia can motivate students to explore new learning environments through research, collaboration, and problem solving. Students can gather information from online resources and create interactive presentations that combine text, graphics, sound, and digital video.

In order to integrate multimedia into classrooms, students and teachers must learn both the technical and application nature of multimedia programs. One of the problems with PowerPoint and other multimedia programs is that teachers have the tendency to use these programs to reinforce their presentations. The result is the reinforcement of teacher-centered behaviors.

In this study, 15 teachers from one school district representing various levels from K to 12, enrolled in a one-credit graduate course titled "Instructional Applications of Multimedia Using PowerPoint." The question asked in this study was "Does the introduction of multimedia training to teachers and students help shift classroom learning from teacher-centered behaviors to student-centered behaviors?"

The purpose of the graduate course was to teach the use and classroom application of Microsoft PowerPoint to practicing teachers. The course was offered at the beginning of the school year and none of the teachers had prior experience using PowerPoint. The school district installed PowerPoint software for all teachers who enrolled in the course. In

addition, PowerPoint was installed in all computer labs throughout the school district.

The graduate course required teachers to create PowerPoint presentations; however, the course also required teachers to have students integrate PowerPoint in student-centered projects. Thus, the teachers had to teach PowerPoint to their students and require students to create classroom projects utilizing PowerPoint software.

At the end of the course teachers were required to report and demonstrate the results of their projects. A survey was also conducted to determine (1) the teachers' attitude toward multimedia as a learning tool and (2) teacher plans to use multimedia in a teacher-centered vs. student-centered activities.

Some of the other questions this study addressed were (1) What is the teacher perception of the application of multimedia to student-centered activities? (2) What are the difficulties associated with incorporating multimedia into the classroom? (3) What learning difficulties are encountered with special-needs learners and younger learners in creating and using multimedia in the classroom?

Preliminary results indicate that the teachers enrolled in the course had a positive attitude towards multimedia. Most teachers planned to use PowerPoint for both teacher-centered and student-centered activities. Most teachers agreed that they would have the students use PowerPoint for both individual and group projects. Teachers reported problems with lab access, storage on floppy disks. Very few teachers reported technical problems. Teachers reported that the younger learners (K-2) had more problems working with PowerPoint than older learners.

Teachers will be surveyed throughout the school year to determine the frequency and type of PowerPoint use in the classroom.

Final results and recommendations will be reported at the conference.

CPR Lessons for Teachers: Current Trends, Practice, and Research in Educational Technology

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Abstract: Young scholars introduce a diverse selection of current trends, practices, and research findings A discussion of constructivist-oriented practices that support K-12 technology use is followed by discussions of the implications of technology integration and the cost-effectiveness of technology use in elementary and secondary settings. Technology application issues are addressed next, including the effectiveness of virtual field trips, instructional courseware, online discussion tools, and computerized tests. These areas represent just some of the research on educational of technology that effective teachers must remain aware of.

Educators at all levels from PreK-16 now have a vital need to be aware of current instructional technology trends, practices, and research findings in order to provide effective learning environments for their students. Findings of research in this area are often mixed, and best practices are frequently not shared among educators. This collaborative paper written by young scholars conducting research in the field will introduce a diverse selection of current trends, practices, and research findings in a sequence that will give the reader a unique overview of the educational technology field.

Constructivism Overview

Constructivism is the new educational buzzword in education. Dewey, Vygotsky, Bruner, and Johnassen have all developed principles that can be called 'constructivist natured', but what is constructivism? What does a constructivist classroom look like? What role does constructivism play in education? How do we apply constructivism to technology? This session will explain the key components of constructivism as well as the assumptions and myths.

Implications of Technology Integration

Technology plays a key role in how the world functions. Schools are now being faced with how to effectively and efficiently integrate technology into their classrooms and curriculums. Technology integration involves challenges--including access inequities among schools, courseware material purchasing decisions, and computer (il)literacy levels--of students and teachers. Schools need to meet these challenges one at a time.

Cost-Effectiveness of Educational Technology

Most schools are funding education technology but is the money being spent simply for the sake of technology or are these investments proving to be beneficial to students? Several large-scale studies, which give some insight on how computers can best be used to raise student achievement, will be discussed.

Virtual Field Trips

How effective is an educational museum web site as an alternative to a museum field trip? The data regarding the educational outcomes of a virtual field trip will be presented to provide a better understanding of the educational opportunities afforded when using the Internet in the classroom.

Courseware

Educators find it difficult to locate effective educational courseware that will work reliably, hold student interest, and meet the requirements of the curriculum. Factors that must be considered include appropriate teaching style to scheduling student computer time with limited computers availability. Findings on the impact of educational software on technological confidence, competence, and teaching effectiveness of high school teachers will lead to a better understanding of these issues to enhance the effectiveness of its use in a teaching and learning environment.

Online Discussion

Do social factors such as intimacy and immediacy, derived from the concept of social presence, affect student learning and satisfaction in computer conferencing? With the introduction of the Internet to education, computer-mediated group interaction has been facilitated for both online courses and face-to-face courses as an instructional supplement. This presentation will present factors that achieve effective student learning in computer conferencing from the sociological perspective.

Assessment

Recent technological advancements in the development of testing software allow teachers more flexibility in assessing student learning. Research and experiences in writing and developing computerized mathematics tests will be discussed. In addition, the advantages and disadvantages of generating computerized alternative forms of tests and of administering the tests via a computer will be presented.

Conclusion

The ongoing research introduced in this collaborative paper is one small portion of the research on the use of technology for teaching and learning that teachers must be aware of to remain effective. The sheer diversity among these few topics emphasizes the types of current trends, practices, and research that will impact teachers and students in the near future.

A Comparison of Preservice, Inservice, and Non Teacher Education Majors on Technology Confidence, Ability, and Use

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Abstract

This paper describes the findings from a study based on a newly enacted state technology standard for new and experienced teachers. Teacher education students rated their confidence level, ability, and usage on technology areas. A control group of non-education majors was used to determine whether the technology competencies were acquired within the teacher education program or general university requirements. The results of the study were also examined to determine whether there is a progression from juniors to seniors to graduate students, and whether there are specific criteria of the new standard that students have not met.

Introduction

The state of Kentucky has enacted a new standard for technology knowledge and use for new and experienced teachers (Kentucky Department of Education, 1999). Nationally, all teachers are expected to meet a new technology standard designed by the International Society for Technology in Education (ISTE, 1997). As a result of these new requirements, teacher preparation programs and graduate programs for experienced teachers must assure the opportunity for students to become competent in technology skills and usage.

At Eastern Kentucky University, faculty members in the College of Education have been busy infusing elements of the new technology standard into required courses at pre-service and in-service levels. In an attempt to assess needs and how well current courses were addressing those needs, an earlier study was conducted which surveyed skills in sample groups of students (Long & Reehm, In Press). However, the survey form used to collect data was not specifically related to the performance criteria outlined in the Kentucky Department of Education's (KDE) new technology standard. The current study addresses this limitation. The authors designed a new survey instrument, administered it to a larger group of students, included a control group, and used the data collected to answer questions raised by the earlier study. Results were examined to answer the following questions: (1) Is there a correlation between the three aspects of student usage of technology which were identified as confidence, ability, and frequency of use?, (2) Is there a progression of technological competence from juniors to seniors to graduate students?, (3) Were the specific criteria of the new standard met by senior preservice teacher education students? (4) Was there a significant difference between the mean scores of the control group of non-teacher education students and the preservice senior teacher education students?, And (5) When comparing the mean scores of the senior groups of elementary, middle, and secondary preservice teacher

education students, is there a difference in the number and types of standard criteria met?

Study Design

The study was conducted at Eastern Kentucky University, a regional comprehensive university of approximately 15,000 students that serves primarily south eastern and south central Kentucky. The college of education offers a variety of undergraduate, graduate, and certification programs to approximately 1,300 students.

A computer survey was designed based upon the 16 performance criteria listed in KDE's new technology standard for teachers. Several of these performance criteria incorporated more than one technology area, which could lead to confusion in determining strengths and needs of students. Therefore the final survey form was delineated into 27 specific technology areas. Each subject who completed the survey was asked to respond to each of the 27 technology areas in relation to his/her level of confidence, ability, and frequency of use. The subjects were asked to indicate on a likert scale of 1 to 5 the following: their feeling of confidence for operating or applying the particular technology area; their current level of ability to use the technology area; and their current frequency of use of that technology area. A score of 1would indicate a low level of confidence, ability, or frequency of use. A score of 5 would indicate a high level of confidence, ability, or frequency of use. (See Table 1 for a list of the 27 specific technology areas)

The population surveyed included 180 undergraduate preservice teacher education students, 70 graduate inservice teacher education students, and 81 undergraduate non-teacher education students. Specifically, 59 elementary, 33 middle, and 37 secondary senior level methods course preservice teacher education students were surveyed. At the junior level, 51 elementary and middle grade preservice teacher education students enrolled in a course that was pre-requisite to the senior level methods block were surveyed. The graduate inservice teacher education students surveyed were enrolled in various elementary, middle grade, and secondary level education courses. The non-teacher education students surveyed were students enrolled in 200 and 300 level economics courses. The survey was given within the first half of the fall 2000 semester.

Analysis and Results

The SPSS program was used to analyze the data gathered from the survey instrument to answer the above written questions. In order to answer the first question (Is there a correlation between the three aspects of student usage of technology which were identified as confidence, ability, and frequency of use?) correlations were computed using the mean scores of the answers given by all the study participants in the areas of confidence, ability, and frequency of use as follows: (1) between confidence and ability means scores the correlation equals 0.99; (2) between the frequency of use and the ability mean scores the correlation equals 0.80; and (3) between the confidence and the frequency of use means scores the correlation equals 0.83. It was concluded that the means scores between all three participant response areas were highly correlated. Based on this conclusion, the rest of the analyses computed in this study were targeted at the ability response area.

A t-test was computed to analyze statistically significant differences of student group mean scores to answer question # 2, is there progression of technological competence from juniors to seniors to graduate students? Mean scores for senior level teacher education students were consistently higher than those for junior level students, but none of these differences were statistically significant. No significant differences were computed or observed between the means scores of the senior preservice students and the graduate inservice teacher education students. These findings indicate there is some progression from junior level to senior level, but not from senior to graduate levels.

In order to answer the third question, whether the specific criteria of the new technology standard were met by senior preservice students, an analysis of the ability means scores was conducted in all 27 technology criteria. The criteria was considered met if the mean score was greater then or equal to 3.00 on a scale of 1-5. Five criteria were not met by the elementary preservice teacher education group of students as follows: #6, #10, #11, #18, and #19. Three criteria were not met by the middle preservice teacher education group of students as follows: #11, #18, and #19. And, seven criteria were not met by the secondary preservice teacher education group of students as follows: #5, #6, #8, #10, #11, #18, and

#19. Only three criteria (#11, #18, and #19) were not met by all three groups of students.

Use of the control group was designed to determine the answer to question # 4, whether skills are gained during the teacher preparation program or as a part of general university requirements. Therefore, a t-test was computed to compare the ability area means scores between the non-teacher education undergraduate students and the senior teacher education preservice students. Eight statistically significant differences between the mean scores of these two groups were found. The non-teacher education student means scores were higher in the 6 criteria of #5, #6, #8, #4, #14, #17. The senior, teacher education student mean scores were higher in the criteria of #19 and #20.

A series of t-tests were computed to determine the answer to question # 5, whether there were statistically significant differences between the mean scores of the three different groups of senior teacher education preservice students (the elementary, the middle, and the secondary groups). Results of these analyses are as follows: (1) the elementary group's mean score for the criteria of #6 was statistically significantly higher than the middle group's means score, (2) the elementary group's mean score for the criteria of #25 and #26 were statistically significantly higher than the secondary group's means score, (3) the middle group's mean score for the criteria of #3, #4, #7, and #10 were statistically significantly higher than the elementary group's means score, and (4) the middle group's mean score for the criteria of #5, #7, #8, #10, #11, #18, #23, and #25 were statistically significantly higher than the secondary group's means scores ($p < .05$).

Discussion

High correlations between the mean scores of confidence, ability, and frequency of use computed from all survey participants indicate that students' self-reported perceptions did not vary significantly between all three areas. Therefore, the ability scores were used to pursue the answers to this study's questions. The focus on these scores was made to align language used by national, state, and teacher education program technology standards.

Although there was a slight progression detected between the junior and senior preservice teacher education ability mean scores, this progression was not statistically significant. Finding no positive increase between the senior preservice teacher education and the graduate inservice teacher education student ability means scores indicates a need to continue to implement the use of information technology into graduate level course work or other professional development efforts.

All three senior preservice teacher education groups of students met a majority of the 27 specific criteria in the new technology standard but there were some criteria that were not met. The elementary preservice teacher education seniors should specifically pursue study in the areas of: (1) demonstrating knowledge of the use of technology in industry, and (2) creating multimedia presentations using scanners. The secondary preservice teacher education seniors should specifically pursue study in areas of: (1) demonstrating knowledge in the use of technology in business, (2) demonstrating knowledge of the use of technology in industry, (3) demonstrating knowledge of computer/peripheral parts, and (4) creating multimedia presentations using scanners. All three groups of senior preservice teacher education students (elementary, middle, and secondary) should pursue the development of skills in the areas of: (1) creating multimedia presentations using digital cameras, (2) using computers and other technologies such as interactive instruction, audio/video conferencing, and other distance learning application to enhance professional productivity and/or support instruction, and (3) requesting and using appropriate assistive and adaptive devices for students/clients with special needs.

An unexpected finding was the significantly higher mean scores on 6 criteria for the control group as opposed to the preservice teacher education students. An examination of the demographic data collected in the survey provides insight into this finding. The control group reported a much higher number of technology courses taken (mean = 3.30) than the number reported by teacher education students (mean = 1.50). The teacher education programs are demanding and include few or no elective courses in their general education programs. This may explain the significant difference in the number of technology courses taken. In order to address the problem of limited exposure to technology courses, it is imperative that the teacher education faculty focus more on infusing technology into existing courses.

The differences found among the mean scores of the three different groups of senior teacher education students were a validation and an extension of the findings of the earlier study conducted by two of the authors (Long & Reehm, in press). Means for the middle grades teacher education students

were generally higher than those for either the elementary or the secondary group. This is similar to the finding of the previous study, and suggests the infusion of technology into existing courses is currently more successful in the middle grade education courses than in either the elementary or secondary teacher education courses.

Means for the secondary group were generally lower than those for both of the other groups. The previous study did not include secondary teacher education students, so this was a new finding. It can be explained in part by the fact that secondary teacher education students take more content area courses and fewer education courses in which technology skills can be developed. It also indicates a need for incorporating techniques used in the middle grade education courses into the required secondary education courses.

The successful middle grade model involved having four middle school faculty members working as a team to decide on technology skills that they felt were important for the middle grades education students to use in their education methods classes. These instructors conducted technology seminars for students at the beginning of the semester and then required students to use skills taught as part of course assignments. The College of Education technology coordinator assisted in developing the seminars, and trained the faculty members to deliver the seminars to students. Through this process, faculty members became proficient in teaching one area of computer skills to five different groups of students. Faculty members also developed an online component for all courses in the middle grades education methods block. Resources such as course syllabi, schedule of class times, electronic addresses, forms needed for the course, assignment guidelines, and other materials were available to students only through this online mode. Students therefore found it necessary to use this web enhanced component of the course, and as a result became familiar with a distance learning application which used online materials for learning.

Recommendations

As indicated in the discussion section, one recommendation is that each of the three undergraduate teacher education programs (elementary, middle grades, and secondary) examine the list of criteria not met by students in the specific program. Faculty members in each program could use this list to design and infuse new strategies into required courses that would promote skill development for the specific criteria identified as a need area.

A second recommendation is that the teaming and training techniques used in the middle grades methods classes be adopted by both the elementary and the secondary programs, with the goal of increasing the overall technology skill level for students in each program. A key element seems to be finding ways to make the use of technological skills necessary for successful completion of course requirements.

A third recommendation is that future studies should continue to examine aspects of the new standard and the degree to which students are able to meet specific criteria of the standard. As changes are made in the education programs, data should be collected to determine the effectiveness of the changes. One way to do this is to develop a longitudinal data set. Another way is to collect data from graduates of the specific programs as they begin working in public school classrooms.

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Table 1: Technology Ability Survey	
Technology Area	**I have the ability to.....** 1 = not true 2 = somewhat true 3 = mostly true 4 = true 5 = very true
1. Operate a multimedia computer and peripherals to install a variety of software.	
2. Operate a multimedia computer and peripherals to use a variety of software.	
3. Use terminology related to computers and technology appropriately in written communication.	
4. Use terminology related to computers and technology appropriately in verbal communication.	
5. Demonstrate knowledge of the use of technology in business.	
6. Demonstrate knowledge of the use of technology in industry.	
7. Demonstrate knowledge of the use of technology in society.	
8. Demonstrate knowledge of computer/peripheral parts.	
9. Attend to simple connections and installations.	
10. Create multimedia presentations using scanners.	
11. Create multimedia presentations using digital cameras.	
12. Create multimedia presentations using video cameras.	
13. Use the computer to do word processing.	
14. Use the computer to create databases and spreadsheets.	
15. Use the computer to access electronic mail and the internet.	
16. Use the computer to make presentations.	
17. Use emerging technologies to enhance professional productivity and/or support instruction.	
18. Use computers and other technologies such as interactive instruction, audio/video conferencing, and other distance learning applications to enhance professional productivity and/or support instruction.	
19. Request and use appropriate assistive and adaptive devices for students/clients with special needs.	
20. Design lessons/projects that use technology to address diverse student/client needs and learning styles.	
21. Practice equitable and legal use of computers and technology in professional activities.	
22. Facilitate the lifelong learning of self and others through the use of technology.	
23. Explore, use, and evaluate technology resources: software, applications, and related documentation.	
24. Apply research-based instructional practices that use computers and other technology.	

25. Use computers and other technology for individual, small group, and large group learning/working experiences.	
26. Use technology to support multiple assessments of student/client learning/production.	
27. Instruct and supervise students/staff in the ethical and legal use of technology.	

Looking Out, Looking In: Technology's Impact on Teaching and Learning

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This paper presents the findings of three-year research project that explored the integration of technology in graduate teacher education classes and the impact of that on the K-12 classrooms in which these graduate students teach. Specifically, it addresses integration of technology in graduate teacher education classes, effective integration of technology in teacher education university classes, and how and in what ways is technology being integrated in the K-12 classroom?

In the 21st century, students will have access to more information than any other students before them. Students can use technology to gather information, produce and disseminate their work. Students are going to have to learn to use and access this information wisely and judiciously. Teacher educators have a responsibility to assist their students in becoming comfortable and facile in the integration of technology in their own and their future students' educational lives. This is particularly true in the area of literacy education. Surely, we know how vital it is for youngsters to become fully literate, but, especially in the information age in which we reside, reading and writing have become even more significant. Before teachers can effectively help their students read, write and utilize technology effectively, they must themselves be comfortable with technology and be cognizant of the additional rewards and demands the technological revolution has placed on education.

Teachers must use effective strategies to help their students read independently, additionally, they need to help them read independently with wisdom. Teachers too, must help their student's access information judiciously and critically. While there has been some concern among educators and other interested parties that technology will take the place of reading and writing, the reality is that reading and writing have taken on an even more significant role in our students' lives due to the internet. In order to access information and telecommunicate using email, our students must know how to read and write effectively. Teachers must also become knowledgeable and at ease with technology and its impact on literacy.

Teaching today's students involves an awareness of the strong forces that are impacting on their lives. Students today are in the throws of the information revolution where they are inundated with reading material. Clearly this is advantageous in terms of motivation for learning to read. But, reading in and of itself is not an end product. The end product is what do readers do with the information that they gather. As Bruning, Schraw and Ronning note, "The aim of teaching . . . is not so much to transmit information, but rather to encourage knowledge formation and development of metacognitive processes for judging, organizing and acquiring new information. (1995 p.216)" Our ultimate goal as educators was, and still is, to help our students become independent and thoughtful readers and learners who use a wide variety of reading materials. Technology is changing teaching and learning.

Any change or paradigm shift comes with attendant concerns and frustrations thus it is necessary for educators to look closely at the process as we engage in varying our classroom practice. The use of technological advances has been an easy accommodation for some educators. For others, this is not the case. Richardson (1990) notes the importance of reflection on the teaching/learning process and on affecting change. Educators must continually make decisions as to the role of technology in their classrooms and the form, function and feasibility of using specific computer programs. To make informed decisions we must clarify our view of the role of technology in our literacy programs and define their relationship to existing curricula. The primary consideration should be the purpose of using technology (Jordan and Follman, 1993). Programs should support interactions between teachers and students and not be used as "teaching machines" to supplant teachers.

While numerous questions arise as to the efficacy of technology integration in K-12 educative environments, we must also look to teacher education programs and why, how and in what ways they are preparing

the teachers who will teach theses technologically savvy students of the new millennium. How do we realize the true potential of technology in our university classrooms? Similarly, how can K-12 teachers integrate and utilize technology effectively? This study was initially designed to look at technology integration in graduate literacy education classes. As questions from the students emerged, the study was then expanded to include an examination of the real world practice of those students who were teaching in K- 12 classes.

Many of us embrace the integration of technology in our classes but that doesn't mean that it is the right way to teach everything nor does it mean it is right for every teacher. Teachers, by the very nature of the profession, are continual decision makers. We (hopefully) decide how best to teach a particular subject to a particular group of students in a particular context. We decide on the pacing, and we decide what resources would be helpful to our students. These are informed decisions, based on years of study and experience. Decisions about the integration of technology must follow a similar thoughtful pattern. This paper explores what aspects of technology are helpful in given contexts and in what ways are they effective. This paper explores such issues as:

Does the integration of technology in graduate teacher education classes impact on students practice in K-12 classrooms?

How is technology most effectively integrated in teacher education university classes? How is technology being integrated in the K-12 classroom?

In what ways can teacher education programs facilitate the integration of technology in K-12 classrooms?

During the first phase of this project the process of engaging both preservice and in-service students in the use of technology in university classes was examined (Rhodes and Flank, 2000; Rhodes, 1998). The findings from these studies led to the current investigation.

Initial analysis of the findings from this current three-year study reveals several key issues and themes related to both teacher education students and those with whom they work. Themes specific to the graduate students include the level of knowledge and expertise they bring to the class; the impact of the use of technology in graduate teacher education classes; and graduate students' perceptions of their ability to incorporate technology into their teaching. The most recent and ongoing aspect of this study involves looking at the classes of those graduate students who were engaged in a technologically rich graduate literacy education class.

This study involved more than 140 students who were enrolled in five different graduate literacy education classes at two metropolitan universities within very close proximity to New York City. Although all of the classes were taught by the same professor the courses and their content was different in four of the courses. None of the courses were advertised or described as involving technology. Three of the classes were "theory to practice" literacy education courses, two were courses on research. With the exception of five students, all were teaching either in New York City Public Schools or schools in the neighboring suburbs.

In all cases, the prime focus of the courses was the content as described above. The manner in which the students were engaged however, often involved technology. Programs were demonstrated, students had the opportunity to work with software, but much of the technology infusion involved engaging students in distance learning environments as described in the previous cited studies.

Baseline data gathered at the beginning of each semester revealed that sixty percent of the students owned or had easy access to a computer but only five percent of the students were comfortable with their ability to use technology. Ninety percent of the students reported using computers only for typing term papers or doing assignments. Ten students indicated that they hated computers; three said they had no interest in learning about or with computers. The three self reported "technophobes" were in different classes but, upon learning that there would be a technology component to the class all indicated that they wanted to drop the class or transfer to another section—only one did. The other two were reassured by their professor and their classmates that they would help them through the process and if at any time they still felt uncomfortable with the technology, accommodations would be made. Almost all of the other students reported varying degrees enthusiasm or excitement at the prospect of using technology in our classes. The following case study of Jennie, typifies the experiences of those students who reported negative feelings about technology.

At the beginning of one semester, for example, Jennie, a self-described technophobe wanted to drop the course because "I have no interest in computers, I think they are a colossal waste of time. To do something with a computer takes too much time and energy." Jennie, like others was given assurances by her professor and classmates that they would help, but she reported having grave doubts and little interest. The semester progressed with the inclusion of an online component to our course. Although the class met face to face each week, there was additional work that had to be done online.

I met individually with Jennie and others each week to guide them through this process. Jennie described her feelings as "a little bit like I would imagine a child learning to read. . . it's clearly something I have to learn and

perhaps something I need to learn, but I just don't want to do it. I don't want to go through the angst and pain especially, if I end up being unsuccessful." At another point Jennie wrote in her journal, "Sure Carole is there for me, and she's really trying, but I'm not sure she fully understands how difficult and frustrating this is for me. I'm trying to do something that I don't see the need for, something that makes me feel like a failure. I don't like confronting difficult tasks." The fifteen-week semester progressed with Jennie getting a bit less frustrated each week. Through her meetings with me, she began to voice her feelings and concerns. As she did so, her progress and interest began to emerge. Within two months, she was working on line by herself and her comments reflected her new, minimal level of confidence. She indicated, "This is not as bad as I thought. I don't fear it as much. . .I'm not so bad at it." By the end of the semester, Jennie delighted in sharing her technological expertise with other members of the class. At the last class meeting, she proudly announced that she told her husband that she wanted a computer for her birthday.

Jennie identified her biases early on in the semester and clearly struggled with them and worked through them as the semester progressed. She drew parallels to others aspects of her life in which she felt successful and those in which she felt unsuccessful. She related it to the plight of some of her students as they struggled with learning to read. She looked at the process of acquiring technological literacy and then thought about her students. She teaches in an urban school district where many of the students are from homes where the parents cannot afford computers. Though the school has some computers, they were not be used very often. At her request, this year, I began working with Jennie in her school since she wanted to incorporate the use of technology in her daily class activities. Jennie, like others has requested such assistance. Of the 140 students involved in this study, more than eighty percent (n=120) reported having computers in their classrooms, but approximately twenty percent (n=25) indicated that the computers were used for more than a half hour a week. Through extensive site visits and interviews, it was clear that the level of incorporation of technology in these teachers' classes was very minimal and usually engaged the students' in simple word processing tasks or basic internet searches. Technology, thus far, has not become an integral part of the teaching learning lives within theses classes. The current phase of this study is a response to the "cry of help" from many of the teachers who have experienced technology integration in their graduate classes but report needing assistance in doing so in their own K- 12 classrooms.

These in-service teachers reported many drawbacks in this process. Among these are that there are not enough multimedia computers available to children-- especially those from impoverished homes; there is not enough time for teachers to scrutinize materials or learn to use programs; too little thought is given by teachers as to whether programs are developmentally appropriate; there is not enough time devoted to teacher staff development and there is clearly a failure on the part of too many administrators and school boards to understand the importance of technology in the future.

The future of education will involve more, better, real, international and current materials; more sharing and collaboration; more threats of censorship; more need to emphasize the human side of teaching and learning; more use of critical thinking skills, more of a need to evaluate and use good judgment and above all more good teachers

Technology will not "fix" poor teaching. It will not take the place of the human side of teaching. It will not solve all of the problems related to teaching and learning. The most important thing we must remember is that the students we teach are going to live in the future and teacher education programs have a responsibility for preparing the teachers and supporting them in their classrooms.

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Domains of Adaptation in Technologically Mediated Classrooms: An Ethnographic Report

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Abstract: An inductive analysis of the adaptation of graduate education students to an interactive televised (ITV) classroom generated four primary domains within which much of their adaptation occurred. These emically-derived categories – student relations, technological aspects, instructor's role, and content/class participation – provided a framework within which to assess the complex social and cultural aspects that influence student adaptation and consequent learning in ITV classes. The paper draws on analysis of hundreds of hours of observations, interviews and informal conversations with students, teachers and staff.

Introduction

Gibson (1998a), in her discussion of the success of distance learners reported that "by fall 1998, 90% of all institutions with 10,000 students or more and 85% of institutions with enrollments of 3,000 to 10,000 expect to be offering at least some distance education courses" (p. vii). Technologically mediated distance education has been around since the 1930's (Johnstone, 1991) and clearly will continue to be an increasing part of the University environment (Chute, Thompson, & Hancock, 1999). Therefore, the more we understand about teaching and learning in distance education the more capable we will be of improving it (Mitchell, 1997).

There is a significant amount of general literature on distance learning in higher education that is produced regularly (Chute et al., 1999; Ludlow & Duff, 1998; Moore & Thompson, 1997; Willis, 1993). It includes fairly standard suggestions for managing, implementing, and succeeding in interactive televised classrooms (Herrington, 1993; Moore & Kearsley, 1996; Ostendorf, 1989). Nevertheless, the call has gone out to researchers to move toward a thorough understanding of the complexities that affect teaching and learning and determine success in the distance classroom (Gentry & Csete, 1991; Gibson, 1998b; Thach & Murphy, 1995; Wagner, 1995).

In Gibson's (1998c) exploration of these complexities, she considered Bronfenbrenner's ecological theory and its relation to distance education. She concluded that the learner exists in a social context that can "profoundly affect success of the distant teaching and learning transaction." (p. 113). She challenges researchers to consider "the existence and impact of multiple forces" (p. 124) that are at work on the distant learner. In this paper we respond to that challenge by sharing some of the results of a yearlong ethnography of graduate students in an interactive televised classroom.

The Study

Cultural anthropology (Geertz, 1973) and symbolic interactionism (Prus, 1996) provided the theoretical framework for this study in which traditional ethnographic and qualitative research methods were used to gather and analyze data (Agar 1996; Maxwell 1996). Data was gathered during a one-year ethnography of graduate education classes in the inaugural year of an interactive televised distance learning classroom called the Interactive Distance Learning Studio (IDLS) (Clevenger-Schmertzing, 2000). There were two sites involved in the study, a host site which was the instructor's classroom and a remote site which had a facilitator and interacted with the instructor via technological media. Sites were located approximately 70 miles apart – one at the main university campus and the other at a branch campus. Of the 13 graduate classes included in the study the branch campus served as host for 2 courses. There were 278 students involved in classes that varied significantly in course content, course objectives, teaching style, and student responses. A database was constructed to house open-ended survey information that was completed by 140 students. The Ethnograph v.5.3 was used to analyze data that was gathered in more than 400 hours of participant observations in classrooms, formal interviews and informal conversations with students and faculty, weekly e-mail correspondence, focus group interviews, and transcripts of videotapes. Thematic coding, frequency counts, and frequent debriefings between ethnographers L. and R. Schmertzing contributed to interpretation and ongoing analysis of the data (Spradley & Mann 1975).

The quotes that have been incorporated into this paper are direct quotes from student participants that are thematically representative of statements that were made by significant numbers of students and are provided to substantiate the complex effects of elements across all four domains on students, their learning, and their attitude toward class. This data set was selected to enhance teacher educators understanding of students' dilemmas and adaptations in order to inform teacher educators on student needs and enhance their instructional design processes.

Domains: Frameworks for Data Analysis

Our approach in this study was to let students map out their significant cognitive territory around distance education and to see what categories emerged. From our analysis of student interview transcripts we defined four emic domains in which students worked to adapt. Although the domains are not unique to distance education the adaptation process through which students developed their own way to succeed within each domain was unique to the unfamiliar, complex environment of the interactive televised classroom. Consequently, establishing the domains as a way to process the complexity associated with the new technologically mediated learning environment offers insight into the multiple forces Gibson (1998c) recognized as at work in the teaching and learning processes. The domains localized issues of technological aspects of the environment, student relations within and across locations, the interrelated roles of student and instructor, and communication of content related information. In this paper we introduce three of the domains and provide examples of issues raised by students. For the domain related to instructor roles we provide only a brief overview. For a more complete discussion of Instructor Roles see Schmertzing and Schmertzing (2001).

Technological Aspects

Technological aspects of the environment surfaced as a domain in response to students who repeatedly voiced concerns about the complicated nature of the technology, the problem of associating the monitors with their traditional television viewing behavior, and their dislike of being on camera (Clevenger-Schmertzing, 2000).

In an e-mail received towards the end of the second semester of research, Milly, who had had two classes in the distance room shared her thoughts about the environment. Her primary issues during the first semester were related to technology. "I wonder what those black things are on top of the TV box things?

They really should tell us what all of this stuff does, some of us really do not know what all the 'bigger/better' stuff are supposed to do much less how it operates, its not like we have it at our school" (HP F E 150.6.26) !!! During her second semester she modified her position somewhat. "I am still learning by doing, but perhaps because it was not my first time, I felt less threatened by the equipment. I still feel an explanation of what it does, what it is, is in order at the opening session if we are to be put upon to work them" (HP F E 150.6.26).

Milly raised four significant issues in her comments. First, she had a curiosity about the technology but at the same time she felt somewhat threatened by it. Second, she did not think that she had enough training and information to get confident in her use of the equipment so she continued to "learn by doing." Third, she believed an explanation about the technology is "in order" and last, her perception was that she was being "put upon" to have to learn the equipment. These four technologically related issues were typical of the complex dilemmas that Milly and others struggled to resolve in their efforts to adapt to the distance classroom.

Mariah, a student who watched the instructor on television, realized that she was distracted because she had trouble accepting the TV as a two-way medium. "You forget that you are in a classroom. You are so used to watching TV this one way. You can do whatever you want in your living room in front of the TV and no one can see you but in this instance, it is two-way and you forget that. [...] I find myself doing things that I wouldn't do if an instructor was sitting right in front of me" (RFt F I v17). Mariah was aware that her behavior in class was different because she connected the television to her home atmosphere and had to force herself to work toward proper classroom behavior, something that came naturally to her in the traditional classroom. Other students identified feelings of "awkwardness" and "separatedness" and complained of "struggling" and "daydreaming" as consequences of having to "watch the TV screen."

In the IDLS, students were required to push a button to activate their microphone if they were to participate properly. When the button was pushed the camera focused on the student who could then be seen and heard at both sites. Essentially this technology required students to shift their cognitive processes away from the central issues of the course to the use of the technology in order to actively participate in the class. For some the shift was only a momentary distraction while for others it was monumental. Monique was asked about memorable experiences she had in her distance learning classes. She replied, "Not knowing which camera to look at. Oh dear, so that you're not facing the wrong way. The first few times that camera panned in on me, that was frightening and you pushed that button and you froze" (RFt F I v8.880). Monique initially admitted her own lack of understanding when she said she didn't know "which camera to look at," but then she shifted to talking about her response to what she saw as the action of the camera. The "camera panned in on me," she said. Then, as she described her reaction to being on camera, she used words like "frightening" and "froze." She was not alone in her perception that the technology acted on her. Molly e-mailed me to say, "I didn't speak for a couple of weeks in class because I didn't want my face to pop-up on the screen" (HP F E 10.5.17). In her mind the technology made her face "pop-up on the screen."

The active role students assigned to the technology and the complexity associated with understanding how it worked are two of the elements that defined the technological aspects domain and were of fundamental importance to students and teachers in the IDLS. When technological aspects of the room were attended to in intentional ways that allowed students to openly express their concerns or anxiety about the technology, students adapted more quickly to the environment and were more capable of maintaining a focus on learning.

Student Relations/Location

One of the elements that allows classrooms to function effectively is the symbiotic relationship between the social structure of the classroom and interaction that occurs there (Metz, 1978). In the IDLS when the physical structure of the classroom was changed such that the four walls of the room no longer defined membership in its social structure, students had to re-formulate their understanding of membership in their classes. Though membership in the academic structure of the classroom was defined by the schedule and the instructor that was not the case for membership in the social structure. The academic structure required all the students in a given class to meet at the same time with the same instructor to study the same subject even if they were in different locations. The academic structure did not, however, translate into a social structure that accepted all students as equal or like participants in the class. Moreover, the structure often spawned two separate and competitive groups with distinct ideas about membership in their own group, as well as

membership in the other group (Clevenger-Schmertzing, 2000). The student relations/location domain accounts for this reformulation of class membership and the complications that accompanied it.

Mary judged her fellow classmates differently based upon whether they were members of her own site or the other site.

> I judge the people in my classroom [her sitemates] and I know they judge me. But maybe we get to know each other a little bit, maybe not on a personal level but you can listen to their conversations when they are talking with somebody that sits across from them, you pick up a little bit on that or you say, "Hi," to them. You chit chat for a minute, [...] So they become more a part of what your environment is when you're in there. Where the people in [the other site], I don't think are part of my environment. They're not people that I know and see their personalities, but they're like people on the screen. I don't know, it is weird. [...] It is different because they are not in your classroom. You don't walk in and see that they are sitting over there with their coke and talking to somebody about something. (HFt F I v14.1336)

Mary was struggling to make sense of classmates who were an extension of her class but not directly part of her environment.

Stan, one of the remote students also noticed that relations were different when all the classmates were not in the same room. "It's easier not to listen when they [other students] are not really in the room with you. [...] It's disrespectful when someone's talking to you and you are not listening. It's easier to be disrespectful when they are in another city. It's easier not to listen (RFt M I s11.8)." For Stan, the natural division created by the televised classroom changed the make-up of the class and introduced complications in the way he defined himself in the class in relation to his fellow classmates. Now, if he chose to accept the students at the other site as his classmates, he had to work harder to maintain the image of being a respectful classmate than if he chose not to accept "their" presence as part of his class.

Stephanie's comments provided further insight.

> Some people really get off to being on camera. [...] And, because I don't know her and she is in [the other site], not here, it is not fair for me to assess somebody that I can't be in the classroom with [...]. But my opinion, being over here and not knowing her is something else. And, it doesn't bother me but I just think, well, I guess it does bother me or I wouldn't be speaking about it but I think, is this just who she is or is it the fact that, "I can be on camera" and I just don't know. (RFt F I v14)

Stephanie was struggling with how to think of her separated classmates, but she did not quite know what to think or how to act.

As students made sense of the situation and developed their own way of adapting to the new physically divided, yet socially connected classroom, they constructed meanings about what it was to be a member of "their" site and what it was to be a member of the "other" site. These meanings affected the way students then related to one another, which in turn, had the potential to, and did, affect the class as a whole, most often in negative ways.

Understanding who constitutes a class is important because classes are shared experiences where interaction between students contributes to successful learning, (Burnett, 1973; Maher & Tetreault, 1994; Wilcox, 1982). On the simplest level such interaction may involve being courteous to others and on the more complex level it may involve the exchange of significant ideas (Musgrove, 1973). The level at which student to student interaction occurs in a class is effected by issues in the student relations/location domain. Those issues include how students feel about each other, how trusting they consider other students to be, and how they construct the list of who they think of as "their class" (Jackson, 1968).

Instructor Role

As students adjusted their thoughts on what the instructor's role in the new classroom was to be, they simultaneously adjusted their thoughts on what their own role was in creating successful classroom experiences. The patterns of adaptation that students worked through as they experienced classes in the IDLS seemed to take one of two directions. They either moved toward a team approach of sharing responsibilities with the instructor, or they moved toward maintaining expectations that the instructor was more completely responsible for activities and learning in the classroom. Student statements within this domain often

expressed the expectation that the instructor needs to offer new rules for classroom behavior, bridge the distance gap between the sites, maintain a focus on content, and help students adapt to the new learning environment (Schmertzing & Schmertzing, 2001).

Content/Class Participation

"Competent participation in classroom contexts requires knowing what context one is in" (Mehan, 1980, p. 137). Context here refers to the complex interactions that occur as participants in the classroom build the floor of conversation by simultaneously listening and speaking to each other (McDermott & Roth, 1978; Shultz, Florio, & Erickson, 1982). In order for these interactions to occur in a way that communicates the intended course related content, participants in the traditional classroom learn to read the cues used by other participants to find the appropriate time and place to take the floor (Doyle, 1977; McDermott, 1977; Snow, 1968).

Students pre-IDLS understanding of how these cues worked was not sufficient to guide them in developing cues for efficient communication of content-related material in the distance classroom. The technological filter changed the procedures associated with speaking in class, the consequent pacing of the class, and the ways students viewed themselves and their involvement in class activities.

Mannie, a student from Pensacola, spoke of the way the technology changed communication patterns and disrupted the traditional ways that students were accustomed to participating in class.

> Usually [in a traditional classroom] their hand goes up, they are called on, usually start talking, and another thing, we're so used to interrupting each other. Even if we're quiet we wait until someone has finished and then just speak out before raising our hand. Now [in the IDLS] I think some people aren't, might not be, quite as willing to do that, because they have to, there's the button war over the microphones. If they were all open mics, that would be more fun I think, but we, being so spread out the camera needs to go to each of us. (HP M I p220)

In Mannie's words, the technology changed the procedure from "speaking out as someone finishes" to a hesitation to get involved in a "button war." Maggie, another host student, was concerned about the loss of freedom that accompanied the procedures that Mannie termed "button wars."

There's not this sense of, if we're in a classroom, you and I and many others in the class, we can just talk freely. And move in and out of conversations without being invited to do that. [...] I think in distance learning you cannot do that. I've seen a couple of times where people have pushed buttons at the same time, from [both sites], and they say, "Oh no, you go," and "Oh no, you go." And it tends to be like, "Well, maybe I didn't have anything to say," when it comes back to me, because it's no longer spontaneous. I think that discussions have really lacked, because of the environment of the system forming at this point in time. (HP F I p4.13)

What started out as a well-intended contribution to class got side tracked because of the awkwardness associated with trying to navigate the discussion through a technological medium.

> *Claire:* Often times, especially at the graduate level, jumping in [to a class discussion], in a smaller setting is acceptable. The rules are not quite as stringent as they are in an undergraduate setting with a large class. [...] I think it is a little more difficult to just jump into a conversation [in the DL classroom] because you have to actually, physically make an effort to hit a button and wait a second before you're recognized. You can't just say, "Oh yea, that reminds me blah, blah." I think a bit of the spontaneous comments are curtailed. [...] I know that I don't jump in unless I know that I know the answer, whereas, in another classroom, I might just throw something out. [...] Whereas, in a distance setting, I tend to not do that, but respond only when I'm pretty sure I have a good idea of what I'm saying.
>
> *Intrvr:* Why do you think that is?
>
> *Claire:* I don't know. I think there is something about everyone being in one room that feels more intimate, that feels more private and, I think that when you add the cameras, you feel like you're going public. I feel more like I'm speaking publicly, like I do when I'm standing in front of a class. [...] If I'm teaching a class and I stand up in front, I get this little nervousness, even if you do it every day, and you feel, okay, I'm on display, I'm on show, here we go. I get a little bit of the same feeling

> when I jump into a conversation in [this environment] because everyone, all of a sudden, looks at you. Whereas, if you are sitting at a desk in a room and you just throw something out for comment, I don't feel in charge or on display or like I'm the presenter. Instead, I feel just like one of the group. (RFt F I v17.196)

Claire identified three things that inhibited the spontaneity that she expected in her graduate classes; the "physical effort" that was required, that there was a need to "get [formal] recognition," and the "intentional pause" that slowed things down. She also identified an awkward new awareness of herself in the class. Claire felt more like she was "speaking publicly," "standing in front of the class," "on display," and being looked at by everyone. Participation in class discussion in the IDLS did not "feel" the same to her as "being one of the group" in the traditional classroom where she would be "sitting in a desk and jump into the conversation." Thus we can see that the effort to adapt to the process of communicating course-related material through a screen of unfamiliar technology hindered students' class participation in the two-way interactive televised classroom. Furthermore, it is clear that teachers and instructional designers, who make an effort to understand the complexities associated with content related interaction in the distance classroom, will be able to make adjustments that will significantly improve the teaching and learning dynamic in such contexts.

Conclusions

This brief introduction to the four domains of an interactive televised classroom in which students attempt to adapt, suggest the complex and varied nature of that process. By identifying these domains we are locating the complexity of distance education in a research-based context that also allows us to begin to understand that complexity. We believe that this research has implications for the way instructional designers think about learner needs, provides important informational context for teacher educators who are concerned with facilitating student adaptation, minimizing their frustration, and freeing them to focus on content rather than process. Further, the concepts referred to in the domains not only provide a basis for a discussion of new strategies for instructors, but also incorporate the ideas of graduate students into the equation of what it takes to more effectively move both learner and instructor toward accomplishing their goals.

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The impact of instructional technology on student achievement

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Abstract

For the evaluation of The WEB Project, a Technology Innovation Challenge Grant (TICG), RMC Research Corporation developed a conceptual framework to measure the impact of instructional technology on student achievement, based on an extension of Sternberg's (1998) Developing Expertise Model. Structural equation modeling, using student surveys, teacher observations of student learning processes, and teacher-scored student products, revealed paths that correlated motivation -> metacognition -> learning processes -> student achievement. This model may be replicable for evaluators who must report impact on student achievement for TICG or PT3 grants using assessments other than standardized test scores.

The WEB Project is a five-year Technology Innovation Challenge Grant that was completed in September 2000. The purpose of this project was to infuse standards-based instruction in multimedia, digital art, music composition, and online discourse into the general arts and humanities curricula of Vermont K-12 schools. Multimedia technology was incorporated within six academic content areas: art, music, technology, history/social studies, English/language arts, and interdisciplinary studies.

Students shared their works-in-progress with a virtual community consisting of teachers; other students; and digital artists, traditional artists, musicians, composers, Web page designers, and other experts via a virtual learning environment called The WEB Exchange, which resided on The WEB Project's server. Through threaded design conversations, students requested feedback on their works of art, music, and multimedia, filtered the feedback they received, and used it to improve their final artistic products, which many of the participating students then posted on The WEB Exchange. Concurrently, language arts students, facilitated by language arts teachers and mentors from the Vermont Center for the Book, discussed curriculum-related texts. Moderating their own discussions, students engaged in deep, rich dialogue that focused on standards-based activities such as responding to text, substantiating arguments with evidence found in the text, informed decision making, and the like. These interventions were stable over the last 2-3 years of the 5-year grant.

One of the research questions posed by the RMC Research Corporation evaluation team in evaluating this project was, "What is the impact of The WEB Project on student achievement?" Our intent was to generalize our methodology to other instructional technology grants in which student achievement must be reported. Findings from an online survey of The WEB Project teachers and administrators, repeated in spring 1998, 1999, and

2000, indicated that a connection between student motivation, metacognition, and learning processes, as outlined in a conceptual model developed by Sternberg (1998), might be applicable.

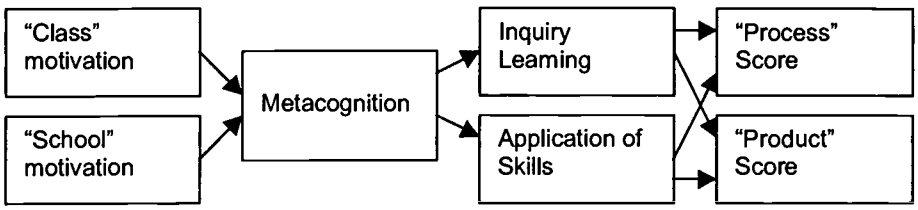
According to Sternberg, motivation drives metacognition, which, in turn, stimulates the development of thinking and learning skills. Thinking and learning skill development further stimulates metacognition, resulting in the development of expertise. The evaluation team extended the Sternberg Developing Expertise model to define "expertise" as student achievement, as measured by teacher-created rubrics. Participating teachers developed, refined, and benchmarked rubrics for student-created products over the past three years. Teachers also selected a rubric for measuring student learning processes from Marzano et al.'s (1993) Dimensions of Learning model. The rubric addressed depth and richness of revisions of student-created products and performances.

Using mixed methods that consisted of the online survey, student pretest and posttest surveys, and scores on teacher-created/selected rubrics that assessed students' learning processes and final products, the evaluation team used structural equation modeling to correlate the various elements of the extended Sternberg model. The hypothesis was that motivation would drive metacognition; metacognition would drive thinking and learning processes (specifically, inquiry learning and application of skills – two scales derived from WEB Project-based activities identified by participating teachers); and increases in thinking and learning processes would result in increases in teacher-scored measures of student achievement. The student survey was pilot-tested in spring 1999, and three derived scales (metacognition, inquiry learning, and application of skills) had high internal consistency (alpha = .72 to .84). Two ten-item sets of questions for "in this class" and "in school in general" motivation were added to the survey in spring 2000.

In January 2000, the survey was administered to 165 students in nine cooperating schools. 137 responses were from students who had not yet been exposed to the intervention, and could therefore be used as pretests. Internal consistency reliability for all scales (class motivation, school motivation, metacognition, inquiry learning, and application of skills) ranged from alpha=.70 to alpha=.87. In May 2000, at the end of the spring term, the survey was re-administered as a posttest to the same group of students. 131 completed surveys were returned by all nine schools as of August 2000. About 75% of the students who responded were from high schools, 25% from middle schools. Gender was about equally distributed.

Seventy-six valid data sets were matched in order to conduct a true repeated measures methodology (pretest vs. posttest). Only the "application of skills" scale increased during the spring term (2-tailed significance = .0165).

For the path analysis, the posttest survey results were correlated with teacher assessments. Participating teachers assigned a "product" score of "0" (no evidence), "1" (approaches standards), "2" (meets standards), and "3" (exceeds standards) to their students' final products. Products were re-scored by a jury of experts to increase reliability, resulting in 91 reported "product" scores. 107 teachers assigned a "process" score of "1" (low) to "4" (high) to each of their participating students for the quality and depth of revisions of their final products, which they construed as a measure of student learning processes. These data constituted two independent measures of student achievement, which served to complete the model.



Four separate simplified path analysis models were tested. The first pair addressed process and product outcomes for class motivation, and the second pair addressed school motivation. The statistically significant ($p<.05$) results were as follows:

Motivation was related to metacognition. The relationship between class motivation and metacognition was slightly stronger ($R=.307$, $p<.0001$) than the relationship between school motivation and metacognition ($R=.282$, $p<.0001$).

The relationship between metacognition and inquiry learning (Beta =.546, $p<.0001$) was stronger than the relationship between metacognition and application of skills (Beta=.282, $p<.0001$).

The relationship between inquiry learning and the student learning process outcome (Beta=.384, $p=.001$) was stronger than the relationship between application of skills and the student learning process outcome (Beta=-.055, not significant).

The relationship between application of skills and the student product outcome (Beta=.371, $p=.004$) was stronger than the relationship between inquiry learning and the student product outcome (Beta=.063, not significant).

Clearly, correlation does not imply causality. However, when each of these elements was considered as an independent variable, there was a corresponding change in associated dependent variables. For example, there was a significant correlation between motivation and metacognition,

indicating that students' enthusiasm for learning with technology may stimulate students' metacognitive (strategic) thinking processes. The significant correlations between motivation, metacognition, inquiry learning, and the student learning process score indicate that motivation may drive increases in the four elements connected by the first path. Similarly, the significant correlations between motivation, metacognition, application of skills, and the student product score indicate that motivation may drive increases in the four elements connected by the second path.

Based on the significant correlations of the two teacher measurements of student achievement with the student survey data, these data validated the evaluation team's extension of the Developing Expertise model to explain increases in student performance as a result of engaging in technology-supported learning activities. Moreover, nearly all students across the project met the standards for both the teacher-created student product assessment and the learning process assessment. This indicates that, in general, the project had a positive impact on student achievement.

These preliminary findings suggest that teachers should emphasize the use of metacognitive skills, application of skills, and inquiry learning as they infuse technology into their respective academic content areas. Moreover, these activities are directly in line with the Vermont Reasoning and Problem Solving Standards, and with similar standards in other states. The ISTE/NETS standards for assessment and evaluation also suggest that teachers apply technology in assessing student learning of subject matter using a variety of assessment techniques; use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning; and apply multiple evaluation methods to determine students' appropriate use of technology resources for learning, communication, and productivity.

Rockman (1998:3) suggests that "A clear assessment strategy that goes beyond standardized tests enables school leaders, policy makers, and the community to understand the impact of technology on teaching and learning". RMC Research Corporation's extension of the Sternberg model can be used to organize and interpret a variety of student self-perceptions, teacher observations of student learning processes, and teacher-scored student products. It captures the overlapping kinds of expertise that students developed throughout their technology-related activities.

One of the greatest challenges facing the Technology Innovation Challenge Grants and the Preparing Tomorrow's Teachers To Use Technology (PT3) grants is to make a link between educational technology innovations, promising practices for teaching and learning with technology, and increases in student achievement. We believe that this model may be replicable in other educational institutions, including schools, districts, institutions of higher learning, and grant-funded initiatives. However, to use this model, participating teachers must be able to clearly identify the

standards they are addressing in their instruction; articulate the specific knowledge and skills that are to be fostered by using technology; carefully observe student behavior in creating and refining their work; and create and benchmark rubrics that they intend to use to evaluate student work.

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Use of Nvivo for Classifying Synchronous Dialogue Resulting from Web-based Professional Development

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Abstract: A SITE 99 paper by the author (Shotsberger 1999) extended the work of (Blanton, Moorman & Trathen 1998) to generate a framework for analyzing synchronous dialogue generated from a Web-based professional development program. The current study attempts to further refine the framework through the use of qualitative analysis software called Nvivo (Scolari Software 1999). The Nvivo program was used to analyze chat transcripts from two different years of a Web-based inservice program for mathematics teachers. The 1997 transcripts from the previous study were re-analyzed using the Nvivo program. Then transcripts from 1998 were analyzed using Nvivo to attempt to validate the new classifications suggested by the re-analysis.

Background

(Blanton, Moorman, & Trathen 1998) classified forms of dialogue that take place in a telecommunications environment, focusing exclusively on asynchronous dialogue. The authors defined Convergent situations as those in which participants assume one correct answer, as opposed to the Divergent condition in which multiple interpretations are possible. Critical situations are defined as those involving some kind of analysis, questioning or perhaps skepticism, and this is contrasted with an Inclusive environment in which each participant's contribution is valued and accepted. The classifications therefore represent intersections of pairs of these situations: Instruction (convergent-critical), Debate (divergent-critical), Inquiry (convergent-inclusive), and Conversation (divergent-inclusive).

A SITE 99 paper extended this framework to encompass synchronous dialogue generated from a Web-based inservice program for mathematics teachers (Shotsberger 1999). Chat transcripts were analyzed from online meetings held during Fall semester 1997 among 13 participants and three facilitators. Participants were primarily high school and middle school mathematics teachers. Analysis focused on the portions of the chat transcripts that dealt specifically with some aspect of the training materials. The following categories of synchronous dialogue emerged from the analyses (an example of each is provided in parentheses):

Affirmation of another participant's efforts ("I like that ....")

Belief about teaching/learning ("I think that a group needs half and half strong [students].")

Concern about implementation ("The really smart kid may talk too much like a teacher...and turn the weaker kid off.")

Current practice ("I use groups on the average of once a week...it is not my main thing.")

Desire to implement ("I also want to do some on line researching for some things that I don't have time to search for now.")

Intent to implement ("I had planned to use the scoring sheet and their scores as part of the analysis.")

Question about implementation ("Does everyone else sit [students] in rows and then move to groups or are your desks in groups?")

Result of implementation ("My other 2 groups with the exception of a very few that are full of raging hormones really work well in groups.")

The categories of dialogic behaviors identified from the chat transcripts seemed to fall under the classification proposed by (Blanton, Moorman, & Trathen 1998) in the following way:

Instruction: *Current practice; Question; Result*

Debate: *Belief; Concern; Current practice; Result*

Inquiry: *Affirmation; Desire; Intent; Question*

Conversation: *Affirmation; Current practice; Belief; Concern*

The 1999 study was presented as a work in progress. The current study attempts to further refine the framework through the use of qualitative analysis software called Nvivo (Scolari Software 1999). As an organizational tool, Nvivo is superlative. It allows for annotations of transcripts using any desired classification scheme, and thus affords the user the ability to generate reports that can isolate one category of dialogue as well as compare instances of a given category across transcripts. (Fig. 1) shows one page of search results for instances of participant *Beliefs about teaching and learning*. Nvivo also provides the capability to graphically organize categories into an integrated whole, building up nodes and connections layer by layer in order to derive a sound theoretical framework from the analysis. (Fig. 2) displays the theoretical framework resulting from the (Shotsberger 1999) analysis.

The Nvivo program was used to analyze chat transcripts from two different years of the Web-based professional development program. The 1997 transcripts from the previous study were re-analyzed using the Nvivo program. Then transcripts from 1998, which represent dialogue generated by a different group of eight middle and high school teachers and one facilitator, were analyzed using Nvivo to attempt to validate the new classifications suggested by the re-analysis.

As a result of using Nvivo, the following additional categories and sub-categories of dialogic behavior were identified:

The category of *Current practice* needs to be differentiated into sub-categories that include separate considerations of Students, Curriculum, and Methods.

The category of *Results of implementation* needs to explicitly address whether outcomes were Positive or Negative.

The category of *Affirmation* needs to add sub-categories that differentiate between affirmation for Actual Implementation or Proposed Implementation.

A new category of *Realization* needs to be added to the framework, which will take into account new participant understandings resulting from dialogue with other participants. This new category of *Realization* might be classified under either Inquiry or Instruction in the framework.

Presentation of project results at SITE 2001 will include a demonstration of the Nvivo program, samples of annotated transcripts, reports and graphics generated using Nvivo, as well as the latest version of the framework.

Document 'Teacher's Role First Chat – Fall 97', 18 passages, 1364 characters.

Section 0, Paragraph 34, 55 characters.

the questioning part is the key to most of my teaching

Section 0, Paragraph 41, 125 characters.

basic classes have to be "led" a bit differently...but once you get them to listen to ecah other...it can be quite productive

Section 0, Paragraph 49, 81 characters.

I think that good questioning is one of the most valuable teaching skills we have

Section 0, Paragraph 50, 81 characters.

It is still hard for them to think of anyone but themself at the 8th grade level

Section 0, Paragraph 63, 135 characters.

I think it's important to let students think alone for a few minutes before putting them into groups. Lets the slower ones participate

Section 0, Paragraph 64, 40 characters.

think-pair-share is also good for groups

Section 0, Paragraph 94, 96 characters.

i believe the eoc will be "covered" if the kids really understand...that's why they need to talk

Figure 1: Sample of Nvivo search results

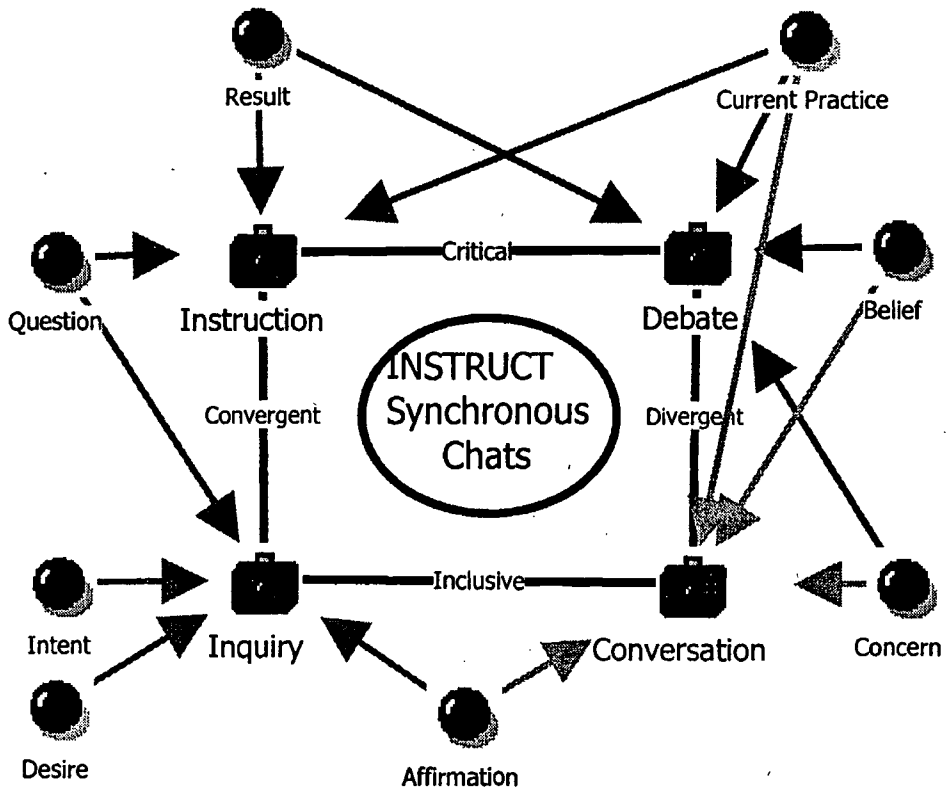

Figure 2: Sample of Nvivo graphical organization

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Professional Development On-line - Doing IT Pedagogically

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Abstract: This paper describes the first phase of a research study to examine the role played by Internet-based teacher professional development in the implementation of an innovation. The innovation in this study is the software application (*StageStruck*) for the performing arts. The professional development web site has been developed to support inservice teachers in best practice use of the software. The cases investigate the effect of this the on-line professional development strategy and teacher implementation of the software with elementary and secondary inservice teachers.

In this first phase the web site portal (http://www.stagestruck.uow.edu.au) has been established to build and support a community of practice in the performing arts areas of learning. The web site development has been an iterative process based on an understanding of best practice in professional development, a review of the literature and exploration of cases available in and about on-line communities, and the contributions and ongoing evaluation of our community members (teachers and students). The current phase of the research begins the data collection of data on the efficacy of the on-line professional development strategy employed.

Professional Development

There is an imperative for new professional development strategies and for teachers themselves to take more control and have ownership of their personal professional development (Fullan 1993). Principles of effective professional development emphasise ongoing activities that build on current practices, in a climate where teachers can take risks as part of a "learning community"(Bull et al. 1994, ACOT 1995, US Dept Education 1996, Grant 1996, Loucks-Horsely & Hewson 1998, Stager 1998). This learning community can be a space where teachers support and learn from each other and take the time to reflect on the effectiveness of change. Novices in the community may collaborate with peers, work alongside experts, share, explore and learn as part of a network. Members can embrace more than a change in skill-set, they can test out new pedagogical frameworks and environments. Technology allows such a community to break out of its geographic confines by linking the members on-line. It is recognised that the best work with on-line communities of practice is still to come. It is suggested that this will happen as the technology becomes more accessible and projects develop that embody the research findings (Ravitz 1997).

The on-line technology has become quite readily accessible. In 2001 nearly all Australian schools will access the Internet through ISDN (64K) connections and figures from a 1999 census show 22% of Australian homes had Internet access with projections showing this figure steadily increasing (ABS 1999). There is much the same picture of technology uptake across many other nations.

The research findings alluded to by Ravitz (1997) relate to new paradigms for professional development and web site design. Designs of on-line communities that are needed to support teachers as professionals in both technical skill development and the broader issues of implementation of constructivist learning theories in their classrooms. Much of the on-line professional development available for specific information technologies or programs will deliver activity directed toward skill development and mastery of the application. Many web sites deliver step by step tutorials to develop competence in the mechanics and productivity of the software. However there is good evidence that teachers, like many other professionals, will not take the time to learn a new piece of software unless they perceive sound practical classroom use which is in keeping with the needs of the curriculum.

This study employs an on-line approach to facilitate not only teacher development of skills but, most importantly for them to explore, model, lead, design and evaluate constructivist learning activities and environments in their classrooms. The site offers teachers many opportunities to make explicit for themselves the connections between activity, pedagogy and curriculum.

The Innovation

StageStruck, the University of Wollongong's award winning interactive CD-ROM product, introduces the learner to the world of performing arts by exploring a performing arts venue (the Sydney Opera House) which showcases contemporary companies, performances, processes and people, and provides theatres and 'tools' with which a learner can create and direct scenes. The StageStruck project sought to focus on the construction of multiple meanings in a field that many would argue is highly subjective and open to numerous interpretations.

Many students have a narrow perception of how a theatrical performance is devised due to the lack of exposure or opportunity to view or take part in the performing arts. By extending the boundaries of interactivity in the context of a virtual setting, learners are provided with opportunities to express their own cultural interpretations and understandings. In this theatrical journey there is the advantage of working with many visual metaphors. The world of theatre, opera, music theatre, dance and contemporary performance styles can be explored through devices such as 'The Green Room' where the user can interrogate a database of the contemporary world of performing arts. The 'Stage' space provides the opportunity to view sample scenes from productions which have been created by professional directors, and more importantly to individually direct and design their own scenes with access to the same theatrical elements. In this process individual users explore processes of visual design, sound development, and the concept of direction and motivation. In this project the construction tools have also been extended to enable the user not only to collect from a defined set of resources, but also to construct their own resources based upon combinations of sets, costumes and performers. This supports the theatrical outcomes of many interpretations of each scene.

Key to the communication of the experience within this application is the facility to save and share files between learners or to re-present a constructed performance and interpretation to others located within the same classroom or across the Internet. This last act offers the potential to create a range of resources that are not bounded by the storage capacity of a prepackaged CD-ROM but are collected and shared from an ever growing unbounded Internet learning environment.

Emerging software programs like *StageStruck* offer teachers a pedagogical sophistication unavailable until now. This software itself is an innovation. The program's learner centred approach gives students the opportunity to write, build and direct performance pieces, theatrical sets and costumes. It allows them to design, experiment and problem solve in a visually rich and stimulating environment. Use of StageStruck therefore, like many other technological innovations, will go through a process to reach implementation. Diffusion is defined by Rogers (1983) as the process by which an innovation is communicated through certain channels over time among the members of a social system. The four main elements are the innovation (StageStruck), the communication channels (the on-line technology), time and the social system (performing arts teacher K-12). The on-line community has been chosen because it has the potential to be an efficient and cost effective way to promote all these elements and to realise professional development goals.

Professional Development and Information Technology for Pedagogy

Current literature and best practice for professional development and on-line learning converges on the concept of on-line communities of practice. What is a community of practice and how might it serve to offer pedagogical support to practicing classroom teachers? Community is a much-argued concept. Long before the "community" went on-line social scientists had disagreed about what a community was. Thousands of print and web pages are devoted to trying to adequately define, refine and finesse what an on-line community is. Rather than define the term 'community' this study examined the available on-line activities that were promoted as communities, their goals, attributes and activities. We did this in order to develop a set of hallmarks for community.

We found community in Tenenbaum's (1998) Media Center Project and Cannings & Stager's (1999), NetAdventure, EdNet@UMass (Reilly, 1999) and the Indiana University (1999), Internet Learning Forum to mention a few. These projects have all explored the development of communities of practice with a particular

focus on support for pedagogical change, a focus that is critical to the StageStruck Professional Development Community. The hallmarks of these projects are:
- A clear focus driven by the members
- Employment of appropriate technologies and styles of communication
- Membership of a social network where their expertise, leadership, content, and contributions are valued.
- Providing ongoing discussion, sharing of, and collaboration on, commonly valued things.

The StageStruck Professional Development Community web site strives to be recognised by its community members for the same hallmarks. Preliminary research has provided insights Ito member's needs and laid the foundation for the community's goals. The web professional development approach incorporates varied opportunities for teachers to be leaders and mentors, learners, and to share their teaching programs and products to support the main goal of creating a community of best practice.

The Research Program

The professional development program has been designed for cognitive flexibility to allow teachers (and students) to visit and revisit aspects of the site and enter from many different perspectives. Whether through animated tutorial sequences or a series of events, units of work, student work samples, mentor and project activities or discussions, teachers have the opportunity to share, reflect on and lead the practice of their peers.

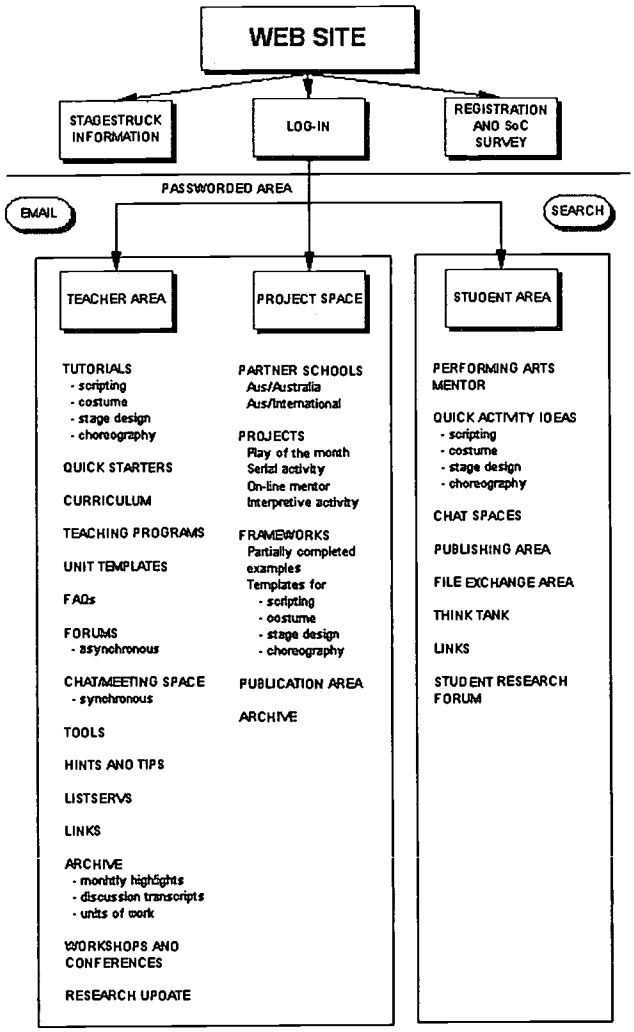

Diagram 1 The Community Web Site Design

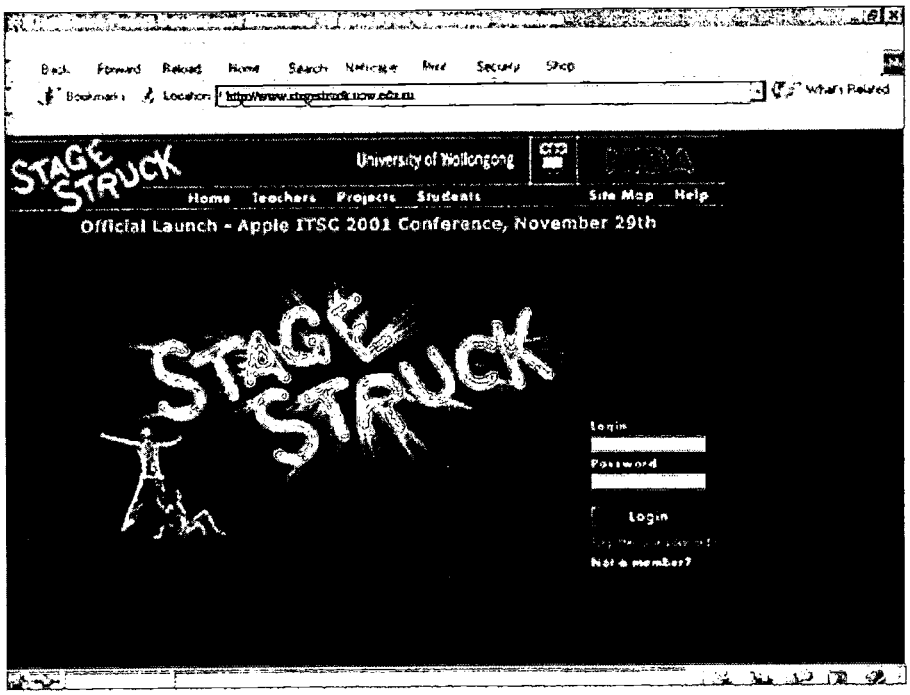

Diagram 2 The Interface Design

Clear focus driven by the members		
• Think tanks • On-line tutorials • On-line meetings	• Resource upload/download • Quick Starter pages • Links to professional associations	• Publication area • Member project proposals • Feedback and suggestion forms
Employ appropriate technologies and styles of communication		
• Resource database • FAQs • Listservs • Threaded discussions	• Chat topic and guests • Links • Browser-based publishing • Archives	• Project activities • Template and PDF files • Ideas forums • F2f functions & events
Members feel part of a social network where their expertise, leadership, content, and contributions are valued.		
• Groups (K-6, 7-10) • Leadership & mentor program • Buddy activities (novice/expert) • Collaborative project development	• Member moderated/lead discussion • Experts on-line program • Rewards and accreditation for member activity • Promotion of local f2f activity	• Student publishing on-line • Schools link-up for local & International project partners • Publicising and encouraging member workshops & publications
Provides ongoing discussion, sharing of, and collaboration on, commonly valued things		
• Syllabus forums • Links • Celebration of student works & achievements • Teaching programs	• Database to support sharing units of work • Classroom practice forums • Member moderated/lead discussion	• Tutorials • Student research forum • Calls for participation in member developed projects • Workshops & conferences

Table 1 Community Hallmarks Mapped Against Planned Internet Activities and Features

A central tenet of professional development and school reform is the creation of an enabling participant-driven environment for students and teachers alike. Web technology shares and promotes this same imperative. The key dynamics of the World Wide Web and school reform are exactly the same. (Tenenbaum 1997 p485)

The StageStruck Professional Development Community aims to test this tenet over a two year period. The research seeks to explore how and to what extent an Internet-based professional development network can support the implementation of innovation. The research seeks to answer the following questions.

- What affordances of Internet technologies (WWW, e-mail, listserv, chat, Java, and CGI) can be harnessed to create effective professional development experiences?
- Through which professional development experiences can teachers express and work to address their needs and concerns about the innovation?
- How can Internet activities be designed and developed over time to attract and maintain a community of users?
- What Internet activities best build and sustain a community of practice?

The central research methodology uses instruments adapted from the Concerns Based Adoption Model (Hall et al 1973, Hall & Hord 1987). These instruments are used to assess teachers' entry level of adoption of StageStruck and the level after 6 months, 12 months and 2 years of involvement as a community member. The innovation configuration (best practice components of use) will be surveyed to describe the pedagogical environment that teachers have developed in their adoption of StageStruck. Structured interviews, focus groups, and system logs will also used to build a thick set of quantitative and qualitative data about the efficacy and life of the community.

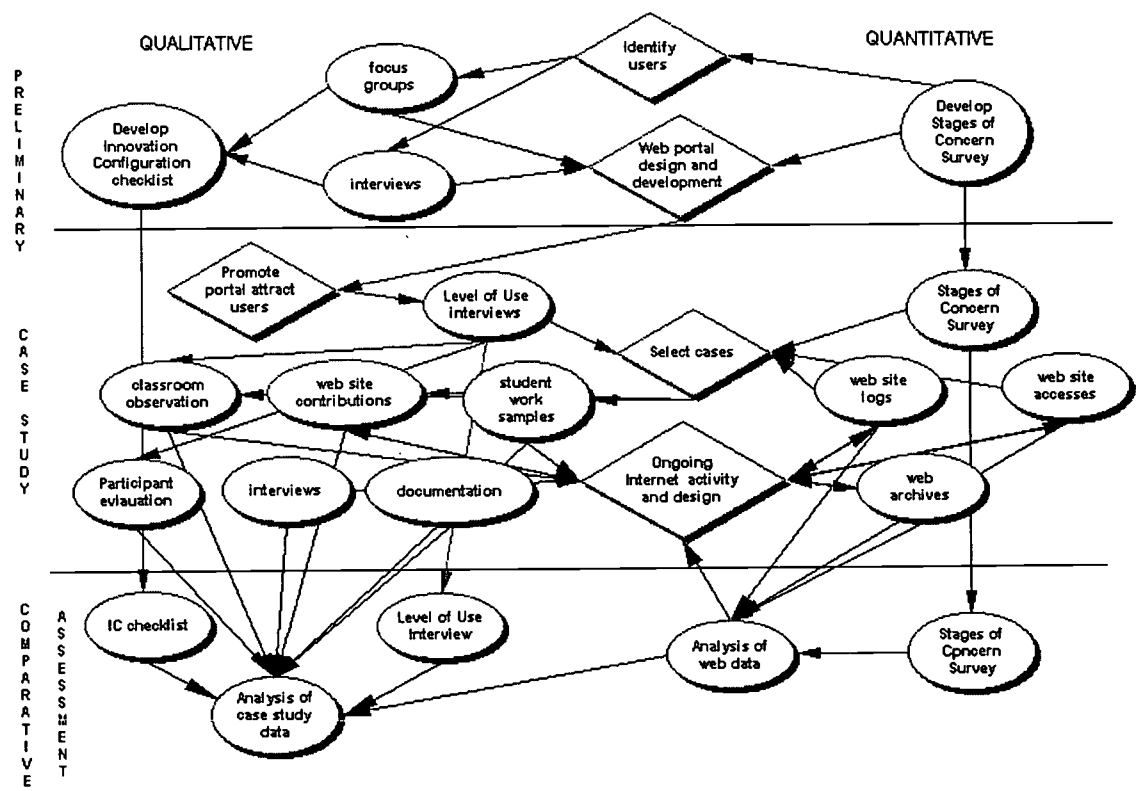

Diagram 3 Mixed Mode Research Design

The research and consultation into community building and design was carried out over 2000. The web site was designed and refined with consultation and feedback from inservice and pre-service teachers during latter half of that year. The site was promoted widely to schools in NSW and internationally during November and December through faxes, conferences and presentations. During this time content was sought from teacher to initiate the resource database and to prepare the site for its first case study selection in early 2001. The StageStruck Professional Development Community web site was launched on 29th November at the Apple Innovative Technology Schools Conference 2001 and first member registrations and activities began on the same day. The main project activity and teacher support will begin with the start of the Australian school year in February 2001. The research will follow the community and its members into 2002. The preliminary phase presented in this paper and conference presentation describes the challenges for, and successes of, the community design, content development, recruitment of teachers and initial implementation. Data collection is in a very early stage but we are able to report on the willingness of teachers to join the community and their motivation for involvement Teachers have responded very positively to the site design and activity ideas, most particularly to the opportunities to share and publish.

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A Web-based Precision Teaching Approach to Undergraduate Physics

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Abstract: The current research involved an undergraduate electromagnetism course at a reputable engineering university with traditionally high levels of attrition. A team of physicists, psychologists, and computer scientists engaged in a five year project in an effort to improve student performance in the course. Based on an extensive task analysis of both expert and novice performers, poor performance was determined to result from a lack of fluency on lower-level skills involved in solving problems. Subsequently, an extensive series of web-based materials were developed based on the principles of precision teaching (Lindsley, 1972). The current research reviews the precision teaching approach in general. Then, in turn, the paper discusses the process of the development of the materials, the computer-based presentation of the materials, and the successful application of the materials at Georgia Tech. Finally, the advantages of using the web-based materials are discussed.

Introduction

Over 80,000 students enter engineering programs as freshman each year (Lashley, 1997). Unfortunately, research shows that less than half will graduate with an engineering degree (Astin, 1993; Hayden & Halloway, 1985). Further, most of this attrition has been found to occur within the student's first two years on campus. For example, Budny, Bjedov, and LeBold (1997) found that over one third of engineering majors left Purdue by the end of their second year. More generally, McCaulley, MacDaid and Walsh (1987) found 40% attrition prior to the third year for a heterogeneous eight-school engineering consortium in the United States. Indeed, our own research at Georgia Tech (Marr, Thomas, Benne, Thomas & Hume, 1999) indicates that the majority of academic-related attrition results from poor performance in basic core courses such as calculus, chemistry and physics. Interestingly, this attrition often occurs prior to students taking classes in their chosen engineering major. Given the social and economic costs associated with such high attrition rates, interventions that improve performance in these courses are clearly warranted.

A common complaint voiced by educational psychologists is that they develop effective teaching techniques only to see them fail to be implemented in mainstream education. Viable solutions to America's so-called "educational crisis" are developed by researchers but are not applied by teachers in the classroom (Goodlad, 1983). Alternatively, they are applied and proven to be effective in the classroom only to simply fade away over the course of time. The current paper will first reintroduce the basic tenets of precision teaching (PT) as a potentially viable instructional technique. Then, a brief discussion of a five year project designed to improve student performance in an introductory physics course will be discussed. The resulting set of web-based materials, the procedures for their use, and the success of the intervention will then be described. Finally, the benefits of using the web-based approach instead of traditional paper-and-pencil implementation will be evaluated.

Precision Teaching

The basic tenets of PT are fairly straightforward. According to Lindsley (1972), in order to develop fluency on higher-order skills, fluency must first exist on lower-level skills. A task must be broken down into the basic skills necessary to complete it. Then, fluency must be established on each of these so-called "tool skills." These "tool skills" must then be recombined into bigger pieces, and fluency subsequently obtained on these larger chunks. Daily measurements are necessary to determine the learning rate and to serve as a vital source of reinforcement for the learner (Pennypacker, Koenig, & Lindsey, 1972). Stringent but realistic fluency goals are established and the learner is not allowed to progress to the next level until fluency has been attained on the preceding level.

The most important point that differentiates PT from traditional methods of instruction is its emphasis on fluency. For precision teachers, fluency consists of much more than simple accuracy. If an individual could only speak 10 words a minute in a foreign language we would not describe that individual as being fluent. This would be true even if the individual enunciated and utilized all 10 words perfectly. Generally speaking, most people would consider a person fluent in the foreign language only if they speak correctly at a "normal" speaking rate. That is, true fluency is a function of both accuracy and speed. PT is quite novel in its emphasis on speed, not accuracy, as the true measure of learning. Traditionally, of course, our educational system has emphasized percent correct and other measures of accuracy as the bottom-line criterion of student performance.

The most often cited example validating the effectiveness of PT is The Great Falls Project (Beck & Clement, 1991). This project started as remedial instruction aimed solely at mildly handicapped students. The investigators found that 79% of precision taught groups performed better than control groups receiving traditional instruction. When PT was implemented in the regular curriculum, PT students out-performed control groups on the Iowa Basic Skills Test by 40 percentile points in math and 20 percentile points in reading. In a separate study Johnson & Layng (1991) found that PT instruction resulted in learning disabled (LD) children improving their reading level by two years per year of study. This is quite impressive in that LD children traditionally show only about a half-year gain in reading level per year of study. Finally, William Beneke (1991) introduced PT principles in an introductory psychology course at Lincoln

University. With an intervention that lasted less than five minutes a day, Beneke increased college students' reading rate by 49%. This increase in reading rate was also accomplished with a 75% increase in the recall of the material. Thus, the intervention resulted in the students reading both faster and having greater retention of what they had read.

The Problem

Despite the above examples, numerous other success stories, and a journal dedicated solely to PT research (*Journal of Precision Teaching*), PT has failed to catch the eye of mainstream educators. Four primary reasons may be given in explaining this lack of mainstream support. First, there is a perception that PT can only be applied to very low-level skills. Most examples discussed in the literature have indeed involved remedial-level skills. Second, PT is also assumed to be very expensive by most people. As traditionally implemented, PT requires a very low student to teacher ratio due to the need of constant monitoring and continual feedback/reinforcement for the learner. Third, PT requires a large investment of preparation time by the teacher. A large data-bank of "tool skill" items is required for daily practice by the student. Moreover, this large investment of time must be undertaken before the student ever enters the classroom. Combined with the short term focus of many educators this large investment of preparation time is seen as a major shortcoming of PT. Finally, PT has been termed a bureaucratic nightmare due to the extensive paper-work involved. PT emphasizes the need to graph and plot student performance and provide the student with the continuous feedback. This process results in much more data tracking and performance monitoring than traditional instructional techniques.

One Potential Solution: Computer-based Presentation

The advent of computer technology and the world wide web provide some answers to these commonly voiced complaints, however. First and foremost, web-based PT would reduce the man-hours involved. The computer could handle the presentation, measurement, feedback, data tracking, and record-keeping. Not only would this reduce the bureaucratic nature of PT, but the time saved here could be used for the identification of tool skills and problem generation required up front. In fact, researchers have shown that when implemented correctly PT actually saves total teacher time (Haring, Liberty, and White, 1970-1980). Second, the amount of paperwork would no longer be a concern since all of the data could be easily tracked and stored by computer. Similarly, student feedback can be directly presented to the student via the computer. Third, the teacher-student ratio would no longer be a concern since immediate reinforcement is accomplished by the computer, not by the teacher. The only remaining concern would then be to see if such a proven instructional approach can be implemented on a non-remedial high level skill. The problem course investigated in the current study was a sophomore level introductory electromagnetism course at Georgia Tech where traditionally 40% of students fail to make C or above in the course.

Task Analysis

The development of the current web-based materials involved a five-year collaboration of physicists, psychologists, and computer scientists. The first step was to determine the cause of poor performance in the electromagnetism course in question. An extensive task analysis was undertaken. First, several focus groups were conducted with both good and poor performers. Second, skills analysis of both expert and novice performance was conducted in the actual testing situation. Students completed the tests long hand and several subject matter experts analyzed both performance and procedural consistency for all students. Finally, to validate the conclusions reached by the subject matter experts, several laboratory studies with verbal protocol of problem-solving behaviors by both expert and novice performers were also conducted. All in all, the three approaches found clear differences between expert and novice performance. For a full discussion of the methodology used to determine these differences please see Cabrera, Marr, Thomas, Walker, Thomas, Wood, Hodges, and Thompson (1994).

In short, the conclusions reached in Cabrera et al. (1994) were that expert performers had automated the lower-level skills involved in solving the more complicated physics problems. This manifested itself on several lower-level skills such as calculator skills, basic math skills, basic physics

skills, etc. Novice performers seemed to engage in much more controlled processing of information at all levels of problem solving. These results are quite similar to the well-published differences often found between expert and novice performance on various different skills and abilities (Koedinger & Anderson, 1990; Simon & Simon, 1978).

Material Development

Based on the overwhelming evidence that poor performance in electromagnetism resulted from a lack of fluency on lower-level skills, we felt precision teaching might be an effective instructional technique. Further analysis found that physics novices suffered from a lack of fluency in, at least, four main areas. The first problem area was a lack of fluency in basic math skills. Many students could solve basic quadratic equations and vector sums, for example, but were far from being fluent in those tasks. Thus, come test time, valuable time was lost recalling and solving the quadratic equation during the testing period. Given the speeded nature of the test this deleteriously effected their grade. A second troublesome area involved what might be termed intuitive skills. These skills included such concepts as knowing the direction of an E field without actually working the math of the problem or knowing what $1/X^2$ looks like without explicitly having to take the time to plot it. Again, time spent on such issues during the testing period negatively affected student performance on the test. A third lower-level skill deficiency demonstrated by novices as compared to experts concerned units of measurement. Experts just "knew" that a joule was a newton-meter or even a kg-m^2 per s^2. Novices had to "think" about the appropriate units and often gave numerical answers that could have been eliminated as incorrect based solely on the presence of inappropriate units. Finally, novices lacked fluency on simple one and two-step physics problems. For example, novices took extensive time and expended valuable cognitive resources solving basic Coulomb's law problems or Gauss' law problems that experts could solve automatically. When combining several of these simple problems into an entire problem on the test, these skill insufficiencies were only magnified.

The Materials

Based on these four areas of deficiency in fluency, a team of physics professors and teaching assistants developed thousands of problems for each of the four areas. Additionally, the content of each domain was carefully tied to the traditional flow of an electromagnetism class. That is, math skills early in the quarter were concerned with fractions and vector addition since traditionally Coulomb's Law and Gauss' law are covered early in the quarter. Later in the quarter, math skills were more likely to be concerned with skills traditionally needed later in the quarter. For example, given the Biot-Savart Law is usually covered quite late in such a course, the math skill materials for that week might heavily stress integration and differentiation. Eventually, ten sets (weeks) of materials were developed. For each week or set, there were five days worth of materials. Each day contained four modules: math, intuitive, units, and basic physics.

Implementation of the Materials

While the material development was a long and tedious process, the implementation of these materials may be more important in determining the success of any precision teaching program. Students were instructed to go onto the web page daily during the week. Once on the web page, the students were prompted by the computer to complete each of the four modules for that day. The sessions were timed with math, units, and intuitive sections limited to around five minutes each and the physics modules averaging about 25 minutes (specific times varied due to the number of skills necessary during various parts of the quarter). It is important to note that this meant that the student was on the computer for only around 40 minutes per day.

Students were carefully instructed about the nature of fluency. Again, the students were instructed that the program emphasized fluency instead of accuracy. Each day, the student completed the math section, then the units section, then the intuitive section, and finally the physics section. The student received instantaneous feedback on each item; however, the program immediately went to the next item in an effort to promote the development of fluency. At the end of that section (i.e. math, units, intuitive, or

physics), feedback was given for performance on the entire section. At that point, the student could assess their performance for that section. Then, the student went to the next section until all four sections were completed. This process was repeated for five consecutive days. It is also possible to display day-by-day performance on each section across the five days. The materials and the procedures utilized can be found at www.blackbox.psych.gatech.edu.

Program Evaluation

Over the course of several years this procedure was evaluated against various other educational techniques. In particular, in successive quarters interventions were conducted where the web-based precision teaching approach's effectiveness was compared directly to several carefully designed control groups. These included: groups doing extra homework problems equated for time on task, groups doing paper and pencil precision teaching, groups receiving traditional recitation instruction equated for time on task, and control groups receiving no extra intervention. Generally speaking, students receiving precision teaching instruction outperformed those that did not receive PT by an average of one full letter grade. The intervention was especially successful for students predicted to be at risk in the course. Combining the various control groups, fully 54.6% of students that did not receive the PT materials made a C or below. In comparison, only 22.7% of the precision taught students made a C or below. This is a truly amazing result if one realizes that traditionally at Georgia Tech around 40% of all students take this course more than once due to poor performance. Precision teaching resulted in not only these students completing the course at a much higher rate, but also in 77.3% of PT students making either an A or a B. The overwhelming success of these materials have been presented elsewhere (Marr et al. 1999) and due to space constraints will not be repeated here. Suffice it to say, the intervention has been extremely successful to date.

Conclusions

The current effort demonstrated that PT can be efficiently implemented at the collegiate level. First, the instructional approach was highly successful despite the high-level skill involved in the training. Further, the web-based approach was able to track the performance of several hundred students at a given time. Likewise, the program provided instant feedback for the students without requiring any additional expenditure of teacher or teacher-assistant time. In fact, when compared to both traditional recitation instruction and additional homework assignment, the PT intervention actually required less total teacher time. Finally, the availability of the materials on the web, complete with timed modules and programs for data management allowed students the flexibility to complete the materials at their own pace and according to their own schedules. Similarly, the availability of these materials via the web should allow other educators easy access to both view and implement the materials (in whole or in part) in their own programs.

The main goal of this project was to resurrect a proven approach to teaching. Precision teaching is a very effective means of instruction. In fact, Binder and Watkins (1989) called it the most powerful instructional tool ever developed. PT failed to be adopted in the 1970s simply due to the fact that there was no way to efficiently implement it at that time. The cost of implementation far outweighed the benefits of PT. Today's technology provides us with a new way to implement this proven approach. This project has proven that the proliferation of personal computers and the world wide web make it possible to implement PT efficiently and very effectively via the internet.

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TEACHERS' ROLES When In The CLASSROOM*With* COMUPUTERS And *Without* COMPUTERS

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Abstract: This study investigated preservice teachers' perceptions of the teachers' role in classrooms *with* computers versus in classrooms *without* computers. Based on the literature review, three research questions were formulated. (1) What are the preservice teachers' perceptions of the teachers' role in the classroom with computers? (2) What are the preservice teachers' perceptions of the teachers' role in the classroom without computers? (3) Do the preservice teachers' perceptions of the teachers' role in the classroom with computers differ from their perceptions of the teachers' role in the classroom without computers? The teachers' role is to be measured as teacher-centeredness versus student-centeredness.

INTRODUCTION

The information age presents teacher education with a new challenge - preparing future teachers to teach with computers. "Learning environments based on new technology impose new challenges on the teachers and on the teacher training system" (Haugen et al., 2000; p. 205). Not only should teacher education train future teachers on how to operate computers, efforts should be taken to ensure that future teachers develop appropriate teaching styles and a clear vision of the teachers' role when they teach with computers.

LITERATURE REVIEW

Microcomputers were made available in school settings since the 1970s. Although technology opens possibilities for innovative and creative learning environments, its potential to impact student learning has been thwarted by ineffectual teaching practices. "Teachers' use of technology often forces it into traditional teaching paradigms that have existed for decades" (Sprague, 1995; p. 52). Technology was primarily used to support the traditional instruction mode (Becker,1991; Dwyer, Ringstaff & Sandholtz, 1991). Computers were routinely used to reinforce memorization of facts rather than promote higher-order thinking and problem-solving skills. "In spite of this increased variety of available software, though, the pattern of software use in typical subject-matter classes remains fairly traditional" (Becker,1991; p. 7).

Teaching with computers requires a shift from the traditional teaching practice. In order for technology to transform teaching and learning, there is a need to redefine the teachers' role and to change existing teaching practice. "To make real changes in classrooms, so that technology is truly used each day as a thinking, creative, and research tool, requires significant work in changing instructional approaches, assessments, and management strategies" (Wiburg, 1997; p. 181).

Teachers' teaching behaviors were rooted in their perceptions of the teachers' role in teaching and learning. Teachers teaching with traditional approaches in the classroom with computers had to confront their deeply-held beliefs and perceptions of their roles as teachers in order to alter their teaching practices (Dwyer, Ringstaff & Sandholtz, 1991). "Technology forced a re-evaluation of the authoritative teacher role" (Chin & Hortin, 1993-94; p. 83). Technology-rich classrooms tend to be more student-centered rather than teacher-centered (Collins, 1991; Grabinger & Duffield, 1996; Kolderir, 1990; Sheingold, 1990). "Roles and teaching

and learning strategies are changing because technology fosters the use of more student-centered learning strategies" (Norum, Grabinger & Duffield, 1999).

The discussion of the teachers' role shift has significant implications for teacher education. "The way that teachers teach is a product of their own schooling, training, and experiences as teachers" (Becker, 1991; p.8). Earlier studies found that preservice teachers' computer use during the practicum fell into the similar traditional pattern. Preservice teachers generally used computers in a limited way. Computers were used as a supplement to their teaching. Drill-and-practice was their first choice for classroom use (Byrum and Cashman, 1993; Downes, 1993; Wang & Holthaus, 1998-99; Wang, 2000). Preservice teachers did not seem to consider the computer's role as one of helping to develop students' higher order thinking skills as much as their students' computer skills (Dunn & Ridgway, 1991). These studies were not designed to explore preservice teachers' perceptions of their roles as teachers when teaching with computers. Possibly, preservice teachers' perceptions were influencing their computer use.

Up to now, little research has investigated preservice teachers' perceptions of the teachers' role when teaching with computers. Research on preservice teachers' perceptions in the field of educational computing primarily focused on their computer attitudes and computer competence (Beaver, 1990; Boone & Gabel, 1994; Reed, Ervin, & Oughton, 1995; Savenye, 1993).

Preservice teachers' beliefs and perceptions about teaching plays a central role in shaping their professional development and subsequent teaching behaviors. Understanding preservice teachers' beliefs will help to improve their professional preparation. Unexplored beliefs and perceptions of preservice teachers might result in the perpetuation of inefficient teaching practices (Pajares, 1992). With computers becoming an essential part of the learning process in classroom settings, it is imperative to investigate preservice teachers' perceptions of their roles as teachers in this new digital learning environment.

The STUDY

This study was designed to explore the preservice teachers' perception of the teachers' role in teaching and learning. The preservice teachers' perception of the teachers' role is measured as teacher-centeredness and student-centeredness. Three research questions were formulated based on the review of literature.

(1) What are the preservice teachers' perceptions of the teachers' role when they teach in the classroom *with* computers?
The review of literature established the importance of investigating preservice teachers' perceptions of the teachers' role teaching in the classroom with computers. The research hypothesis for this question is that preservice teachers would perceive their roles to be more teacher-centered rather than student-centered when they teach in the classroom with computers. The null hypothesis is that preservice teachers would not perceive their roles differently in terms of the teacher-centeredness and the student-centeredness when they teach in the classroom with computers.

(2) What are the preservice teachers' perceptions of the teachers' role when they teach in the classroom *without* computers?

The review of literature points to the fact that teacher-centered teaching behaviors in the classroom with computers are guided by teachers' beliefs and perceptions about teaching and learning in traditional classrooms. If preservice teachers would more likely take the teacher-centered role while teaching with computers, it indicates that preservice teachers' perceptions about teaching remain within the paradigm of traditional teaching and delivery. Therefore, the research hypothesis for this question is that the preservice teachers would perceive their roles to be more teacher-centered rather than student-centered teaching in the classroom without computers. The null hypothesis is that preservice teachers would perceive no difference in the teacher-centered role versus the student-centered role teaching in the classroom without computers.

(3) Do the preservice teachers' perceptions of the teachers' role in classrooms *with* computers differ from their perceptions of the teachers' role in the classroom *without* computers?

Based on the first two hypotheses, it is hypothesized that preservice teachers' perceptions of the teachers' role in classrooms *with* computers would not differ significantly from their perceptions of the teachers' role in classrooms *without* computers. There would be no significant difference between the preservice teachers' perception of the teacher-centered role in classrooms *with* computers and their perceptions of the teacher-centered role in classrooms *without* computers. There would be no significant difference between the preservice teachers' perceptions of the student-centered role in classrooms *with* computers and their perceptions of the student-centered role in classrooms *without* computers.

SAMPLE

The setting for the study was at a public university in an unincorporated territory of the United States in the Pacific Rim. The sample for this study was all the preservice teachers (N=78) who had completed all their course work and were ready for student teaching. All the 78 students participated in the survey. Out of 78 questionnaires, four were deemed not usable because of missing items.

INSTRUMENT

The data collection instrument for this study was a survey questionnaire adapted slightly from one originally developed by Bichelmeyer, Reinhart and Monson (1997) at Indiana University to measure teachers' beliefs about the teachers' role when teaching with technology. Two constructs were tested in the survey; teacher-centeredness and student-centeredness. Two scenarios were presented, teaching in the classroom without computers and teaching in the classroom with computers. The participants were asked to answer the questions on their perceptions of the teacher's role teaching in the two different scenarios - in the classroom without computers (e.g. When I teach in the classroom without computers, I believe my role is to keep quiet and order in the classroom.) and with computers (e.g. When I teach in the classroom with computers, I believe my role is to provide individualized learning objectives).

DATA ANALYSIS

Data was analyzed by using SPSS (Statistical Package for Social Sciences).

(1) What are the preservice teachers' perceptions of the teachers' role in the classroom *with* computers? The result showed that there was no significant difference (t=.48 p=.630) between the preservice teachers' perceptions of the teacher-centered role (M=4.1227, SD=.598) and their perceptions of the student-centered role (M=4.0926, SD=.672). The null hypothesis is not rejected.

(1) What are the preservice teachers' perceptions of the teachers' role in the classroom *without* computers? The test showed that there was significant difference (t=.2.85 p=.006) between preservice teachers' perceptions of the teacher-centered role (M=4.1366 S.D.=.578) and their perceptions of the student-centered role (M=3.9861 S.D.=.647). The null hypothesis is rejected.

(3) Do the preservice teachers' perceptions of the teachers' role in classrooms *with* computers differ from their perceptions of the teachers' role in the classroom *without* computers? The comparison showed that there was no significant difference between the preservice teachers' perceptions of the teacher-centered role in the classroom *with* computers and their perceptions of the teacher-centered role in the classroom *without* computers (t=.21 p=.837). The preservice teachers' perceptions of the student-centered role in classrooms *with* computers did not differ significantly from their perceptions of the student-centered role in classrooms *without* computers (t=1.49 p=.141). The null hypothesis is not rejected.

DISCUSSION

When placed in a classroom with computers, the preservice teachers would likely take balanced teacher-centered roles and student-centered roles when the computers are available in the classroom. To put it in another way, the preservice teachers were neither more teacher-centered, nor were they more student-centered when teaching with computers. It appears that due to the presence or mediation of computers in classroom settings, the preservice teachers considered they would become less teacher-centered, if not more student-centered, than they were in the classroom *without* computers.

There is no doubt that the computer is a tool that can be used to transform teaching and learning. The review of literature points out that technology can serve as a catalyst to change teachers' teaching pedagogy. Nevertheless, unless preservice teachers confront and restructure their deeply-held teacher-centered beliefs and perceptions, they would not be able to take the full advantage of the technology to impact student learning.

Worth mentioning here is a study conducted by the same researcher focusing on the same group of preservice teachers (Wang, in press). This group of preservice teachers were tested on specific computer use by means of a survey. Six items in this survey were teacher-centered computer uses and six items were student-centered computer uses. Preservice teachers overwhelming pursued teacher-centered computer uses. There was a significant difference between the preservice teachers' choice of teacher-centered computer uses and the student-centered computer uses. The preservice teachers would more likely use the computer as a teacher-centered tool than as a student-centered tool. This study, as well as the other studies investigating preservice teachers' computer use, demonstrates clearly that preservice teachers need to restructure their perceptions about teaching in order to transform their teaching practices in classrooms with computers.

The result of the second research question lends support to the claim that there was a need for the preservice teachers to reconstruct their beliefs and perceptions about teaching. The preservice teachers were more teacher-centered when teaching in the classroom *without* computers, which obviously is the result of their own educational experiences in the traditional classroom. This result supports findings of the previous studies on preservice teachers' perception of teaching. Despite the current trend in teacher education of the paradigm shift from the traditional didactic delivery of instruction to the constructivist learner-centered approach, preservice teachers' perceptions of teaching gives cause for concern. Most preservice teachers entered teacher education with perceptions that teaching is telling, lecturing and dispensing information. Teachers are information givers. The preservice teachers often underestimate children's capability of understanding and learning (Kagan, 1992). Most studies found that preservice teachers' perceptions about teaching are resistant to change. Faculty were more likely to reinforce preservice teachers' beliefs and perceptions rather than confront and restructure them (Brookhart & Freeman, 1992).

This study found that there was no significant difference between the preservice teachers' perception of the teacher-centered role in classrooms *with* computers and their perception of the teacher-centered role in classrooms *without* computers ($t=.21$ $p=.837$). The preservice teachers' perception of the student-centered role in classrooms *with* computers did not differ significantly from their perceptions of the student-centered role in classrooms *without* computers ($t=1.49$ $p=.141$). This result could well be interpreted that preservice teachers would conduct teaching business in the classroom with computers as they do in regular classroom, guided by their beliefs and perceptions of the traditional way of teaching.

CONCLUSION

This research investigated preservice teachers' perceptions of the teachers' role in the classroom *with* computers and *without* computers. Few would argue that computers will be more pervasive in our schools in the future. Preservice teachers are potential change agents. It is imperative that preservice teachers develop appropriate teaching styles and perceptions about teaching, especially about teaching with computers. More research needs to be conducted in this area. Such investigations would provide useful information to teacher education training programs. Although preservice teachers' perceptions of teaching is often resistant to change, research has shown that preservice teachers were capable of going through a transformation of their beliefs and perceptions. It is up to teacher educators to guide and direct preservice teachers to challenge, confront, and reconstruct their beliefs and perceptions about teaching and learning.

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Internet Based Learning Environments in Higher Education: Experiences from the HALÜBO-Project

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Abstract:
In our paper we present experiences from a joint Project, which was started in 1998 and since then has been realised every summer term by the Universities of Hamburg, Lüneburg and Bochum (HALÜBO)(GER), involving at times up to 80 students. In the respective seminars selected European policies and practices in general and higher Education were studied and discussed by means of traditional seminar working techniques as well as new working tools, e.g., the internet, chat rooms, etc. In our paper we reflect on the advantages and restrictions related to such a mixture of working techniques in view of developing social competence within the Internet.

The European process of integration is steadily moving forward, since 1993 and the coming into force of the Maastricht contract also with a greater effect on European general education systems. Even though this development is by no means yet a central topic for future teachers and others in higher education, it clearly affects their professional and personal future. Another world-wide rapidly developing movement takes place in the field of the new media, especially in the area of internet based teaching and learning: Virtual contact situations, claiming for intercultural as well as media competencies. Why are these important competencies? Intercultural competence in virtual contact situations can contribute to a globalized and regionalized society, permitting peaceful co-existence and leading to the dismantling of prejudices and stereotypes. Up to now the interaction between intercultural and media key competencies has been rarely considered; the subject of social competence, which can be regarded as decisive in global as well as regional contact situations in the Internet, is by no means a central topic of academic research and practice. In our presentation of the HALÜBO-project we will deal with the relationship between intercultural competence and the Internet, in order to enrich the very technically oriented discussion by an often neglected aspect: Based on the presumption of a mutual influence between the Internet and intercultural competencies, the influence of a social competence through the Internet will be discussed on the basis of three case studies, which, due to their paradigmatic character, are of definite importance for the development of a 'global social competence' in the Internet.

Just how far the Internet poses a chance for intercultural learning depends very much on how far the Net lends itself to learning processes. So the important question is, which new opportunities the Internet-based learning environments offer for the development of intercultural competence for learners of different cultural backgrounds. One possible target size lies in the connection of the effects of the new media with a differentiated understanding of society. At the same time, the technical development allows for the integration and creation of an interactive design of the various media. It is at this point where the process of community building becomes increasingly important, since social actors can join forces with one another or with many others because of a common interest. This process will be encouraged in the international context and by the Internet, creating trans-national societies, consisting of many sub-societies. The new media therefore has the potential of being identity-founding, because trans-national societies unite people of different cultures; for example, through trade, immigration and emigration or shared activities in the Internet. This doesn't mean though that the state or the related concept of the international community becomes obsolete nor that the artificial particalization of the society must increase (Kleger 1997). But because trans-national spaces are at the same time trans-cultural, they require a corresponding competence from the social actors going beyond the traditional intercultural understanding. It must concern itself with a trans-cultural competence which allows the social actors to deal with many cultures of the trans-national society, since with the multitude of contact possibilities, not all specific cultural competencies can be conveyed. Objectives for a global

social competence can therefore be culture-overlapping fundamental competencies, of which a trans-cultural social competence is one, consisting of sociability, communicative flexibility and sensitivity.

The three case studies of the HALÜBO-project represent typical characteristics of international learning environments within the Internet; and although the range of possibilities for their technical design will continuously change, they are of a paradigmatic character because they are based on the following three basic sensitization possibilities: The project is concerned with learning environments working by sensitization through explanation and training (Type 1), through consensus creation (Type 2) and through knowledge construction (Type 3). For Type 1, case study CCED (Cross-Cultural Explorations and Dialogue) was chosen, chan online-communication training which since winter 1998 has been expanded by accompanying video conferencing. DEMETER (Distance Education Methods in Teacher Education and Research) was chosen for Type 2 and HALÜBO (Hamburg-Lüneburg-Bochum) for Type 3. On the whole, all three learning environments proved capable of initiating a learning process centered around the creation of a social competence going beyond one culture toward a sociable, open and considerate learner. Within the framework of the exploratory character of the study, it can be suggested that the Internet is well suited to the construction of trans-national societies since, through the development of social competence, the process of community building is supported, whereby people of different nations and cultures band together out of common interest. This bond can also be understood in terms of the perceptions of one's own subjectivity which is part of identity and culture developmental processes.

The best learning effect though, we are convinced, would be the result of a combination of the three types of seminars, since a comprehensive trans-cultural competence cannot be provided by just one type of Internet learning environment. This would be conceivable in serial modularity, a type of seminar not easy to realise in the European university system because of its organisational constraints. The teletutoring structure should therefore have a more pronounced influence on the virtual and partially virtual universities of the future (Geyken et al. 1998). At the same time, only a few universities are likely to prevail as truly virtual institutions (single model). Instead, they are more likely to become Add-on or More-Quality models (dual mode), which perform parts of their services virtually.

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Technology in Arizona: A Summary of the Report to the Arizona Board of Regents

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Abstract: The significance of technology in today's society is self-evident. What is less clear is how to ensure that today's children, the workforce of the future, will have the technological literacy and skills to successfully function and support our highly technological society. Public education is charged with the mission of providing the foundation in not only the basic workplace and personal skills of reading, writing, numeracy, language, and communication, but also, "a high level of competence with computers, telecommunications...and the ability to quickly adapt to new technologies and new ways of working" (National Governor's Association, 1999). In considering the charge to prepare a future technological workforce the school's role is to demonstrate technology as an object that is to be used and manipulated. On the other hand, the school's role as society's institution of cultural perpetuation emphasizes the use of technology as a tool for learning. These two roles are not necessarily mutually exclusive but they are distinct and schools must have an idea of which role they play—where, when, and how. It is this situation which shaped the Technology in Arizona study—an overview of the state of technology in Arizona's schools at all levels.

Introduction

> ...To succeed in the nation's economy, workers must be well versed in computers and other high-technology systems. In addition, workers must be able to adapt to changing work structures and be willing to perform a wide range of tasks. Workers today and tomorrow can expect to change jobs several times during their careers. As a result, workers will have to constantly upgrade their skills and expand their knowledge base. They will be lifelong learners. (National Governor's Association, 1999)

The significance of technology in today's society is self-evident. What is less clear is how to ensure that today's children, the workforce of the future, will have the technological literacy and skills to successfully function and support our highly technological society. Public education is charged with the mission of providing the foundation in not only the basic workplace and personal skills of reading, writing, numeracy, language, and communication, but also, in today's world "a high level of competence with computers, telecommunications...and the ability to quickly adapt to new technologies and new ways of working" (National Governor's Association, 1999). Schools across the nation are struggling to educate children about a technological revolution using the technology itself.

In considering the charge to prepare a future technological workforce the school's role is to demonstrate technology as an object that is to be used and manipulated. On the other hand, the school's role as society's institution of cultural perpetuation emphasizes the use of technology as a tool for learning. These two roles are necessarily mutually exclusive but they are distinct and schools must have an idea of which role they play—where, when, and how. It is this situation which shaped the Technology in Arizona study—an overview of the state of technology in Arizona's schools at all levels.

The report is divided into three parts. Part one focuses on Arizona's universities and how they prepare pre-service education students with respect to technology. Part two focuses on the results of two roundtables, one involving business and technology industry leaders and one involving educational leaders, examining the role of technology in education. Part three focuses on five case studies of K-12 schools/districts around the state whose technology programs, and in particular professional development programs, were considered exemplary by K-12 educators, technology coordinators, and education professors.

The Project

The project began when the Senior Project Coordinator of the Arizona Board of Regents (ABOR) asked the Arizona K-12 Center to assist in assessing and evaluating how K-12 schools and universities in Arizona were preparing a technologically literate workforce. A five-part project was initiated to look at various components of Arizona's education system to try to get the "big picture" of exactly how Arizona's schools are preparing students to take their places in an increasingly technological society.

The project team faced its first challenge in finding a frame of reference to shape the project: the standards of business and technology industries or the standards of education could be used. Because the study was sponsored by the ABOR, being carried out by the Arizona K-12 Center, and the team was made up of educational and educational technology participants it seemed appropriate to use educational standards from the International Society for Technology in Education (ISTE) to frame it. Consequently, though the study benefits from the input of the business and industrial sector, it emphasizes how teachers and professors at the K-16 levels can improve the delivery of educational technology education to ensure that students are well-prepared to be successful as a computer/technology workforce and for successfully utilizing computers and technology in their personal and professional lives.

The report begins with the chapter examining the syllabi of educational technology syllabi courses at the three state universities with respect to the International Society for Technology Education (ISTE) standards.

Syllabi of Educational Technology Courses

Using the ISTE Recommended Foundations in Technology for all Teachers as a guide, the project team found that Arizona's universities prepare pre-service teachers in educational technology very differently.

Syllabi of required undergraduate teacher preparation courses in technology from three of the Regent's universities were reviewed for a match with the ISTE Recommended Foundations in Technology for all Teachers in three categories: (1.) Basic Computer/Technology Operations and Concepts; (2.) Personal and Professional use of Technology; (3.) Application of Technology in Instruction. Results of the review indicate that two of the universities mention the ISTE Standards in their syllabi and, in some way, address each of the three general foundational categories. One university does not note the ISTE Standards in their syllabi, but offers activities in courses supporting one category, Basic Operation and Use of Applications. It would seem that there would be less variation about what educational content is taught in required courses. However, it should be noted that the findings of the evaluation were based solely on the syllabi and do not reflect what may have actually been taught, nor does it take into consideration the variability of instructors.

Clearly, universities differ among their conception of educational technology courses and which ISTE standards should receive highest priority if included at all. Whether this is problematic is another issue. If the three Arizona Regent's universities are preparing at least fifty percent of the Arizona teacher workforce, there should be some articulation *within* and *among* them as to what content is being covered in educational technology courses. This articulation might help ensure that at least a basic and uniform level of competency and expertise in integration and application of technology in classroom instruction occurs.

In addition to the analysis of the syllabi to determine educational technology course content, it is equally important to know the students' perceptions of their own technology skills. A survey based on the ISTE standards was designed for student teacher participation. A discussion of the survey and its results follow.

Survey of Student Teachers Using ISTE Standards

Again using the ISTE Recommended Foundations in Technology for all Teachers as a guide, the team designed and created a web-based survey to determine how the 243 student teachers at the three Regent's universities perceived their own levels of computer technology competence. Researchers designed and created a twenty-five item Likert-type survey questionnaire based on the ISTE Foundations for All Teachers that included items about Basic Operations and Concepts, Personal and Professional Use of Technology, and the Application of Technology in Instruction. The survey response choices were on a five-point scale ranging from (1) Strongly Agree, to (5) Strongly Disagree, with (3) as Not Sure.

The survey site on the World Wide Web (WWW) allowed students to complete the questionnaire on line. Email listservs (distribution lists that allow for one message to be sent simultaneously to may people) provided communication access to student teachers at U1 and U3 to inform them of the survey web site and provide information about the study. Student teachers at these two universities received an emailed invitation to participate through the listserv set up at each school. Students at one university were given the invitation and survey to complete with paper and pencil when they met for a general student teacher orientation. Included in both on-line and hard copy invitations was the added incentive for participation of being entered in a drawing for a gift certificate. With data collected from the student teachers on the questionnaire, researchers sought to determine the perceptions of competence of student teachers graduating from Arizona institutions with respect to meeting the ISTE standards.

The results of this survey have significant implications. First, they provide an indication of which areas of technology in which newly graduated teachers feel they are most and least competent. Second, such results might provide insight into how universities should and/or can better prepare teachers in educational technology.

Results of the survey suggest that the students feel very competent about their basic computer skills and knowledge, but less confident about their competence in more advanced uses of educational technology, such as integrating technology in diverse classroom settings. As this is the area which has the greatest potential direct impact on K-12 students, specifically high school graduates about to enter the workforce, there is a concern about the current preparation of pre-service teachers.

The first finding from the survey questionnaire was the lack of participation from the student teachers who were contacted through email and directed to the survey web site: a total of forty three respondents from

two universities, out of five hundred sixty contacted. There are several possible explanations for this low level of on line participation: (1) student teachers were very busy and felt that they could not take the time; (2) student teachers did not use their university email addresses and so did not get the invitation; (3) student teachers were uncomfortable taking surveys on line; (4) student teachers were not interested in supporting the study, even with the incentive of a gift certificate drawing.

In general, the student teachers reported competence with, Basic Operations and Concepts, Personal and Professional Use of Technology, and the Application of Technology in Instruction. Although there is little difference among the means, the lowest reported competence is the Application of Technology in Instruction or Integration, and the highest competence level reported is for the Basic Operations. This finding seems reasonable and indicates that teacher education technology courses should perhaps emphasize curriculum integration concepts rather than the basic concepts of using hardware.

Although one might be tempted to claim that student teachers believe they are well prepared to meet the ISTE Foundational Standards, a few important exceptions should be noted. Students appear to have become competent with respect to simple standards that affect their personal use of computers, however significant numbers of students teachers do not feel competent in the more complex uses of computers, especially more complex instructional uses. As this is the area which has the greatest potential direct impact on K-12 students, specifically high school graduates about to enter the workforce, there is a concern about the preparation of teachers.

The ISTE Foundational Standards for Teachers guided the syllabi review and student teacher survey. To explore how Arizonans viewed the use of technology in education two roundtable discussions were held. First, in order to determine what technological skills high school graduates need to enter the workforce, a business roundtable was held. There, recommendations were collected from professionals in business and labor about what high school students should be learning in school in order to improve their chances for employment.

Following the business roundtable, an education roundtable was held, with educators from different schools in Arizona, to share the list of recommendations from the business roundtable. The educators came up with their own recommendations concerning pre-service and in-service teacher education. The ultimate goal for both roundtables was to determine what should be done so that teachers can prepare graduating high school students for the workforce.

Roundtable Discussions

Two roundtable discussion sessions were held to solicit input from various stakeholders in the educational technology in Arizona issue. One roundtable consisted of business and technology industry leaders from companies such as Hewlett Packard, General Motors and US West (Q-west). The main goal was to collect a set of recommendations from three tables of participants about how to better prepare students for the future workforce.

The second roundtable included educators from K-12 schools, universities, and community colleges. The main goal of this roundtable was to collect a set of recommendations regarding both pre-service teacher preparation in using technology as part of instructional delivery and in-service teacher professional development.

At both roundtables participants discussed, from their unique perspectives, their perceptions of how the educational system in Arizona is preparing students to be technologically literate citizens. Business leaders and educators agreed that teachers and their preparation are critical in meeting the workforce needs of the new economy. To provide students with the experiences they need to enter the workforce, teachers need better preparation and professional development that provides them with rich and sustained opportunities to observe, develop, practice, reflect upon, and evaluate technology lessons that meet important content objectives. Roundtable discussion participants recommended that school-university and school-business partnerships could play an important role in improving technology education.

The next section discusses six districts/schools whose technology programs were considered exemplary. Through interviews and on-site visits, six case studies were developed that focused on each school's

technology programs and more specifically professional development in this area. Professional development of teachers is a crucial factor because it ultimately impacts how technologically adept students will be.

K-12 Case Studies

Six case studies examined the technology programs of a variety of Arizona K-12 districts and schools that were deemed "exemplary" by professors, K-12 educators, and technology directors around the state. The case studies focused on the professional development programs and activities in educational technology to determine how in-service teachers are being educated in technology skills and literacy. Six case studies were conducted. Forty-seven individuals were interviewed in thirty-three sessions. This information summarizes findings across all the cases, which varied along many socio-economic and geographic dimensions. Schools and districts in the northern, central and southern part of the state were represented. Large urban districts and small rural districts were represented. Districts with 100%, 50%, and 0% free and reduced lunch were represented. Finally, districts with high and low minority populations were also represented. Thus, the schools and districts making up this part of the project are a diverse set.

These descriptive studies revealed that a complex set of variables impact professional development and the implementation of technology programs for in-service teachers. Professional development programs that promote the effective use of educational technology are based on:

- Ongoing substantial support by the school district
- Commitment of resources
- Leadership with a clear vision
- Clear communication
- Meeting the real needs of the participants
- Partnerships

Teachers interviewed in the case studies appear to believe strongly that the above components lead to the improvement of teaching and learning.

Conclusions and Recommendations

The Technology in Arizona project highlights a number of areas in Arizona's K-16 educational system in which the teaching of educational technology might be enhanced. The following recommendations stem from the four parts of the study: review of university syllabi, survey of student teachers, business and education roundtables, and the case studies.

Arizona's Regent's Universities

- University educational technology courses should further focus on and emphasize the ISTE Foundation Standard category Application of Technology in Instruction
- All the university teacher education programs should ensure that all the ISTE standards are addressed through any combination of courses offered
- All course content offered in the Regent's universities' educational technology courses should be assessed using performance-based measures rather than just content knowledge assessment
- University faculty working with pre-service teachers should have the necessary skills to teach and model the integration of technology in diverse K-12 classroom settings and do so in their own instruction
- University faculty teaching educational technology courses should be provided opportunities for ongoing professional development
- Exemplary teachers who integrate technology should serve as mentors to pre-service teachers

- All graduating pre-service teachers should be held accountable by demonstrating a minimum level of proficiency with respect to a set of educational technology standards, i.e., the ISTE Recommended Foundations in Technology for all Teachers.

K-12 Instruction

- Encourage teachers to be "coaches" of learning in order to facilitate their students' learning of technology
- Promote team teaching partnerships between teachers and mentors from business and the technology industry
- Provide options of different tracks in schools for student who want to enter the workforce immediately following high school rather than attend college, but ensure that students of either track have basic literacy, numeracy, and technology skills
- Integrate technology into the school curriculum with a focus on providing a "wholistic," integrated educational model for the student of reading, writing, numeracy, problem-solving, and technology skills
- Provide opportunities for authentic applications of technology both inside and outside the classroom
- Hold practicing teachers accountable to a minimum level of educational technology proficiency, i.e., ISTE Recommended Foundations in Technology for all Teachers, through their district evaluation process
- Develop district technology plans to guide the implementation of the classroom and computer lab use of technology
- Ensure equitable access to computers and technology for both students and teachers

Professional Development for Educators

- Use a peer mentor "teacher-coach" model for staff development in educational technology
- Ensure that professional development in educational technology is relevant to teachers' needs and the school curriculum
- Provide time during the school day and school year for ongoing professional development
- Develop professional development activities in educational technology which are continuous and sustained
- Obtain the support and endorsement of school and district administrators for professional development and evaluation in educational technology
- Base professional development in educational technology on research in best practices in learning and teaching
- Evaluate and reward teacher proficiency in computer/technology use in the classroom

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