PREPARING PROSPECTIVE TEACHER EDUCATION STUDENTS AT TWO-YEAR POST SECONDARY INSTITUTIONS: AN ASSESSMENT OF PROFICIENCY IN TECHNOLOGY USAGE

A Dissertation

by

PAMELA ELAINE ROGERS CAVENALL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2008

Major Subject: Curriculum and Instruction

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Approved by:

Co-Chairs of Committee,	Norvella P. Carter
	Stephanie L. Knight
Committee Members,	Patricia Larke
	La Verne Young-Hawkins
Head of Department,	Dennie L. Smith

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ABSTRACT

Preparing Prospective Teacher Education Students at Two-Year Post Secondary Institutions: An Assessment of Proficiency in Technology Usage.

(August 2008)

Pamela Elaine Rogers Cavenall, B.S., Stephen F. Austin State University;

M.S., Stephen F. Austin State University

Co-Chairs of Advisory Committee: Dr. Norvella P. Carter
Dr. Stephanie L. Knight

The purpose of this study was to examine the proficiency or lack of proficiency of prospective teacher education students at two-year community colleges to use and integrate instructional technologies. In addition, this study also examined the perceived perceptions of prospective teacher education students' levels of preparedness to use instructional technologies in their future classrooms.

Participants in the study were students in a teacher preparation program. The survey was administered to students from six community colleges in the southeastern part of the United States. The *Prospective Teacher Education Students Survey* was developed and administered to a sample of 109 prospective teacher education students.

Results of the study revealed a low proficiency in technology use for database, ethical use understanding, and spreadsheet. Prospective teacher

education students reported greater proficiency in computer operation, word processing, and internet use. Low frequency and effectiveness were reported in the use of technology mediated instructional strategies for synchronous communication and simulations. Results indicated higher frequency and effectiveness in technology mediated instructional strategies for word processing and Internet use by students. Generally, students perceived their level of preparedness to implement various technology skills as “somewhat well prepared”. Descriptive statistics, raw percentages, and independent t-tests were used to analyze the data.

DEDICATION

This dissertation is dedicated to my grandmother, my parents, my husband, my children, my sister, and my niece who have supported me throughout this entire venture.

Their constant love and caring are every reason for where I am and what I am. My gratitude and my love to them are beyond words.

ACKNOWLEDGEMENTS

During this long PhD journey I met many individuals who helped, encouraged, and led me through this challenging experience. I have to first thank my dissertation co-chairs, Dr. Norvella Carter and Dr. Stephanie Knight, who have generously given their time and expertise to better my work. I am grateful for their help and confidence during this process.

I would also like to thank Dr. Patricia Larke and Dr. La Verne Young-Hawkins who served on my dissertation committee. Their suggestions were extremely insightful and useful. I appreciate their contributions and support with this project.

Sincere appreciation also goes to the instructors and students from the various community colleges for providing me the opportunity to study technology use at their school. I am exceptionally grateful to the participants of this study for sharing their time and perceptions.

There are so many people who have encouraged and inspired me when I wanted to give up. To Dr. Prathiba Natesan, your statistical knowledge has given me a greater appreciation for SPSS. To Kamala Williams, I can not thank you enough for taking things to campus for me. To Nikki Babineaux-Henry, you are the epitome of a technology proficient teacher. Thank you for your expertise. To Dr. Eronif Ibrahim, thank you for your words of encouragement and wisdom. You are my mentor, my friend, and my example of success. To my

sisters in Christ, Julia Lewis, Raquel Youngs Bradley, Deborah Vyborny -- thank you for your faith and prayers. You are the Proverbs 31 women in my life.

I want to thank my husband, Ivan, for his love, motivation, patience, and understanding throughout this arduous process. I could not have completed this dissertation without him taking care of our children and our home. I am especially grateful to my wonderful children, Ian and Evan, and my niece, Camille for encouraging me to work on this paper even when I wanted to spend more time with them. In addition, I want to thank my God-children: Dominic, Diara, Jalen, Ricci, and Karissa. I would be remiss if I did not thank my sister, Fran, who inspired me to pursue this dream. I am glad you told me to complete what I started. I could not have asked GOD for a better sister or friend.

To my mom, Bennie Rogers, your constant harassment has paid off. Thanks for believing in me. To my dad, Willie Rogers, you are my foundation. I would not be where I am today without your guidance, wisdom, and faith in me.

Those that I did not mention, charge it to my head and not my heart. It meant a great deal that everyone had confidence in me to successfully complete this prestigious degree. Your prayers and words of encouragement were greatly appreciated.

Success isn't measured by the position you reach in life:
It's measured by the obstacles you overcome.
-- Booker T. Washington

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CHAPTER I

INTRODUCTION

Background of the Study

As technology becomes more prevalent in our global knowledge and information age society, a growing challenge is preparing prospective teachers to effectively integrate technology to enhance the learning process. This challenge has become a catalyst for change in educational institutions, particularly at two-year colleges. Technology continually alters educational institutions and two-year colleges face challenges never before experienced as they play a critical role in preparing prospective teachers to integrate technology in the learning process (Hull, 1999; Palma-Rivas, 2000).

In the 1990's, surveys conducted by the United States Congress and the Office of Technology Assessment (OTA) indicate that most pre-service teachers felt ill-prepared to utilize technology in their classrooms (Wild, 1996; Thurston, Secaras, & Levin, 1997; Brush, 1998; Stetson & Bagwell, 1999; Strudler, McKinney, & Jones, 1999). While a majority of teachers believe that it is important to use computers in the classroom (Scheffler & Logan, 1999), only 20% of all teachers feel prepared to integrate technology into their curriculum

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The style and format for this dissertation follow that of *The Journal of Teacher Education.*

(Scheffler & Logan, 1999; Smerdan, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000; Thomas, 1999; Swain & Pearson, 2002). Foa, Schwabb and Johnson (1996) declared, "the most advanced technology in the world is useless if teachers have not learned to feel comfortable with it to the point that they automatically and easily incorporate its use into their lesson plans".

Moreover, a study by the Milken Exchange (1999) found that, “in general, teacher-training programs do not provide future teachers with the kinds of experiences necessary to prepare them to use technology effectively in their classrooms.” Preparing prospective teacher education students to effectively use instructional technology tools in their teaching profession is a growing challenge in teacher preparation. Numerous studies (Miliken Exchange and ISTE, 1999; Web-based Education Commission, 2000; CEO Forum on Education and Technology, 2001) have reported that schools of education are not providing the kind of experiences teachers need to integrate technology in their courses.

Recommendations from organizations include continuous and relevant instruction, support, and experiences for educators at all levels. Furthermore, they encourage states to develop standards for teacher technology preparation to demonstrate their technology skills. For instance, The Technology Performance Profiles for Teacher Preparation (NETS, 2003) developed by the International Society for Technology in Education (ISTE) suggest ways

programs can provide learning experiences that will help prospective teachers meet the standards.

Even though many teachers may not feel prepared to integrate technology (Schrum, 1999; Strudler & Wetzel, 1999; Topp, Mortensen, & Grandgenett, 1995), two-year colleges have the potential to raise the educational level and “hasten the elevation of standards of teacher preparation” (Koos, 1924). If the academic subjects are taught in a way that integrates technology, interest in teaching might be further developed by prospective teacher education students at community colleges.

For many prospective teachers, the interest to teach is identified and cultivated at the community college. Additionally, education at a community college is often the first exposure to higher education for many prospective teachers. DeBeal (2001) asserts that approximately 46% to 60% of all teachers begin their preparation in community colleges. Many teachers received their basic educational foundation and college-level mathematics, science, and technology courses from a two-year college (Boggs & Bragg, 1999; Bragg, 1998; National Science Foundation, 1998). Higher education instructors have a key role in fostering students' early teaching curiosity by providing good educational experiences that prepare prospective teachers to use technology.

Introducing prospective teacher education students to technology integration before students transfer to a four-year program can further develop their interests in teaching. The proficiency skills the prospective teachers have

and develop with regards to instructional technology will enable prospective teachers to effectively use instructional technology. Effective integration and implementation of technology within a classroom curriculum requires that teachers know and understand how to operate the technology (Ragan, Lacey, & Nagy, 2002) to enhance the learning process.

Constructivist Theory

The relationship between teaching and learning is based very much on the types and levels of activity that the teaching engenders in the learners. Contemporary educational thought supports the notion that students learn through a process of constructing knowledge. In other words, learning takes place in contexts, and that learners form or construct much of what they learn and understand as a function of their experiences in situation (Schunk, 2000).

As the constructivist theory has permeated the pedagogies of content areas, so too, it applies to the integration of technology in these same areas. The instructor is no longer seen as the source of information but as a co-learner, a collaborator, and a facilitator of learning. Jonassen (2000) states the "role as the teacher must change from purveyor of knowledge to instigator, promoter, coach, helper, model, and guide of knowledge construction". The student becomes more responsible for and interacts with the process of his/her own learning as the classroom is no longer teacher centered.

Many of the constructivist practices in teacher preparation programs and technology integration are derived from the works of Vygotsky (1978) and Papert (1980). Constructivists believe that students learn best by actively constructing their own knowledge. When a learner is confronted with new knowledge, the learner's intentions and previous experiences are all essential elements in determining what becomes of the knowledge.

Technology integration used in conjunction with constructivist practices can mediate and transform the experiences of prospective teacher education students. Research indicates that teachers whose pedagogical beliefs are consistent with constructivists learning theory are more likely to use technology in their practices (DiPietro, 2004). Fisher (1997) surveyed 287 Colorado public school teachers to determine the degree of importance to 10 technology literacy competencies. These teachers viewed the ability to use constructivist teaching pedagogy supported by technology as the most critical technology competency. Becker (1999) surveyed approximately 2,250 teachers to determine Internet use. What he found was “the more constructivist the teacher, the greater their average use and the more positively they viewed the Internet” (page 56). The teachers’ pedagogical beliefs and understanding of constructivism are critical factors that can determine and shape their technology usage.

Many prospective teacher education students learn from college instructors who follow the constructivist theory (Stuart and Thurlow, 2000). How and what prospective teachers are taught about technology influences the way

these teachers will understand and think about integrating it in their classrooms. Prospective teacher education students are more positive about the use of technology. According to Vanetta (2000), a constructivist vision of technology can develop when students (1) observe their instructors model technology integration, (2) are required to develop technology-rich lesson/unit plans, and (3) complete several assignments using technology. Additionally, Faison (1996) believes skills are developed in the teacher preparation program to assist prospective teacher education students to become more technologically proficient. This also includes providing prospective teachers with models for technology use by college instructors and individualizing courses to meet the diverse experiences and knowledge backgrounds of prospective teachers (Wild, 1996). Providing prospective teachers with field experiences rich in technology use can also assist them to become more proficient (Faison, 1996).

It is generally agreed upon that teacher preparation programs must provide experiences and knowledge that can be used by prospective teachers to construct knowledge and attitudes (Larson & Clift, 1996). The constructivist approach to teaching and learning may be an effective way to successfully integrate technology. By allowing prospective teacher education students to learn by doing, they work with others and have authentic experiences making the learning relevant and motivating.

If education at a community college is often the first exposure to higher education for many prospective teacher education students, then the need to

expose students to classroom and field experiences that model appropriate and effective integration of technology exists in teacher preparation programs at community colleges. Engaging prospective teacher education students in the constructive processes of analyzing, adapting, testing, negotiating, retrying, and reflecting can begin at community colleges. This can improve the prospective teacher education students' learning experience and their preparedness to integrate technology in their future classrooms. Using a constructivist approach, administrators and instructors can devise strategies that address the integration of technology in the teacher preparation program.

Statement of the Problem

Teacher preparation is typically regarded as within the domain of four-year institutes. However, many students begin their teacher preparation program at a two-year college (Wood, 2001). Two-year community colleges are playing an important but often-overlooked role in teacher preparation. Many prospective teacher education students graduate from two-year colleges and then transfer to four-year institutes to continue their teacher education. It is essential that community colleges prepare their students to meet the expectations of teacher education programs at four-year institutes.

If teacher preparation students do not experience technology integration at community colleges, problems can prevail. These students may not be prepared to integrate the technologies effectively at a four-year teacher

education program or perhaps even in their future classrooms. Dockstader (1999) stated “technology integration is using computers effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in meaningful ways” (p. 35). Integration of technology requires teachers who possess the technology skills to develop appropriate activities. Herein lays the greatest challenge to integration of technology in the classroom: many prospective teachers have not learned how to effectively utilize technology themselves let alone how they will integrate it into their classrooms.

Purpose of the Study

The integration of technology is critical. Prospective teachers need to be familiar with instructional technology tools, learn how to design instruction that includes technology, and need to develop the ability to solve technology challenges before they enter the complex reality of a classroom. This purpose of this study is to examine the proficiency or lack of proficiency of prospective teacher education students at two-year community colleges to use and integrate instructional technologies. In addition, this study is to determine the perceived perspectives of prospective teacher education students’ levels of proficiency and preparedness to use instructional technologies at a two-year community college. For purposes of this study, instructional technology is being aligned with information technology, which is the term that has been adopted as the term of preference by major educational organizations such as: (a) the Association for

the Advancement of Computing in Education (AACE); (b) the Association for Information Technology in Teacher Education (ITTE); and (c) the Society for Information Technology and Teacher Education (SITE). The information technologies for instruction include, but are not limited to: (a) word processors/computers; (b) software/CD-ROMS; (c) electronic communication devices; (d) audio/video equipment; (e) electronic mail programs; (f) Netscape/World Wide Web programs; and (g) distance learning technologies.

Significance of the Study

A need exists to determine how proficient prospective teacher education students in two-year community colleges are at integrating technology best in classrooms. Through this study, teacher preparation instructors will gain an understanding of how prospective teacher education students perceive their preparedness to integrate technology into their future classrooms before they enter four-year teacher education programs.

Research Questions

The following research questions will serve as a guide for this study:

1. What are prospective teacher education students' perceptions of their level of proficiency for instructional technology use?

2. What are the differences in perceptions of technology proficiency levels between prospective teacher education students of color and White prospective teacher education students?
3. What are the differences in prospective teacher education students' perceptions of the frequency and effectiveness of technology mediated instructional strategies?
4. What are prospective teacher education students' perceptions of their level of preparedness to implement technology skills?

Definition of Terms

The following is a list of terms that may need to be defined for the reader:

Community College: A two-year postsecondary institution beginning at grade "13" and offering instruction adapted in content, level and schedule to the needs of the local community and its workforce

Information technology: Information technology includes the use of computer applications such as word processing, spreadsheets, presentations, Internet searches, and electronic mail (e-mail).

Instructional technology: Computers, DVD/CD-ROMs, interactive media, modems, satellites, teleconferencing, and other technological means to support learning.

Prospective Teacher Education Students: Students who plan to transfer to a four-year institute to further their teacher education to become a teacher.

Teacher preparation program: Coursework and curriculum designed to prepare college students to become classroom teachers.

Technology: Any electronic applications of hardware and/or software capable of being used to sequence, manipulate, store, retrieve, present, project, and represent data in a combination of audio, graphic, video, or text mode.

Technology integration: Refers to the incorporation of technologies/multimedia and technology-based practices into everyday tasks and classroom instruction (Forum of Education Statistics, 2002) that enhances student learning.

Technology-mediated instructional strategies: Represents a broad range of activities and forms of instruction that utilize electronic and/or computer-based technology to enhance face-to-face learning.

Assumptions

Assumptions associated with this research study are as follows: The community colleges have transfer policies with their four-year counterparts and they have a strong commitment to quality teacher preparation. The participants of the sample intend to transfer to teacher education programs at four-year colleges or universities. Moreover, the participants of the sample will provide accurate information to the questions posed.

Limitations

This study was limited to prospective teacher education students attending two-year community colleges located in the southeastern part of the United States. The participants were not required to take a technology course as part of their academic program. The students were not in a teacher education program; however, they were taking teacher preparation classes which indicated a desire to go into a teaching career. Because technology is infused throughout many academic courses, the students were enrolled in other non-teaching preparation courses during the same semester that incorporated technology. The students' goals and attitudes toward technology could have been influenced by these concurrent experiences. Also, the participants were classified in their freshman level and sophomore level of taking teacher preparation courses. Therefore, the results many not be generalizable to teacher education students at other levels or classifications. The study excluded students who have been in the teacher preparation program for more than two years.

Summary

There is little argument among leaders in the field of educational technology that teacher preparation programs are not adequately preparing future teachers to effectively integrate technology into their classrooms (Brush, 1998; Moursund & Bielfeld, 1999; O'Bannon et al.; OTA, 1995; Wetzel, 1993). It is imperative that prospective teacher education students learn not only about

technology, but with technology. Technology integration can become a gateway to prepare prospective teachers when they are exposed to instructional technology by (1) seeing how it is used in the classroom, (2) using technology to enrich observation and field experiences, and (3) incorporating technology to help share their experiences and insights. Establishing a clearer understanding of technology integration can be achieved. In order to successfully integrate any technology in teaching, prospective teacher education students need to improve their technology skills through frequent use and practice. As technology continues to evolve without limitations, there is no reason to believe that the technology evolution will stop.

CHAPTER II

REVIEW OF THE LITERATURE

Background

The central intent of teacher education, according to Furlong, Barton, Miles, Whiting, and Whitty (2000), is to "construct a new generation of teachers with different forms of knowledge, different skills and different professional values." One of the skills to be acquired by the new generation of teachers is integrating and implementing technologies for instruction. The Office of Technology Assessment (OTA) (1988) reported that even though 89% of all college of education programs offered some form of teacher preparation in technology for their students, two-thirds of the graduates of teacher preparation institutions did not feel prepared to use instructional technology in their daily practice. Seven years later, OTA, (1995) reported "most new teachers graduate from teacher preparation institutions with limited knowledge of ways technology can be used in professional practice" (p. 165). In 2000, the U.S. Department of Education reported that "new teachers entering the profession are still not being adequately prepared to teach with technology… fewer than half of the nation's teacher preparation institutions require students to design and deliver instruction using technology, and that even fewer require technology use in the student teaching experience" (p.14).

A review of literature indicates that few colleges of education adequately prepare their graduates to integrate technologies in their teaching (Miliken

Family Foundation, 2001; Moursund & Bielfeldt, 1999; OTA, 1995; Summary, 2000; Willis, Thompson, & Sadera, 1999). Prospective teachers want to learn strategies for integrating technology tools into their teaching (Mowrer-Popiel, Pollard, & Pollard, 1994; Oliver, 1994), and expect to use instructional technologies in their teaching.

Technology Integration

Technology integration means viewing technology as an instructional tool for delivering subject matter in the curriculum already in place (Woodbridge, 2003). The Forum of Education Statistics (2002) defines technology integration as the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods (Forum of Education Statistics, 2002).

Technology integration is more than merely utilizing a computer as a typewriter, calculator, or film projector. Rather, integration begins with solid planning by the teacher so that the use of technology is meaningful and relevant to the educational experience of the student. "Teachers are most likely to

embrace technologies if they can see the connection between their work and the tools" (Mckenzie 1999).

Pierson (2001) noted that technology integration occurs when a teacher draws on extensive content knowledge and pedagogical knowledge in combination with technological knowledge to provide a learning experience. Technology integration includes content and effective instructional practices. Earle (2002) reinforces this idea by stating that technology integration involves the tools with which teachers deliver content and implement practices in better ways. Moreover, integration is defined not by the amount or type of technology used, but by how and why it is used.

How and Why Technology Integration

According to Jefferies (2000), technology integration should support a solid curriculum, not dominate it. Technology should assist students with problem solving, and create collaborative learning environments whereby the teacher seamlessly transitions from the role of facilitator to that of a learner. Integrating technology in the instruction and curriculum is an effective way to open doors for students and to assist students in becoming engaged learners. This enables the student to take ownership of his or her education. "Engaged learning challenges teams of students to employ information technologies to investigate authentic problems which parallel curriculum question and topics" (Mckenzie 1999). Technology is a tool that is able to bridge the gap between

academic disciplines.

Dockstader (1999) stresses that “true integration comes when students learn through computers, not about them.” According to Dockstader (1999), there are a few but important reasons for integrating technology: (1) correctly designed, more depth into the content-area curriculum is possible, (2) in the information age, there is an intrinsic need to learn technology, (3) students are motivated by technology, thus increasing academic engagement time, (4) while working in more depth with the content, students are able to move beyond knowledge and comprehension to application and analysis of information, (5) students learn where to find information in an information rich world, (6) computer skills should not be taught in isolation and (7) students develop computer literacy by applying various computer skills as part of the learning process.

Fifty percent of recent graduates indicate that they could adequately use technology in the forms of games, word processing, drill and skill practice, and tutorials, less than 10% feel equipped to use multimedia, electronic presentations, electronic networking, or problem solving software (OTA, 1995). Schools of education have assumed that most prospective teachers will “automatically” graduate well prepared to integrate technology into their future classrooms, presumably because they have grown up comfortable with the technology (Schrum, Skeele, & Grant, 2003). Younger teachers may have basic technology skills (e.g., the ability to use word-processing software,

spreadsheets, presentation software, and Internet browsers). Yet, they do not know how to apply these skills to teaching (Means, 2000; Web-Based Education Commission, 2000). Moreover, the ability to use technology for non-instructional purposes does not necessarily translate into the will or the capability to integrate technology to support student learning.

Northrup and Little (1996) note that "teachers are being inadequately prepared to use instructional technology and consequently are unable to effectively integrate technology into classroom teaching practices" (p. 213). Faison (1996) and Queitzch (1997) mention that part of the problem is that technology is not central to most teacher preparation programs. According to Faison (1996) the instruction merely focuses on the technology itself, "…rather than providing experiences in using and integrating instructional technologies into the curriculum." The experiences prospective teacher education students receive will enable them to be more prepared to integrate instructional technologies in their future classrooms.

Studies have documented improvement in the amount and quality of course work in educational computing but have recognized that one required class is not adequate to prepare teachers to use technology effectively in the teaching and learning process (Hunt, 1994; Strudler, 1991; Wetzel, 1993). In addition to technology courses, it is recommended that prospective teachers need to observe appropriate modeling throughout their teacher preparation (Huang, 1994; Hunt, 1994; Gunn, 1991; Novak and Berger, 1991; O'Bannon,

Matthew, and Thomas 1998; Strudler, 1991; Wetzel, 1993). In addition, teacher education instructors need to serve as role models since their uses of, and attitudes towards, technology in the classroom will strongly influence the implementation of the technology by future teachers (Barker, Helm, and Taylor, 1995; Huang, 1994; Handler and Marshall, 1992).

Research indicates that new teachers entering classrooms must have role models to help them acquire skills to merge today's technologies into learning activities and strategies that will stimulate and maintain student interest (Barker, 1993). Pellegrino and Altman (1997) argue that successful use of technology in schools may depend on how well teacher preparation programs model technology, provide opportunities for practice and reflection, and prepare prospective teachers to apply technology in their own classrooms. By understanding the what, why and how of technology integration, prospective teacher education programs can meet the challenge of preparing future teachers to become proficient information and technology users.

Stages and Phases of Technology Integration

Hart and Rieber (2000) proposed three stages that take prospective teachers through a systematic process of learning how to integrate technology into classroom practice: familiarization, creative application, and partnerships. The first stage, familiarization, involves helping students to become familiar and confident with a wide range of different technologies. In this stage students

reach the "familiar and confident" level with a number of different technologies, such as electronic communication, presentation programs, Internet site development, databases, and spreadsheets (Hart & Rieber, 2000).

Creative application involves helping students to apply technology creatively in their subject areas. Since the students will come to this stage “familiar and confident” with different technologies, instructors are able to concentrate on their specific subject area and not the teaching of the specific technology. In view of the fact that beginning teachers teach the way they were taught, modeling becomes an important factor in the second stage. The third stage, partnerships, has to do with prospective teacher education students collaborating with instructors who are incorporating technology into their classrooms.

A model that describes a shift in instructional style, from traditional to constructivist was developed by Sandholtz, Ringstaff, and Dwyer (1997). According to the authors, the Apple Classrooms of Tomorrow (ACOT) research produced the Stages of Instructional Evolution, an adoption model for the use of technology in the classroom. The authors believed this shift takes place as teachers become expert technology users leading to new levels of confidence and willingness to experiment with instruction as they integrate technology. This model describes the five stages of thought and practice utilized when integrating technology. The five stages are entry, adoption, adaptation, appropriation, and invention.

Teachers in the “Entry” phase reluctantly implemented technology in their classroom. They use text-based materials and instruction to support teacher-directed activities. They may have also used an occasional isolated piece of software or created a lesson plan that included students’ use of the computer as a typewriter to type a handwritten story. In this stage, teachers learn the basics of using technology.

During the “Adoption” phase, the teachers’ basic instructional patterns were maintained. Technology was used as an instructional support for drill and practice and for word processing. Teachers use technology for keyboarding, word processing, or drill-and-practice software to support traditional instruction.

During the “Adaptation” phase, teachers found their instructional program was completed more rapidly and efficiently using technology. Exploration of new technologies supported curricula and pedagogy. Project based learning using technology was implemented in their practice. As they integrated new technologies into traditional classroom practices, students used word processors, databases, graphic programs, and computer-assisted instruction.

At the “Appropriation” phase, teachers increased computer expertise. They began to experiment with new projects and technologies. This allowed teachers to understand the usefulness of technology. Students frequently worked at computers as cooperative, project-based instruction began to take place.

Teachers in the most advanced phase, “Invention”, invented and implemented fundamentally new strategies for teaching and learning using technology. Learning becomes more student-centered. Multi-disciplinary, project-based instruction, peer tutoring, and individually paced instruction occurs. It is during this final stage that discovery of new uses for technology tools occurs.

Findings from this study indicated that technology encouraged interaction among students and between students and teachers as well as engaged students in high-order cognitive tasks. This study reported the stages of technology integration as an integral part of teaching and learning. As Sandholtz, Ringstaff, and Dwyer (1997) explain, "the benefits of technology integration are best realized when learning is not just the process of transferring facts from one person to another, but when the teacher's goal is to empower students as thinkers and problem solvers" (p. 176).

Gimbert and Zembal-Saul (2002) co-authored an article in which they examine the successful integration of technology by prospective teachers. The authors described the “Learning to Teach with Technology Model” developed by faculty at Pennsylvania State University Science Education Department to help design learning experiences for prospective teachers. The authors explain that the model "is designed to raise the status of prospective teachers’ conceptions of supporting children’s learning using technology" (Gimbert & Zembal-Saul, 2002; Friedrichsen, Dana, Zembal-Saul, Munford, & Tsur, 2001).

According to the “Learning to Teach with Technology Model”, prospective teachers proceed through five phases. In the first phase, students are viewed as learners and engage in scientific inquiry in a technology-rich environment using selected instructional technology tools in their undergraduate courses. The design of this phase is to help students find the conception of teaching with technology intelligible. After the initial engagement with the tool, prospective teachers are asked to reflect on their experience. The reflection process allows prospective teachers to begin to generate possible uses of the tool.

In the second phase, the students focus explicitly on the technology tool and learn about the technology itself (Gimbert & Zembal-Saul, 2002). Some of the instructor support is removed in this phase so that prospective teachers gain experience setting up the technology tool. While the focus shifts to the tool, including possible troubleshooting scenarios, this phase is designed to concentrate on the information or skills the prospective teachers feel they may be lacking before the conception of teaching is plausible (Friedrichsen et al, 2001).

During the third phase, the prospective teachers examine technology-enhanced curriculum materials to integrate the use of the technology tool (Gimbert & Zembal-Saul, 2002). Discussion of the curricula enables prospective teachers to examine the technology tool. Instructors are given an opportunity to assess the prospective teachers’ views of the plausibility of using a particular technology tool (Friedrichsen et al, 2001).

In the fourth phase, prospective teachers are given the opportunity to teach students using technology in a supported setting (Gimbert & Zembal-Saul, 2002). The goal of this phase is to help prospective teachers see the conception of teaching with technology as beneficial as they gain teaching experience. According to Friedrichsen et al (2001), prospective teachers are asked to write reflections on their experience and to discuss their impression of teaching with various technologies.

Finally, in the fifth phase, the prospective teachers plan and teach a technology-enhanced lesson to students (Gimbert & Zembal-Saul, 2002, Friedrichsen, et al, 2001). In an effort to help the prospective teachers build confidence in teaching with various technology tools, they write lesson plans, teach using technology tools, and write reflective papers on their experiences. As prospective teachers advance through these five stages of technology integration, they begin to realize that technology is more than a teaching tool. They start using various technologies to create learning environments that augment student learning.

Successful integration does not require prospective teacher education students to be proficient in a large variety of technology applications. Instead, students in teacher education programs need to feel comfortable and confident in instructional methods of technology integration.

Obstacles and Challenges of Technology Integration

Researchers feel that there are several obstacles that keep prospective teachers from integrating technology into the curriculum and instruction (Hornung & Bronack, 2000; Sherwood, 1993; Vanetta, 2000). One obstacle that is frequently cited in educational settings is inadequate teacher preparation. Sherwood (1993) says:

> Inadequate pre-service teacher training courses and inappropriate in-service workshops … [do] not prepare teachers to integrate computers into their teaching. It does not include enough time for them to become comfortable with the software, nor does it include support to help them troubleshoot during the early implementation stages and the training experience is not tailored to their needs. (p. 74)

Training and field experiences are critical aspects of teacher preparation. Experiences with technology integration give prospective teacher education students opportunities to observe the use of instructional technologies and to practice teaching with various technologies. Yet, Hornung and Bronack (2000) noted that many prospective teacher education students find that experiences with practical application of technology are lacking.

The lack of experiences can be a challenge to integrating technology in the classroom. Slough and Chamblee (2000) reported that teachers who have positive experiences in using technologies to help their work tend to teach their students with technology. Prospective teacher education students need more experiences with technology to be prepared to teach in our increasingly global

and technological world (Cavanaugh, 2003). Unfortunately, many prospective teachers do not observe the integration of technology in their teacher preparation. Therefore, they do not have frequent experiences of how helpful technology can be in the classroom.

Additionally, the teacher preparation programs do not, typically, incorporate technology across the curriculum (Walters, 1992). Single preservice technology classes are not sufficient; teacher preparation instructors must make a conscious effort to include technology in their own teaching methods and model different techniques and strategies. Continual exposure to technology will ensure that prospective teacher education students will graduate with both the skills and the confidence they need to use both hardware and software well and create a robust climate for learning.

Another challenge is that the instruction that is provided to prospective teachers tends to focus more on the older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing). Prospective teacher education students need exposure to and practice with newer, more sophisticated tools (e.g., electronic networks, integrated media, and problem-solving applications). The newer, more sophisticated tools support the development of students' higher-order thinking and problem-solving skills (Baron & Golman, 1994; Office of Technology Assessment, 1995).

The vision for the use of technology for teaching and learning can also be a challenge. Oftentimes, this vision is created by instructional technology

specialists who are not educators. This can lead to computer courses that are too technical (Jacobsen, Clifford, and Friesen (2002). Dusick (1998) states that teachers appear less competent in multimedia, networking, presentations, and programming due to their more technical nature.

If teacher preparation programs are going to provide the best education possible, they must find ways to overcome challenges in integrating technology. Integrating technology into teacher preparation programs can provide a variety of opportunities to treat technology as a learning tool. The challenges and obstacles that prevail can be overcome.

Teacher Preparation

To successfully integrate instructional technology into teaching and learning in schools is a challenging task that hinges on effective teacher preparation. While efforts to integrate technology are expanding at a rapid pace in teacher preparation programs, they “still have a long way to go” (Miliken Family Foundation, 2001). As a result, a vast majority of teachers are not prepared to use technology in their curriculum and instruction.

The U.S. Department of Education and the National Education Association have stressed the importance of incorporating instructional technology in teacher preparation programs (Ely, 1996). Research continues to show that teachers feel they are not prepared to effectively integrate technology in their classrooms (Schrum, 1999; Strudler & Wetzel, 1999; Topp, Mortensen, &

Grandgenett, 1995). "The biggest obstacle to teachers using technology in their classrooms" is the lack of adequate teacher education (Yildrim, 2000).

Teacher preparation programs are engaged with the challenge of preparing future teachers to teach and instruct with the aid of technology in our nation's schools. This is an important issue for teacher preparation programs as they respond to demands for technologically prepared teachers that integrate technology in schools.

Over the past decade, reports have indicated that despite the importance of technology in teacher education and its growing access, it is not central to the teacher preparation experience in most colleges of education in the United States (Milken Report, 1998). Prospective teacher education students want to learn strategies for integrating technology tools into their teaching (Mower-Popiel, Pollard, and Pollard, 1992). However, the likelihood that future teachers will be successful integrating technology into their curriculum is dependent upon two factors: (a) their basic technology skills and (b) the effective modeling of technology integration by faculty (Panel on Educational Technology, 1997; Willis & Mehlinger, 1996; Office of Technology Assessment, 1995; Wiburg, 1991). Reports describe basic deficiencies in the implementations of technologies in teacher preparation programs. For example, faculty members fail to model appropriate use of computers, do not incorporate the use of technology across the curriculum, and often focus on low-end applications (e.g., drill and practice, word processing) while ignoring more sophisticated tools that can integrate

realistic problem-solving activities into teacher training programs (Abdal-Haqq, 1995; OTA, 1995).

Wetzel (1993) pointed out that three program components are necessary to prepare future teachers in integrating technology into the teaching and learning process:

(a) faculty who model uses of technology in their own courses;

(b) core courses in educational computing; and

(c) field experiences with cooperating teachers whose students use information technology.

According to Wetzel (1993), teacher preparation programs should provide prospective teachers with opportunities to become proficient with instructional technologies. In addition, future teachers need to observe appropriate modeling throughout their coursework because instructor uses of and attitudes toward technology in the classroom strongly influence the integration of the technology by prospective teachers. Wetzel (1993) views these components as vehicles to better preparation of future teachers in integration technology into the teaching and learning process.

Modeling Uses of Instructional Technologies

> "If college of education faculty do not model the integration of technology, then teachers will be less able to integrate technology in their own classrooms" (Zehr 1997).

For prospective teacher education students to be prepared to integrate various instructional technologies in the K-12 environment, they must see the integration of technology modeled by their instructors rather than simply being told about its potential benefits and how it might be effective (NCATE, 1997). Schrum (1999) noted that technology use is not being effectively modeled for future teachers. Researchers recommend that future teachers need to observe appropriate modeling of technology throughout their teacher preparation program (Huang, 1994; Hunt, 1994; Gunn, 1991; Novak and Berger, 1991; O'Bannon, Matthew, and Thomas, 1998; Strudler, 1991; Wetzel, 1993).

Most teachers have not had adequate training in the use of technology, especially how to integrate technology into the curriculum and how to use technology to transform the teaching and learning process (Barron and Goldman, 1994). The researchers proposed that teacher educators must use technology as tools themselves, modeling for their students the many ways that technology can enhance teaching, learning, and scholarship. By introducing problems for student investigation using computer technologies, this can be effective for "allowing students to experience a shared context in which they engage in sustained thinking about complex problems" (Barron & Goldman, 1994, p. 84). The idea of technology's use as a tool that engages students in authentic and challenging tasks should become one of the focuses of teacher preparation (Barron and Goldman (1994).

Knapp and Glenn (1996) stress the importance of "modeling appropriate

technology use in restructured classrooms and curricula, and for prospective teachers to have frequent opportunities to practice using technologies as learning tools and also as teaching tools" (Knapp & Glenn, 202). They suggest that effective modeling of how the integration of technology could enhance teaching and learning. The researchers also feel that technology integration is an integral constituent of teacher preparation programs. According to Knapp and Glenn (1996), the key component in fostering change is for teacher educators to model appropriate technology use in classroom and curricula. Future teachers should take advantage of opportunities to practice using technology as both learning and teaching tools (Knapp and Glenn, 1996).

In a survey of 416 teacher preparation institutions commissioned by the Milken Exchange of Education Technology, most faculty members did not model the use of instructional technology skills in their teaching (Moursund & Bielefeldt, 1999). In several other studies, it was revealed that faculty who were not modeling also did not require students to use technology in their lessons or assignments (Lewallen, 1998; Wetzel, 1993).

The Milken Exchange on Education Technology report (1999) pointed out that most instructors do not model the integration of technology in teaching routinely. Having the opportunity to observe and teach with technology in their teacher preparation experiences is critical for prospective teacher education students. The modeling behavior illustrates technology integration and can lead to subsequent use, especially among future teachers. This supports Norris,

Sullivan, Poirot, and Soloway's (2003) assertion that teachers' use of technology is dependent upon their access to technology. If the opportunity to access and use technology is limited, use and integration of technology will be minimal.

Mims and McKenzie (1995) stressed that until instructors participate at their own comfort level and integrate technology, the students they teach may not feel prepared to teach in the 21st century. Dawson and Norris (2000) reported that technology integrated into the classroom by the instructor increased the possibility that prospective teachers transferred the technology skills into their future classroom. Without appropriate modeling by faculty, students may struggle with the integration of technology.

Instructional Technology Coursework

Teacher preparation programs generally provide prospective teachers with one required or elective course in instructional technology (Hargrave & Hsu, 2000; Milken Exchange on Educational Technology, 1999). Depending on the level of integration within other disciplines and by other instructors, this is often the only opportunity prospective teachers have to discover, explore, and use instructional technology.

Hoffman, Novak, and Schlosser (2000) conducted a study about opportunities to discover, explore, and use various technologies among minority and White students. Their study indicated the notion that the presence, or lack thereof, of a computer in the home is the key in technology use. Students of

color lagged behind their White counterparts in technology use. Many researchers attribute this disparity as being part of the “digital divide” (Charp, 2001; Hoffman, Novak, & Schlosser, 2000; Swain & Pearson, 2002). Swain and Pearson (2002) define three areas where research has indicated that educators can influence the digital divide: frequency of use, the differences in students' experiences with respect to computer use, and technology professional development for teachers.

A curriculum infused with instructional technology can provide all prospective teacher education students with the knowledge, skills and attitudes necessary to work with technologies in their classrooms. According to Reed, Ervin, and Oughton (1995), the amount of computer experience provided during their education programs may affect the extent to which new teachers will implement technology in their own teaching. Abbott and Faris (2000) also found that integrating technology into the curriculum of teacher education programs better enables future teachers to use technology in their teaching.

Thurston, Secaras, and Levin (1997) observed that when technology is infused in the university coursework, prospective teacher become more positive about their plans to use technology in teaching than do students who participate in programs in which technology is not infused. In discussing her research, Halprin (1999) states that the “integration of technology with integrated methods courses increased the probability that teachers transferred the computer skills into their classroom as compared to preservice teachers who learned computer

skills in an isolated manner (p. 128)." Not only is technology instruction important, but the way in which it is delivered is also significant. How it is delivered has an impact on whether prospective teachers will actually use this skill in their future classrooms.

Historically, research shows that prospective teachers will teach the way they were taught (Keiper, Harwood, & Larson, 2000); Moursund and Bielefeldt, 1999; Britzman, 1991; Lortie, 1975). Unfortunately, they have not been taught in a manner that integrates various instructional technologies into teaching (Wetzel, 1993). Instead, they have traditionally been taught instructional technology in a separate "stand alone" course in the education curriculum.

Moursund and Bielefeldt (1999) called for increased use of technology in curriculum courses and indicated that a single course in instructional technology does not provide adequate training for prospective teachers. Prospective teachers do not see effective instructional technology modeled for them in multiple core and content courses in their teacher preparation program (Wetzel & Strudler, 1999; O'Bannon, Matthew, and Thomas, 1998; OTA, 1995). Consequently, they will face an uphill battle to apply the technologies successfully in teaching subject areas.

According to NCATE (1997), prospective teachers are currently required to enroll in courses that will provide them with the knowledge and skills to utilize technology in the classroom. Northrup and Little (1996) reported that approximately half of the teacher preparation programs have adopted a "stand

alone" approach that calls for a specific course to be designed for technology education purposes. The other 50% of teacher preparation programs have adopted a more integrative approach. The integrative approach believes "technology should be integrated seamlessly into all coursework making the need for a separate instructional technology course obsolete" (Northrup & Little, 1996).

For at least a decade schools and colleges of teacher preparation have been behind schedule in areas related to integrating technology in today's K-12 classrooms (Stetson & Bagwell, 1999). This can be attributed to the belief that "stand alone" technology courses in teacher preparation programs do not teach prospective teachers how to integrate technology (Stetson & Bagwell, 1995). Eisenberg and Johnson (1996) argue that technology skills should not be taught in isolation. These separate classes do not really help students learn how to apply instructional technologies in meaningful ways. A major criticism of "stand alone" technology courses is that there is limited expose to "more sophisticated tools (e.g. the Internet, integrated media, problem-solving applications) that support the development of students' higher-order thinking and problem-solving skills, leading to classroom integration" (Smith, Martin, & Lloyd, 1997; OTA, 1995). Teachers continue to use technology for low-level, supplemental tasks such as drill and practice activities, word processing, educational games, and computer-based tutorials (Strudler & Wetzel, 1999; Willis, Thompson, & Sadera, 1999; OTA, 1995). Some researchers have even gone so far as to state that

"...few teachers routinely use computer-based technologies for instructional purposes" (Abdal-Haqq, 1995, p. 1). The integration of technology in instruction has progressed beyond the use of basic drill and practice software, and now includes the use of complex multimedia products and advanced networking technologies (Kosakowski, 1998). Despite the fact that 50% of recent teacher education graduates indicate that they could adequately use technology in the forms of games, word processing, drill and skill practice, and tutorials, less than 10% feel equipped to use multimedia, electronic presentations, electronic networking, or problem solving software (OTA, 1995).

In addition, the 1999 report of the NCES reported that 10 percent of teachers reported feeling "very well prepared," and 23 percent reported feeling "well prepared" to use computers and the Internet for classroom instruction. At least half (53 percent) of teachers reported feeling "somewhat prepared" to use these technologies for instruction, and 13 percent reported feeling "not at all prepared" to use these technologies for instruction (National Center for Education Statistics (NCES), 1999).

Whether high-end (e.g., the Internet, hypermedia, multimedia) or low-end (e.g., word processing, drill and practice applications), the need to explore options of technology integration in teacher preparation courses is vital to prepare future teachers to constructively integrate technology into their future classrooms (Handler, 1993; OTA, 1995; Wetzel, 1993).

In Handler's study (1993), 122 teacher education students from a mid-western university were surveyed upon completion of their preservice program. This survey found that 81% of the students did not feel prepared by their preservice program to use computers in their own instruction.

The data analysis of Handler's study showed a significant difference in the feeling of preparedness by those students who had taken the required "Introduction to Using Computers in Education" course. Handler noted that of those students feeling prepared, the introductory course was said to be of great value by only those students who lacked prior experience with computers. The course was considered not important for those students who had rated themselves as having prior computing skills. Before requiring introductory course in instructional technology coursework, it may be beneficial for instructional and curriculum designers to identify the perceived skill level of all students.

Comments from the students from the qualitative component of the survey elicited responses concerning additional technology skills they felt would be important for a novice to bring to a first teaching job. Responses included, "Their comments make it clear there were 'technology gaps' in their pre-service experience" (Handler, p. 152). Some of these "gaps" included: (a) the need to have more information on hardware and software; (b) the need to become more familiar with instructional strategies for computer use in the classroom; (c) the importance of finding time to practice and preview software; (d) the need to know "how to make use of" personal applications; (e) the need to know "how to

teach" using a computer; and (f) the need to know the ways in which the computers can be integrated into various subject areas.

Recommendations from Handler's study suggest that "equal attention, it appears, should be given to technological climate in which students have "hands-on" and "minds-on" opportunities in their methods courses and their pre-student teaching experiences." (1993, p. 152). Technology based hands-on learning activities may encourage students to begin the reflection processes of the issues they may face as novice teachers.

Constructivist Theory and Technology

Bransford, Brown, and Cocking (2000) report on the benefits of "learning by doing". This instructional approach is classified as constructivist. In terms of technology, "learning by doing" takes advantage of applications such as simulations, visualization tools, and the use of real data sets in problem solving. Within the constructivist realm, experience, combined with reflection and social interaction, allows the learner to build on prior knowledge and create their own understanding of ideas and concepts. Today's college students enter colleges and university with a wealth of technology knowledge and skills. It is up to instructors to help students take the information they know and make it useful.

Many constructivists are interested in the learner's prior knowledge in terms of cognitive processes and self-reflective skills (Vrasidas, 2000). College students are always "multiprocessing". They are able to do several things

simultaneously like listen to music, talk on the cell phone, and use the computer, all at the same time.

According to the Educause Center for Applied Research (2005) report, nearly all (99.9 percent) undergraduate students create, read, and send e-mail, and more than 80 percent send instant messages, most of them doing it daily. The students use their arsenals of electronics to write documents for coursework (98.8 percent), search the Web and institutional library (94.0 percent), and create presentations (90.8 percent) (Katz, 2006). In general, ECAR survey respondents were confident in their skills using information technologies.

Clifford, Friesen, and Lock (2004) found that prospective teacher education students who were technologically fluent did not "understand what it means to teach with technology. The students know technology, but do not know how to apply it in the classroom. Even though prospective teacher education students enter classrooms with a bevy of information, the ability to learn what is need for tomorrow is more important than what they know today. A real challenge for constructivist theory is to actuate known knowledge at the point of application. Students must construct learning and build on the knowledge base that they have previously acquired. As knowledge continues to grow and evolve, access to what is needed is more important than what the learner currently possesses.

Experiences Using Instructional Technologies

Norton and Sprague (2001) suggested that candidates need to be aware that using technology in teaching helps students become more engaged in their learning through collaborative efforts, simulations, and actively constructing information through new knowledge. Researchers report that the experience of technology use in teacher preparation programs positively influences prospective teacher education students' attitude toward using technology in their teaching and classrooms (Hunt & Bohlin, 1993; Koohang, 1989; Yildirim, 2000). However, the Milken Exchange on Educational Technology and the International Society for Technology in Education (ISTE) argue that "in general, teacher-training programs do not provide future teachers with the kinds of experiences necessary to prepare them to use technology in their classrooms" (Milken Exchange on Education Technology, 1999, p. i).

Technology integration is a necessity in preparing teachers for our technological world. The paradigm shift from "preparing teachers to use technology to using technology to prepare teachers is evident" (Cassady, 2001, p. 9). Teachers must learn to use technology and allow it to change their present teaching paradigm (Bitner & Bitner, 2002).

Most researchers agree that more technology training is needed for teachers. Moursand and Bielfeldt (1999) revealed that teacher preparation programs do not provide their students with sufficient experiences that use

technology to prepare teachers. Their study indicated that most teacher education students do not ordinarily use technology during field experiences.

Numerous suggestions exist in the literature regarding the content of the training and the methods for delivering the training. Researchers believe that technology skills should be integrated throughout their teacher preparation (Huang, 1994; Hunt, 1994; Gunn, 1991; Novak & Berger, 1991; O'Bannon, et al., 1998; Strudler, 1991; Wetzel, 1993). This would provide students with skills and experiences to apply technology to their specific content areas.

Strudler and Wetzel (1999) discussed how teacher education institutions such as Vanderbilt and the University of Virginia focused on collaboration among methods faculty and educational technology faculty in order to provide prospective teacher education students with experiences in integrating technology into their teaching. These programs emphasized the need to provide prospective teachers with integrating technology in authentic teaching situations. Instead of learning to integrate technology into hypothetical lessons required as part of a teaching methods class, prospective teachers developed, implemented, and evaluated technology-rich lessons during field-based teaching experiences (Strudler & Wetzel, 1999).

Loucks-Horsley, Hewson, Love, and Stiles (1997) focused on providing prospective teachers with authentic training experiences in real classrooms prior to their student teaching experiences. This program went beyond the idea of integrating technology with teaching methods courses. Prospective teachers

learned to integrate technology into their teaching as part of field-based experiences in real classrooms. Levin and Waugh sum up the issues of instructional technologies and teacher preparation into pedagogy: “The best approach for educating prospective teachers about using computers is to integrate computers and other new technologies into the preservice teacher education curriculum, from the first freshmen course to student teaching and beyond, so that prospective teachers regard computers as being as valuable as artists regard their palettes, accountants their spreadsheets, or biologists their microscopes" (par. 1).

Community Colleges

Community colleges have been actively involved in teacher preparation since their inception in the nineteenth century (Rudolph, 1990). According to Boggs and Bragg (1999), “community colleges have long played an important role in preparing teachers” and are well situated to play an even bigger role in teacher preparation. Boggs and Bragg (1999) indicate that more than one-third of the students taking science, mathematics, and technology courses are enrolled in community colleges. For prospective teachers, community colleges offer education coursework, teaching field experiences, and teacher preparation articulation agreements and partnerships with four-year institutions (Gerdeman, 2001). It is estimated that 40% of the nation’s teachers have completed at least a portion of their undergraduate work at community colleges.

The core mission of community colleges is to serve the community. According to the National Center for Education Statistic, in 2003-2004, the majority of community college students were female (59%) and White (60%). However, community colleges are becoming more ethnically diverse. Students of color comprised 35.8% of the community college student population (National Center for Education Statistics, 2004). As of January 2008, the American Association of Community Colleges reported the distribution of students of color as 15% Hispanic, 13% Black, 6% Asian/Pacific Islander, and 1% Native American (AACC, 2008). The diverse community college student population is an important source of future teachers.

Teacher Preparation at Community Colleges

Community colleges offer an increasing number of teacher education courses. Many students taking teacher preparation courses at community colleges go on to finish their education degrees at four-year institutions. They have articulation agreements with universities to make sure that the credits will transfer (Evelyn, 2002). By completing a university-parallel associate degree program, community college students can complete the first two years of a baccalaureate in teacher education program (Townsend, 2004). Most students in their freshman and sophomore years at a community college are able to transfer to a four-year university with junior status in a teacher education program to pursue a teaching certificate. Recruiting New Teachers, a Boston-

based nonprofit group, found in a May 2000 survey that 5.5 percent of community college freshman say they are interested in elementary-school teaching careers, and 3.5 percent in secondary-school teaching (Evelyn, 2002).

Preparing teachers at a community college is not a new mission. Historically, Joliet Community College, founded in 1901, is the oldest existing two-year college. In the 1920s, enrollments were low, and the few colleges in existence focused on general liberal arts studies. The leading role the colleges played was in the preparation of grammar school teachers. According to the American Association of Community Colleges (AACC) (1997), it was common for more than 60 percent of community college students to be women, virtually all of them preparing to be teachers.

The American community college has strong roots in the nation's history and its commitment to expanding educational opportunity for all. The community college has combined characteristics from the public high school, private junior college, and the four-year college and university. Despite the commonalities shared, it has developed its own identity. The community college has been influenced by such diverse forces as the rapid expansion of public high school after 1890 and calls for the reform of American education by university leaders and scholars early in the 20th century. Other influential factors include the G.I. Bill, the baby boom, the civil rights movement of the 1960's, the Vietnam war, federal student aid, and many state legislations and laws. Today's community college embodies Thomas Jefferson's belief that education should be practical

as well as liberal and should serve the public good as well as individual needs" (Vaughan, 2000). Community colleges have not only survived, they have thrived by demonstrating remarkable resiliency and becoming centers of educational opportunity for prospective teachers.

Technology Integration at Community Colleges

By providing introductory content courses to many prospective teacher education students, four-year institutes are recognizing the role two-year colleges play in teacher preparation (Wood, 2001). These programs provide a foundation in the humanities, mathematics, sciences, and technology and often represent the only such courses taken by prospective elementary and middle school teachers (Boggs & Bragg, 1999). Many transfer programs at community colleges also offer education foundations or other introductory courses in teacher preparation as well as early field experiences designed to introduce prospective educators to the profession.

Generally, community colleges offer general education course work required for prospective teacher students in the first two years of college before they transfer to a four-year college or university (Evelyn, 2002). The completed coursework corresponds to the freshman and sophomore years of college. Credits earned from community colleges transfer to four-year schools, so that a student may transfer as a junior. When these students transfer to a four-year college, they enter a teacher education program for the first time.

Prospective teacher education students in two-year community colleges face challenges that may not be present for their counterparts who begin their teacher preparation at four-year colleges or universities. Since curricula and standards may vary between two-year and four-year programs, students transferring from two-year programs may find themselves lacking particular courses, content, or experiences compared with their four-year counterparts (American Association of Colleges for Teacher Education, 2000). The involvement of community colleges in teacher preparation and technology integration can prepare prospective teachers to have similar experiences as their four-year counterparts.

The pressure to train prospective teachers during their teacher preparation program at community colleges has emerged as a challenge. Meaningful connections between instructors, experiences, and courses that expose students to technologies need to be created. As teacher preparation programs continue to embrace technology integration, collaborating with instructors and peers can enrich prospective teachers' learning experience before they enter their classrooms. Thus, prospective teacher education students at community colleges will be better prepared to explore the potential of instructional technologies in the teaching and learning process.

Lack of technology integration in teacher preparation programs at community colleges has been identified as a challenge when evaluating the use of technology in the classroom (Hope, 1998; Hurley & Mundy, 1997). There is

no value of learning how to integrate technology, unless it is used to further content comprehension (Eisenberg & Johnson, 1996). Since teachers are the key designers of instruction, they are an integral part of the process of integration. Well-trained and competent teachers of the next century will define what integration is and is not for them. They will know and understand why technology integration is important. And they will know how to integrate technology using a consistent and well-designed model of instruction.

Summary

The National Council for Accreditation of Teacher Education (NCATE), recognizes that teachers "hold the key to technology use in the classroom" (NCATE, 1997, p. 4) and recommend steps be taken to improve teacher preparation and continued professional development. These steps include requiring schools of education to have a vision and plan for the use of technology and encouraging each school to explore the use of instructional technologies (NCATE, 1997).

Technology integration does not guarantee effective teaching or learning; however, inappropriate uses of technology can hinder the teaching and learning process. As Dockstader (1999) contends true integration comes when students learn through technology, not about it. How future teachers integrate technology into their instruction is critical to achieving the benefits of technology in students' learning. The possibilities of instructional technologies are vast in the

preparation of prospective teachers. By understanding the definition, intention, stages, phases, and obstacles of technology integration, teacher preparation programs in community colleges can assist prospective teachers to meet the challenge of becoming proficient in the integration of instructional tools using information technologies in their future classrooms. Be it at a two-year community college or at a four-year college, teacher preparation institutions throughout the United States must close the present gap that exists within teaching and learning.

CHAPTER III

METHODOLOGY

This descriptive study examined the proficiency and perceptions of prospective teacher education students to integrate instructional technologies in the teacher preparation program at a Texas two-year public community college. Examining the perceptions of a target audience is a widely used strategy based on the premise that perceptions matter and often influence behaviors. This approach has been used to study teacher education students' perceptions of technology integration (Larson & Cliff, 1996; Glazewski, Brush, Ku, & Igoe, 2002).

This study examined the proficiency or lack of proficiency of prospective teacher education students at two-year community colleges to use and integrate instructional technologies and their perspective regarding the implementation of technology-mediated instructional strategies. According to Smith and Robinson (2003), many technology applications are not being implemented fully due to lack of teacher training in the usage of technology. The guiding questions for this study were as follows:

1. What are prospective teacher education students' perceptions of their level of proficiency for instructional technology use?
2. What are the differences in perceptions of technology proficiency levels between prospective teacher education

students of color and White prospective teacher education students?

3. What are the differences in prospective teacher education students' perceptions of the frequency and effectiveness of technology mediated instructional strategies?
4. What are prospective teacher education students' perceptions of their level of preparedness to implement technology skills?

Research Design

The research design of this study employed a descriptive cross-sectional design to gather information from prospective teacher education students about their proficiency to integrate technology. Descriptive research involves collecting numerical data to test hypotheses or answer questions concerning current status. The purpose of descriptive survey research is to find out what situations, events, attitudes or opinions are occurring in a population (Pinsonneault & Kraemer, 1993). A quantitative methodology (selected-response survey items) was employed for the purpose of investigating the perceptions of prospective teacher education students' proficiency to integrate technology-mediated instructional strategies for teaching and learning.

Population

The subjects for this study were prospective teacher education students at Houston Community College -- Southeast location, Lee College, North Harris College, The Victoria College, and Cy-Fair College. The two-year community colleges are located in southeast Texas and are members of Texas Association of Community Colleges, Texas Community College Teachers Association, and the American Association of Community Colleges.

These community colleges were chosen because they offer an Associate of Arts (A.A.) in interdisciplinary studies for students who plan to transfer to a four-year institute to continue their teacher education. They are comparable between community colleges in southeast Texas in terms of enrollment size and types of studies offered.

Sample

The participants in this study included students in a teacher preparation program from Houston Community College -- Central location, Lee College, North Harris College, Cy-Fair College, Victoria College, and Tomball College. Seven students at Tomball College were also queried. Participants include: 26 students (23.9%) from Houston Community College – Central location; 33 students (30.3%) from Lee College; 7 students (6.4%) from North Harris College; 9 students (8.3%) from Cy-Fair College; and 34 students (31.2%) from Victoria College. Administrators from Tomball College later contacted the

researcher and asked that the results of the seven students queried not be included in the analysis. Consequently, there were a total of 109 students queried. The rate of return for survey was 94%. There were 102 females and 7 males. There were 12.8% of the students who identified their ethnic status as Black; 28.4% of students identified their ethnic status as Hispanic; 52.3% students identified their ethnic status as White; 2.8% of the students identified their ethnic status as Asian; and 2.8% of the students identified their ethnic status as other. There were no students who identified their ethnicity as Native American. One student did not respond to the item regarding ethnicity. Ninety-six (87%) of the respondents reported that they intend to enter the teaching profession.

Instrument

Since descriptive studies seek to find the answer to the question: "*What is?",* it is impossible to predict how respondents will interpret the items unless the researcher tries out the survey and analyzes the responses of a sample of subjects before starting the main study (Borg, P. Gall & D. Gall (1993). Therefore a survey was piloted to ensure the participants understood questions on survey.

Pilot Study

A powerful scientific tool for gathering accurate, useful facts and sound data that can be translated into valuable information for its intended users

is a survey (Salant & Dillman, 1994). In a study conducted by the Partnership for Quality Education (PQE) project, newly developed instruments were field tested with a group of study of approximately 200 preservice teachers and instructors to examine survey characteristics. The instrument used in this study was modified from the previous instruments originally field tested in the PQE study. Information from the PQE project was used as a pilot study.

The PQE project is a coalition of education-based institutions that focuses on integrating instructional and technological strategies in teacher preparation programs for prospective teachers and instructors. There were five goals in the PQE project that surround the redesign of teacher preparation. The fourth goal in the PQE project hinges around the integration of technology at all levels of the teacher preparation program. The surveys in the study with PQE investigated perceptions of technology. The PQE project investigated instructor perceptions of their technology proficiency and their technology use. The PQE project also investigated student perceptions of the use and effectiveness of technology experienced.

Surveys were administered to instructors and students to determine perceptions and proficiencies. The survey for the instructors contained a section for their perceptions of their technology proficiency. The instructors were also queried about their teaching strategies and technology use. The survey for the students provided information about students' perceptions of effectiveness and frequency of the teaching strategies experienced in the course.

In the PQE administration of the instruments, the range of internal consistency was high both for instructors (ranging from .80 to .96) and students ranging from (.92 to .96). Reliability analyses at each subsequent administration of instruments have yielded similar results for the PQE project. Adequate discriminant validity was established through examination of the correlations of items between and within scales (Knight, 2001). The survey items in this study were adapted from existing surveys from the PQE project. A scale for "level of preparedness" was added for this study. The reliability for the first ten items relating to technology proficiency ranged from .8788 to .8908 for alpha if items were deleted. The alpha coefficient was .8938. The reliability for the twenty-four items in the scale for frequency and effectiveness ranged from .9028 to .9087 for alpha if items were deleted. The alpha coefficient was .9098. The reliability for the six items regarding preparedness to implement technology skills ranged from .8682 to .8832 for alpha if items were deleted. The alpha coefficient was .8958. A reliability coefficient of .70 or higher is considered "acceptable" in most Social Science research situations

Survey

Pinsonneault and Kraemer (1993) defined a survey as a "means for gathering information about the characteristics, actions, or opinions of a large group of people" (p.77). In this study, the *Prospective Teacher Education Students Survey* was administered using a Likert-type scale to gather

information from prospective teacher education students (Appendix C). The item questions targeted students' proficiency with technology, their experiences with technology, and their perceived preparedness to use technologies in the classroom. According to Gall, Borg, and Gall (1996), the Likert-type scale asks individuals to check their level of agreement with various statements. The survey items were organized into four sections:

(1) Section I: Background (11 items)

(2) Section II: Technology Proficiency (10 items)

(3) Section III: Technology-Mediated Instructional Strategies (12 two-part items)

(4) Section IV: Technology Perceptions (6 items)

The Background, Section I, contained 11 items covering demographic information and agreement to participate in the study. There were 10 demographic items. These items included course name, name of community college, major, semester, year, gender, ethnicity, intentions to transfer to a four-year university, intentions to enter teaching profession, and number of post-secondary technology courses taken. The last item on the Background survey asked students if they agreed to participate in the study and to sign the informed consent form.

Section II, Technology Proficiency contained 10 items that allowed participating students to rate their level of proficiency with various technologies. The items corresponded to the students' current level of technology from Level 1 to Level 4. For example, checking Level 3 indicated that a student was

proficient in the skills indicated in previous levels as well as the skills in Level 3. The dimensions included computer operation, email use, web browser operation and Internet, information searching, presentation skills, word processing, spreadsheet, database, graphics use, and ethical use understanding.

The third section of the survey, Technology-mediated Instructional Strategies, asked participating students to respond to 12 two-part items. The twelve items measured the frequency and effectiveness of technology use they experienced in the teacher preparation program at the community college. The items regarding frequency allowed students to rate technologies experienced on a 1-4 Likert-type scale, where 1=never (0-25%), 2= sometimes (25-50%), 3= often (50-75%), and 4= almost always (75-100%). The second part of the Technology-mediated Instructional strategies section contained items regarding effectiveness. These items allowed students to rate technologies experienced on a 1-4 Likert-type scale, where 1=ineffective, 2= somewhat effective, 3= effective, and 4= very effective. If students were not familiar with a technology, they were to check the box in the first column titled “Don’t Know What This Is”.

The fourth section of the survey, Technology Perceptions, explored participating students’ preparedness to use technology in their teaching. Six items allowed students to rate their preparedness in computer applications, Internet correspondence, presentation skills, information searching, practice drills, and classroom instruction. The items on preparedness were rated on a 1-

4 Likert-type scale, with 1= not at all prepared, 2= somewhat prepared, 3= moderately well prepared, and 4= very well prepared.

Data Collection

Data were collected at the end of the Fall 2004 semesters in conjunction with the regularly scheduled course evaluations, an Institutional Consent letter was sent to six community colleges (Appendix A). The community colleges that received the letter were Cy-Fair College, Houston Community College –Central campus, Lee College, North Harris College, Tomball College, and The Victoria College. The Institutional Consent letter introduced the researcher and explained the purpose and intention of the survey. It also assured the confidentiality of individual respondents and asked for permission to conduct the survey with the students in the classroom setting. Five of the six Community Colleges granted permission to contact students and administer the survey. Tomball College was not able to grant permission. After receiving permission to administer the survey at the other institutions, the researcher contacted instructors who taught an "Introduction to Teaching" course or similar courses at the college. Upon arranging a designated time (two weeks before semester's end), the researcher visited the classrooms and explained to the students their rights, the purpose of the research, and procedures of the survey. Since prior experience from the PQE project indicated that surveys mailed to the participants generated a low response and return rate, the survey was distributed to each student by the

researcher. To increase the return rate, the researcher waited until students completed the survey to collect them. The rate of return for this survey was 94%. Prospective teacher education students were given a survey packet that consisted of (a) consent form for participation in the evaluation (Appendix B) and (b) the Prospective Teacher Education Students Survey (Appendix C). The survey took approximately 20 minutes to complete. Upon completion of the survey, the researcher collected the surveys to keep secure.

As recommended by Texas A&M University to maintain confidentiality, the surveys have been kept in a locked cabinet in the researcher's home office in Houston, Texas and were accessible only by the researcher.

Data Analysis

A master list of codes was developed to help in the analysis of the items. The list contained codes for the identification of instructors, courses, the names of the institutes of higher education, the majors of the prospective teacher education students, the gender of the students, the ethnicity of the students, the intentions of prospective teacher education students to transfer to a 4 year university, and their intensions to enter the teaching profession. There was also a code for the number of post-secondary technology courses the prospective teacher education students have taken. Since the prospective teacher education students were asked to write their major, a separate list of codes for

majors was developed. This list contained 25 different majors the students declared.

Descriptive statistics were used in reporting frequencies, cross tabulations, percentages, means, and standard deviations of responses from the *Prospective Teacher Education Students Survey.* The data were analyzed using SPSS (Statistical Package for the Social Sciences). The mean and standard deviations were presented for each survey item. Inferential statistics were performed to determine whether the differences between the mean scores were statistically significant. Independent t-test tests were conducted to explore the differences in perceptions of technology proficiency levels between prospective teacher education students of color and White prospective teacher education students. Paired sample t-tests were conducted to explore the differences in frequencies and effectiveness of technologies-mediated strategies. All statistical analyses used .05 level of significance.

Summary

This chapter described the methodology used to examine the proficiency or lack of proficiency of prospective teacher education students at two-year community colleges. A survey for prospective teacher education students at two-year public community colleges was designed to obtain students' perceptions and proficiencies to use instructional technologies. Pilot testing and instrument validation were conducted to ensure the quality of the survey.

Appropriate statistical analyses were used in data analysis. The quantitative research design used in this study provided a comprehensive understating of the perceived levels of proficiency and perceptions of prospective teacher education students. The next chapter presents the results and analysis obtained.

CHAPTER IV

RESULTS AND ANALYSIS

The purpose of this chapter is to present the results of this study. Descriptive statistics were used in reporting frequencies, percentages, means, and standard deviations of responses from the *Prospective Teacher Education Students Survey.* The analysis of data was also completed utilizing independent and dependent sample t-tests. The SPSS (Statistical Package for the Social Sciences) for Windows software program was used to analyze the quantitative data using descriptive statistics, frequencies, cross tabulations, t-tests, and Analysis of Variance (ANOVA) statistical methods. The instrument used to collect data for this study may be found in Appendix C.

The intent of this study was to: (a) identify the level of technology proficiency prospective teacher education students have to use instructional technologies; (b) identify the frequency prospective teacher education students implement technology-mediated instructional strategies; (c) identify the effectiveness of the technology-mediated instructional strategies; and (d) identify the perceived level of preparedness of prospective teacher education students to use technology.

Description of the Subjects

This empirical study sample was comprised of 109 prospective teacher education students. Descriptive data were computed by gender, ethnicity, and

transfer status. Section I of the *Prospective Teacher Education Students Survey* contained 10 items covering demographic information. These items included course name, name of community college, major, semester, year, gender, ethnicity, intentions to transfer to a four-year university, intentions to enter teaching profession, and number of post-secondary technology courses taken. See Appendix C for the *Prospective Teacher Education Students Survey.*

Gender

Regarding the variable gender, these were 102 (93.6%) female teacher education students and 7 (6.4%) male teacher education students who participated in the study. See Table 4.1 for these results.

TABLE 4.1. Frequency Distribution of Participants by Gender

Gender	Frequency	Percent
Female	102	93.6
Male	7	6.4
Total	109	100.0

Ethnicity

Seven subgroups represented the variable ethnicity. There were fourteen (12.8%) students who identified their ethnic status as Black; thirty-one (28.4%) identified their ethnic status as Hispanic; fifty-seven (52.3%) students identified their ethnic status as White; three (2.8%) students identified their ethnic status as Asian; three (2.8%) students identified their ethnic status as other; zero (0.0%) Native American students participated; and one (0.9%) student did not respond. See Table 4.2 for these results.

TABLE 4.2. Frequency Distribution of Participants by Ethnicity

Ethnicity	Number	Percent
Black	14	12.8
Hispanic	31	28.4
White	57	52.3
Asian	3	2.8
Native American	0	0.0
Other	3	2.8
No response	1	0.9
Total	109	100.0

The sample of Black students in this study was closely aligned to the demographics of Black students (13%) reported by the American Association of Community Colleges (AACC). The sample of Hispanic students in this study was almost doubled compared to the 15% of Hispanic students reported by the AACC. This may be due to an increasing number of Hispanic students attending community colleges. Hispanics made up 61 percent of the statewide enrollment growth in Texas (Zimar, 2006).

Intention to Transfer

The variable for transfer status was categorized into three distinct groups to measure the intention of prospective teacher education students to transfer to a four-year university. Ninety-six (88.1%) of the students reported they intend to transfer to a four year university and 7 (6.4%) said they do not intend to transfer to a four-year university. In comparison, 6 (5.5%) students indicated they were undecided about transferring to a four-year university. See Table 4.3 for these results.

TABLE 4.3. Frequency Distribution of Participants by Intent to Transfer Status

Intent to Transfer	Number	Percent
Yes	96	88.1%
No	7	6.4%
Undecided	6	5.5%
Total	109	100.0%

Intention to Teach

The variable for intention to teach was categorized into three distinct groups to measure the intention of prospective teacher education students to transfer to a four-year institution. However, one (0.9%) participant did not respond to the question. Ninety-six (88.1%) of the students reported they intend to enter a teaching profession and three (2.8%) of the students indicated that they do not intend to teach. In comparison, nine (8.3%) of the students were undecided in their response to enter into the teaching profession. See Table 4.4 for these results.

TABLE 4.4. Frequency Distribution of Participants by Intent to Teach

Intent to Teach	Number	Percent
Yes	96	88.1%
No	3	2.8%
Undecided	9	8.3%
No response	1	0.9%
Total	109	100.0%

Number of Technology Courses Taken

The participants were queried about the number of technology courses they had taken. The number of technology courses prospective teacher

education students had taken at their community college ranged from zero years to ten years. Fifty-nine percent (59%) of prospective teacher education students have had at least one technology course. Forty-one percent (41%) of the prospective teacher education students had not taken any technology courses. See Table 4.5 for the results.

TABLE 4.5. Frequency Distribution of the Number of Technology Courses

Number of Courses	Number of Participants	Percent
0	45	41.3%
1	33	30.3%
2	17	15.6%
3	4	3.7%
4	3	2.8%
5	5	4.6%
6	0	0.0%
7	1	0.9%
8	0	0.0%
9	0	0.0%
10	1	0.9%
Total	109	100.0%

The majority (87%) of prospective teacher education students have had zero, one, or two technology courses. A cross tabulation (also known as crosstabs) procedure was used to identify the number of technology courses taken compared to the ethnicities of the participants. There were 95 students who had zero, one, or two courses. The remaining 14 of the 109 students have

had three to ten technology courses. They were considered as outliers in the analysis. See Table 4.6 for the results.

Table 4.6 Cross Tabulation of Number of Technology Courses Compared to Ethnicity

Ethnicity	Number of Technology Courses	
	Zero Courses	One or Two Courses
Asian	0	1
Black	8	3
Hispanic	14	13
White	23	29
Other	0	3
No response	0	1
Total	45	50

Research Question One

What is the perceived level of technology proficiency prospective teacher education students have to use instructional technologies?

This section contained 10 items that allowed the 109 participating students to rate their perceived level of proficiency with various technologies. The items corresponded to the students' current level of technology use from low, Level 1, to high, Level 4. For example, checking Level 3 indicated that a student was proficient in the skills indicated in previous levels, 1 and 2, as well as the skills in Level 3. The dimensions included basic computer operation,

email use, web browser operation and Internet, information searching, presentation skills, word processing, spreadsheet, database, graphics use, and ethical use understanding.

Prospective teacher education students reported greatest proficiency in technology use for basic computer operation, word processing, web browser operation and internet (Table 4.7). For the item, basic computer operations, 59 students (54.1%) indicated that they have Level 4 proficiency (Table 4.8). There were zero students who indicated that they did not use a computer.

For the item, word processing, 54 students (49.5%) indicated they have Level 3 proficiency. However, 46 students (42.2%) indicated they have Level 4 proficiency in word processing. Only 2 students (1.8%) indicated they do not use a word processor, nor could they identify any uses, features, or benefits a word processor might have on their learning (Table 4.9).

Table 4.10, web browser operation and internet, reported 80 students (73.4%) have Level 3 proficiency. Only one student (0.9%) indicated they do not use the Web.

The participants reported low proficiency in technology use for database, ethical use understanding, and spreadsheet (Table 4.7).

TABLE 4.7. Means and Standard Deviations of Prospective Teacher Education Students Perceived Levels of Technology Proficiency

Technology Proficiencies	M	SD
Basic Computer Operation	3.42	.698
Email Use	2.73	.789
Web Browser Operation & Internet	2.94	.542
Information Searching	2.91	.632
Presentation Skills	2.82	.841
Word Processing	3.32	.679
Spreadsheet	2.48	.929
Database	2.09	.823
Graphics Use	2.74	.985
Ethical Use Understanding	2.40	.883

1=low level, 4=high level

TABLE 4.8. Frequency Distribution of Basic Computer Operations

Basic Computer Operation	Number	Percent
Level 1	0	0.0%
Level 2	13	11.9%
Level 3	37	33.9%
Level 4	59	54.1%
Total	109	100.0%

TABLE 4.9. Frequency Distribution of Word Processing

Word Processing	Number	Percent
Level 1	2	1.8%
Level 2	7	6.4%
Level 3	54	49.5%
Level 4	46	42.2%
Total	109	100.0%

TABLE 4.10. Frequency Distribution of Web Browser Operation & Internet

Web Browser Operation & Internet	Number	Percent
Level 1	1	0.9%
Level 2	16	14.7%
Level 3	80	73.4%
Level 4	12	11.0%
Total	109	100.0%

Research Question Two

What are the differences in perceptions of technology proficiency levels between prospective teacher education Students of Color and White prospective teacher education students?

Differences between ethnicities in perceptions of technology proficiency levels were analyzed. Prospective teacher education students who identified their ethnicity as “Black”, “Hispanic”, “Asian”, or “Other” were aggregated into a single group. This group was labeled “Students of Color”. There were 52 participants in the “Students of Color” group. The responses to technology proficiencies of the “Students of Color” group of students were compared to the students who identified themselves as “White”. There were 57 “White” participants.

The highest mean of the perceived technology proficiencies of prospective teacher education students of color was Level 3 for only two of the ten items. Prospective teacher education students of color reported greatest proficiency in basic computer operations, (M=3.25, SD=.738), and word processing, (M=3.17, SD=.760). They perceived their level of technology proficiency at 3 for two out of the ten items. This implied the prospective teacher education students of color were proficient in skills indicated in previous levels, 1 and 2, as well as the skills in Level 3. The highest level that could be reported was level 4.

On the other hand, their White counterparts perceived their highest level of technology proficiency at Level 3 for four out of the ten items. White

prospective teacher education students reported their greatest proficiency in basic computer operations (M=3.58, SD=.625), word processing (M=3.46, SD=.569), web browser operations and Internet (M=3.02, SD=.517), and presentation skills (M=3.00, SD=.779).

The prospective teacher education students of color and White prospective teacher education students both indicated low technology proficiency in database and ethical use and understanding. The mean for both groups reported their perceived technology proficiency below Level 3. The mean for database and ethical use and understand was M=2.02, SD=.779 and M=2.19, SD=.817, respectively, for prospective teacher education students of color. The mean for database and ethical use and understand was M=2.16, SD=.862 and M=2.60, SD=.904, respectively, for White prospective teacher education students.

Independent sample t-tests were used to compare the means of two sets of values from one variable. Each technology proficiency variable was tested and compared to the values for prospective teacher education students of color and White prospective teacher education students. The Levene's Test for Equality of Variances for each variable was: basic computer operation, F=1.930, p=.168; email use, F=.761, p=.385; web browser operations and Internet, F=1.359, p=.246; information searching, F=.053, p=.819; presentation skills, F=2.402, p=.124; word processing, F=.297, p=.587; spreadsheet, F=.003, p=.959; database, F=.728, p=.395; graphics use, F=1.468, p=.228; and ethical

use and understanding, F=3.085, p=.082. Since the p level for each variable was greater than .05, the variances were not significantly different and equal variances were assumed.

As shown in Table 4.11, mean scores between prospective teacher education students of color verses White prospective teacher education students were significantly different for basic computer operation (M=3.25 vs. M=3.58, respectively, t=2.518, df=107, p=.013); presentation skills (M=2.62 vs. M=3.00, respectively, t=2.440, df=107, p=.016); word processing (M=3.17 vs. M=3.46, respectively, t=2.213, df=107, p=.029); spreadsheet (M=2.25 vs. M=2.68, respectively, t=2.496, df=107, p=.014); graphics use (M=2.54 vs. M=2.93, respectively, t=2.104, df=107, p=.038); and ethical use and understanding (M=2.19 vs. M=2.60, respectively, t=2.441, p=.016). The mean scores between prospective teacher education students of color and White prospective teacher education students were not significantly different for email use (M=2.69 vs. M=2.77, respectively, t=5.24, df=107, p=.601); web browser operations and internet (M=2.87 vs. M=3.02, respectively, t= 1.473, df=107, p =.144); information searching (M=2.88 vs. M=2.93, respectively, t=.372, df=107, p=.711); and database (M=2.02 vs. M=2.16, respectively, t=.878, df=107, p=.382).

Table 4.11. Differences in perceptions of Technology Proficiencies between Prospective Teacher Education Students of Color and White Prospective Teacher Education Students.

Technology Proficiency	Mean	SD	t	p
1. Basic Computer Operations				
Students of Color	3.25	.738	2.518	.013
White	3.58	.625		
2. Email Use				
Students of Color	2.69	.829	.524	.601
White	2.77	.756		
3. Web Brower Operations & Internet				
Students of Color	2.87	.561	1.473	.144
White	3.02	.517		
4. Information Searching				
Students of Color	2.88	.583	.372	.711
White	2.93	.678		
5. Presentation Skills				
Students of Color	2.62	.867	2.440	.016
White	3.00	.779		
6. Word processing				
Students of Color	3.17	.760	2.213	.029
White	3.46	.569		
7. Spreadsheet				
Students of Color	2.25	.883	2.496	.014
White	2.68	.929		
8. Database				
Students of Color	2.02	.779	.878	.382
White	2.16	.862		
9. Graphics Use				
Students of Color	2.54	.979	2.104	.038
White	2.93	.961		
10. Ethical Use & Understanding				
Students of Color	2.19	.817	2.441	.016
White	2.60	.904		

N = 52 (Students of Color); N = 57 (White)
1=low level, 4=high level

Research Question Three

What are the differences in prospective teacher education students' perceptions of the frequency and effectiveness of technology mediated instructional strategies?

Prospective teacher education students were asked to indicate the extent to which they experienced an instructional strategy on a 1-4 Likert-type scale, where 1=never (0-25%), 2= sometimes (25-50%), 3= often (50-75%), and 4= almost always (75-100%). If students were not familiar with an instructional strategy, they were asked to mark "Don't Know What this Is". Frequency items allowed students to rate technologies experienced at their college (Table 4.12).

Prospective teacher education students were also asked to indicate the effectiveness of instructional strategies. The items regarding effectiveness allowed students to rate technologies experienced on a 1-4 Likert-type scale, where 1=ineffective, 2= somewhat effective, 3= effective, and 4= very effective. If students were not familiar with a technology, they were to check the box in the first column titled "Don't Know What This Is". The items regarding effectiveness allowed students to rate technologies experienced at their community college See Table 4.12 for the results.

Prospective teacher education students reported the greatest frequency and effectiveness with technology-mediated instructional strategies in word processing (M=3.24, SD=1.04; M=3.30, SD=1.00, respectively). Students reported the lowest frequency with technology-mediated instructional strategies in computers for synchronous communication (M=1.17, SD=1.29). Prospective

teacher education students reported the lowest effectiveness with technology-mediated instructional strategies in computer-based simulation (M=1.71, SD=1.34).

Further analysis was done to determine if there was a difference in how often prospective teacher education students implement technology-mediated instructional strategies and how effective the students felt technology–mediated instructional strategies were in the learning process. Because the data from the frequency of technology-mediated instructional strategies were tied to the data from the effectiveness of technology-mediated strategies, a paired sample t-test was preformed. The differences in frequency of technology-mediated instructional strategies and how effective these same instructional strategies were in the learning process were reported in Table 4.12. The means and standard deviations of the frequency and effectiveness variables were also included.

The following list reports the mean difference between frequency and effectiveness: 1) internet for instructional purposes by the teacher was -.39, t=-5.153, df=108, p<.001); 2) internet for instructional purposes by the student was -.28, t=-4.234, df=108, p<.001; 3) presentation software by teacher was -.37, t=-4.65, df=108, p<.001; 4) presentation software by students was -.28, t=-3.79, df=108 p<.001; 5) multimedia presentations by teacher was -.26, t=-.4.36, df=108, p<.001; 6) multimedia presentations by student was -.32, t=-5.40, df=107, p<.001; 7) computers for communication (asynchronous, such as email)

was -.16, t=-3.30, df=106, p<.01; 8) computers for communication (synchronous, such as chat rooms) was -.18, t=-3.00, df=107, p<.01; 9) computers for drill and practice was -.20, t=-3.48, df=108, p<.01; 10) spreadsheets was -.30, t=-4.32, df=106, p<.001; 11) word processing was -.05, t=-1.04; df=108, p>.05 at the .05 level; 12) simulation was -.13, t=-2.62, p<.05. See Table 4.12 for the results.

TABLE 4.12. Differences in How Often and How Effective Technology-Mediated Instructional Strategies are Perceived by Prospective Teacher Education Students.

Instructional Strategies	How Often M	SD	How Effective M	SD	df	t	P
1. Internet for Education Purposes (by teacher)	2.36	1.13	2.74	1.22	108	-5.15	.000*
2. Internet for Education Purposes (by students)	2.89	.985	3.17	.958	108	-4.23	.000*
3. Presentation Software by Teacher	2.28	1.12	2.65	1.24	108	-4.65	.000*
4. Presentation Software by students	2.09	.967	2.38	1.22	108	-3.79	.000*
5. Multimedia Presentation by Teachers	2.24	1.19	2.50	1.31	108	-4.36	.000*
6. Multimedia Presentation by student	1.62	1.05	1.94	1.34	107	-5.40	.000*
7. Computers for Communication (Asynchronous)	2.19	1.46	2.35	1.48	106	-3.30	.001*
8. Computers for communication (Synchronous)	1.70	1.29	1.88	1.44	107	-3.00	.003**
9. Computers for drill and practice	1.90	1.28	2.10	1.45	108	-3.48	.001**
10. Spreadsheets	1.78	1.00	2.07	1.24	106	-4.32	.000*
11. Word Processing	3.19	1.10	3.24	1.09	108	-1.04	.299***
12. Simulation (computer based)	1.53	1.22	1.66	1.35	108	-2.62	.010**

Note: * P<.001; ** P<.01; *** P<.05

The results showed the mean difference between the frequency and the effectiveness of the twelve technology-mediated strategies to be negative. This indicates that the means for all of the items for effectiveness were higher than the means of the items for frequency. This suggests the prospective teacher education students perceived the technology-mediated instructional strategies to be effective based on the frequency of the technology-mediated strategies. Incidentally, there was no statistical significance with respect to word processing ($t=-1.04$, $df=108$, $p=.299$) at the .05 level.

A bar graph of students' perceptions of frequency of technology-mediated instructional strategies and perceptions of effectiveness was generated to examine the relationship between frequency and effectiveness (Figure 4.1).

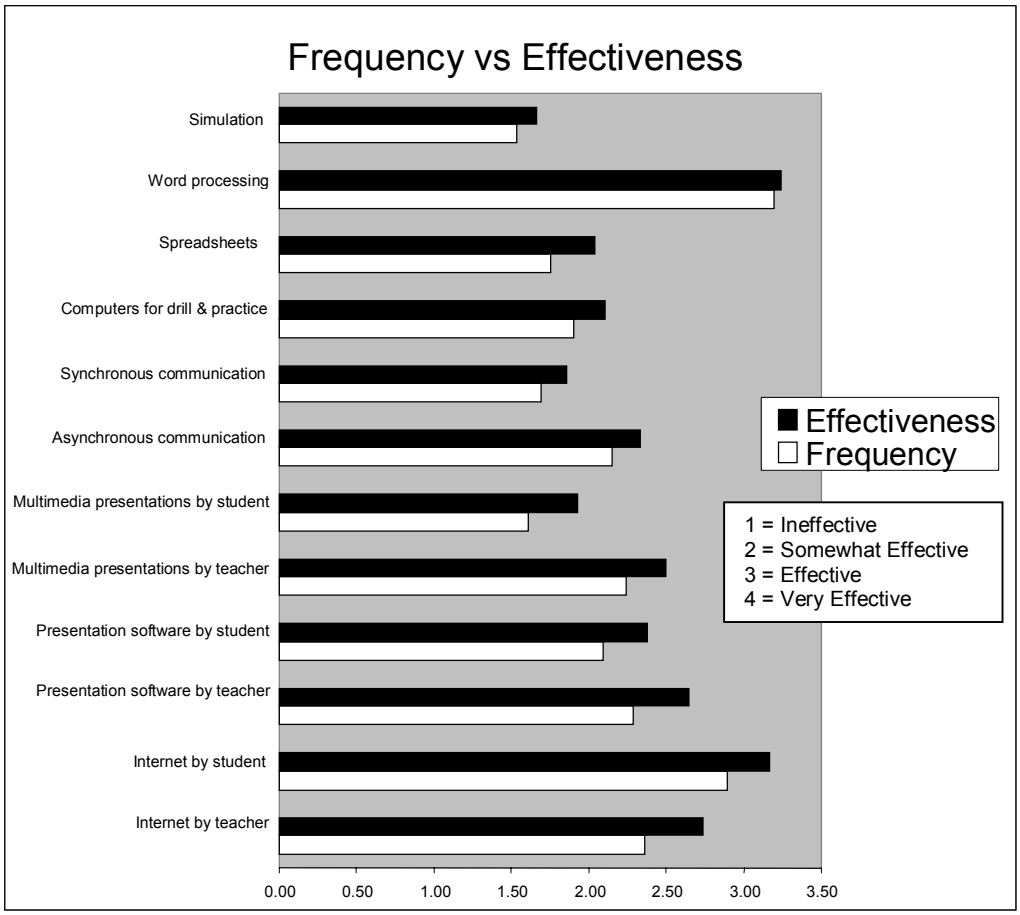

Figure 4.1. Comparison of Means and Standard Deviations of Frequency and Effectiveness of Technology-mediated Instructional Strategies.

Research Question Four

What is the perceived level of preparedness prospective teacher education students have to implement technology skills?

Prospective teacher education students were queried regarding their perceived level of preparedness to implement various technology skills. Students were asked to respond to six items regarding their perceived level of preparedness. The six items included computer applications, internet correspondence, presentations skills, information searching, practice drills, and classroom instruction. The items corresponded to the students' perceptions from "not at all prepared", "somewhat prepared", "well prepared", and "very well prepared" to implement these technology skills (Table 4.13).

TABLE 4.13. Percent of Teacher Education Students Perceived Level of Preparedness to Implement Technology Skills

Technology Skill	How well prepared students feel			
	Very well prepared	Well prepared	Somewhat well prepared	Not at all prepared
Computer applications	33.0	25.7	33.9	7.3
Internet correspondence	19.3	33.0	36.7	11.0
Presentation skills	27.5	23.9	33.9	14.7
Information searching	32.1	34.9	25.7	7.3
Practice drills	17.4	27.5	36.7	18.4
Classroom instruction	27.5	34.9	30.3	7.3

Prospective teacher education students perceived their highest level of preparedness in information searching (M=2.92, SD=.934). Information searching involved assigning work that incorporated search strategies using the Internet. To implement this skill, 32% of the prospective teacher education students felt “very well prepared”, 35% felt “well prepared”, 26% felt “somewhat prepared”, and 7% felt they were “not prepared”. Shown in Table 4.14 are the results of the descriptive statistics for each of the six items.

Prospective teacher education students perceived their lowest level of preparedness in practice drills (M=2.44, SD=.985). Practice drills involved assigning computer work for drill and practice. To implement this skill, 17% of the prospective teacher education students felt “very well prepared”, 27% felt “well prepared”, 37% felt “somewhat prepared”, and 18% felt they were “not prepared”. See Table 4.14 for results.

TABLE 4.14. Means and Standard Deviations of Prospective Teacher Education Students Perceived Levels of Preparedness to Implement Technology Skills

Technology Skill	M	SD
Computer Application	2.84	.973
Internet Correspondence	2.61	.923
Presentation Skills	2.64	1.041
Information Searching	2.92	.934
Practice Drills	2.44	.985
Classroom Instruction	2.83	.921

Each technology skill variable was also tested and compared to the values for prospective teacher education students of color and White prospective teacher education students using an independent samples t-test. The Levene's Test for Equality of Variances was: computer applications, F=.000, p=.985; Internet correspondence, F=.175, p=.676; presentation skills, F=1.908, p=.343; information searching, F=5.962, p=.016; practice drills, F=.027, p=.871; and classroom instruction, F=5.810, p=.018. The p levels for computer application, Internet correspondence, presentation skills, and practice drills were greater than .05. Thus, the variances were not significantly different and equal variances were assumed. The p levels for information searching and classroom instruction were less than .05. Thus, the variances were significantly different and equal variance was not assumed.

The results indicate that there were no significant differences in regards to: 1) computer applications (t=-.765, df=107, p=.446); 2) presentation skills (t=-1.939, df=107, p=.055); 3) practice drills (t=-.953, df=107, p=.343), and 4) classroom instruction (t=-1.867, df=100, p=.065) between prospective teacher education students of color and White prospective teacher education students of color. That is, there was no significant difference between the mean scores of prospective teacher education students of color and White prospective teacher

education students in regards to computer applications (M=2.77, SD=.983; M=2.91, SD=.969, respectively), presentation skills (M=2.44, SD=1.07; M=2.82, SD=.984, respectively), practice skills (M=2.35, SD=.988; M=2.53, SD=.984, respectively), and classroom instruction (M=2.65, SD=.988; M=2.98, SD=.834, respectively). See Table 4.15 for results.

However, the results did indicate there were statistical differences in Internet correspondence (t=-.3129, df=107, p=.002) and information searching (t=-2.002, df=99, p=.048) between prospective teacher education students of color and White prospective teacher education students. This means there were statistical differences between the mean scores of prospective teacher education students of color and White prospective teacher education students in regards to Internet correspondence (M=2.33, SD=.901; M=2.86, SD=.875, respectively) and information searching (M=2.73, SD=1.012, M=3.09, SD=.830, respectively). See Table 4.15 for results.

Table 4.15. Differences in perceptions of Preparedness to Implement Technology Skills between Prospective Teacher Education Students of Color and White Prospective Teacher Education Students.

Technology Skill	Mean	SD	t	p
1. Computer Application				
Students of Color	2.77	.983	.765	.446
White	2.91	.969		
2. Internet Correspondence				
Students of Color	2.33	.901	.3129	.002
White	2.86	.875		
3. Presentation Skills				
Students of Color	2.44	1.074	1.939	.055
White	2.82	.984		
4. Information Searching				
Students of Color	2.73	1.583	2.002	.048
White	3.09	.830		
5. Practice Drills				
Students of Color	2.35	.988	.953	.343
White	2.53	.984		
6. Classroom Instruction				
Students of Color	2.65	.988	1.867	.065
White	2.98	.834		

N= 109
(1=not prepared, 2=somewhat prepared, 3=well prepared, 4=very well prepared)

Summary

This chapter reports the results of the research study conducted. The results give a great deal about how prospective teacher education students think and learn. The frequency and relevance of learning increases when technology enables us to tap outside experts, visualize and analyze data, link to real-world contexts, and take advantage of opportunities for feedback, reflection, and analysis (Bransford, Brown & Cocking, 2000).

Data collected revealed perceptions of technology proficiency of prospective teacher education students from five southeastern community colleges in Texas who completed the *Prospective Teacher Education Students Survey*. The data were analyzed using SPSS (Statistical Package for the Social Sciences). Descriptive statistics were used in reporting frequencies, percentages, means, and standard deviations of responses from the survey. Descriptive statistics revealed the level of proficiency characteristics of prospective teacher education students, the frequency and effectiveness of technology-mediated instructional strategies, and their perceived preparedness to implement technology skills as a teaching tool. The mean and standard deviations were presented for each survey item. Inferential statistics were performed to determine whether the differences between the mean scores are statistically significant. Independent t-test tests were conducted as a follow-up analysis to explore the differences between prospective teacher education students of color and White prospective teacher education students. All statistical analyses used .05 level of significance.

In summary, prospective teacher education students believed they were adequately proficient at various technology skills. They felt that they had the basic skills and concepts to operate computers and use word processing. However, they were not proficient at database, spreadsheet, and ethical use understanding. Prospective teacher education students felt they were somewhat prepared to assign work that involves internet correspondence and

practice drills. However, they did not feel prepared to use computers and the Internet for classroom instruction.

What does this mean? Abboud-Blanchard (2005) asserts that the new generation of teachers has a positive perception of technology. The prospective teacher education students in this study indicated a fairly proficient perspective of basic computer operation. The participants were also able to explore technology-mediated instructional strategies such as word processing and internet use. However, "teaching with digital tools does not simply mean considering the software and hardware used" (Monaghan, 2004, p. 339). Prior experiences with technology need to also be considered as those experiences may influence perspectives. Prior experiences of these participants ranged from zero technology courses (45 participants) to ten technology courses (1 participant). Participants' lack of experience with technology or observing their instructors implement various technologies may have hindered the perspectives about the role of technology in their teacher education program. However, their lack of experience with database, spreadsheets, and simulations may have caused participants not to realize the pedagogical potential of the higher level nature of the technology. A more detailed summary and discussion of the results are presented in the next chapter.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND SUMMARY

From the use of instructional films to audiovisual and radio to the television age, new forms of technology have pushed the boundaries of technology integration. Technology has become an omnipresent fact of life and education. As information is transferred on a daily basis in this fast-paced world, the role of the teacher has also shifted.

Teachers are not only responsible for delivering content to their students, but must also develop new ways of learning. No longer can teachers give students a “book”; they must also teach students to read in order to make that “book” useful. The “book” for today’s prospective teacher education students is technology. Technology as a tool has become a widely used instructional strategy in the development of new ways of learning.

In their quest to be technologically proficient teachers, prospective teacher education students have various technologies at their disposal. Throughout their teacher preparation program, they have the opportunity to engage in a learning process that can help them become the teachers they seek to be. It is important to connect technology to their practice and their future students’ learning in meaningful ways. Without making the necessary connections, prospective teachers can easily dismiss the technology used in their teacher education courses as abstract and impractical (Shoffner, 2007)

The challenge confronted by teacher education instructors is to learn how

to “leverage this new knowledge and skill set in fostering innovative, technology-based pedagogical practices within teacher education” (Clifford, Friesen, & Lock, 2004). It is incumbent that teacher education instructors present information that helps prospective teacher education students solve problems, gain deeper insights, increase proficiencies, and to support learners' thinking in terms of analysis, synthesis, and evaluation.

Discussion and Results

The identification of prospective teacher education students’ level of proficiency in the use of technological tools and devices addresses the first research question. *What is the perceived level of technology proficiency prospective teacher education students have to use instructional technologies?* The proficiency levels were analyzed to determine how proficient prospective teacher education students in two-year community colleges were at integrating technology best in classrooms. There were ten dimensions: basic computer operation, email use, web browser operation and Internet, information searching, presentation skills, word processing, spreadsheet, database, graphics use, and ethical use understanding.

Most prospective teacher education students indicated they have greater proficiencies in basic computer operation and word processing. Basic computer operation proficiencies included being able to run programs simultaneously, load software, print, and use most of the operation systems tools. Being able use the

word processor for written work and helping others format documents indicated a high proficiency in word processing.

Many teacher preparation programs require students to possess certain technical skills, such as knowledge of specific computer technology functions. It is not surprising that most prospective teacher education students felt proficient in basic computer operations and word processing. These are often the two most widely used computer applications in education (Becker, 2000).

On the other hand, prospective teacher education students did not indicate a high level of proficiency in database and spreadsheet. Level one was an indication of low proficiency. Twenty-two percent of prospective teacher education students perceived their least proficient skills in database. In addition to the low proficiency in database, eighteen percent of the prospective teacher education students did not feel proficient using spreadsheets. This is reason for concern because information tools, such as database and spreadsheet, allow the rapid and flexible manipulation of information.

Databases and spreadsheets enable students (and teachers) to analyze data and to form insights from a number of different perspectives. Databases are an important step in the transition between looking for information and composing a solution or response. Spreadsheets are used to organize and analyze data. This is worth noting because these uses of technology often support learning activities involving inquiry and project-based constructive learning (Aust, Newberry, O'Brien, & Thomas, 2005). Additionally, database and

spreadsheet require many higher order thinking skills that makes thinking and questioning more efficient and offers opportunity to see new patterns and relationships not previously seen (Cronon, 2004). These higher order thinking skills fall within the constructivist theoretical framework (Sheffield, 2007).

The perception of low proficiency in database and spreadsheet might be due to their more technical nature. Consequently, prospective teacher education students with low proficiency in database and spreadsheet may be less likely to use these more "technical" technologies in their classroom. It is incumbent that teacher preparation programs prepare students accordingly.

"What are the differences in perceptions of technology proficiency levels between prospective teacher education students of color and White prospective teacher education students?" was the second research question. The results of this question indicated lower perceptions of technology proficiencies in all ten dimensions among prospective teacher education students of color compared to their White counterparts. White prospective teacher education students' perceptions of technology proficiencies were slightly higher in all ten dimensions.

Ragon (2004) suggests the differences are due to a lack of access to computers and the Internet at home. In other words, students of color did not have technology available at home. This equated to less technology use in college which translated into reduced study time. However, students exhibited some levels of technology use because, even without home computer ownership or access, they presumably had access at the college.

The disparities in this study can not be simply solved by creating access. Based on the trend of data, the results indicate a precipice situation for prospective teacher educations students of color in regards to technology proficiencies. As the population of American's K-12 schools grows more diverse, it will be incumbent upon schools to recruit teachers who reflect the ethnic diversity present in schools. In their future classrooms, students of color risk being academically behind if these prospective teachers are not as proficient with technology skills as their White counterparts. The same can be concluded when comparing students at community colleges versus their counterparts at universities (AACTE, 2000). All students need to be given more support and opportunities to learn and use new technologies.

The largest differences were in technology proficiencies for spreadsheet, graphics use, and ethical use and understanding. The margin decreased between students of color and Whites for proficiency skills in information searching and email use.

The digital divide has sometimes been defined as the gap in technology ownership and access between those who are poor or live in rural areas with limited or no access to the Internet (Charp, 2001; Swain and Pearson, 2002). Even though more technologies are becoming more prevalent, and technology skills more essential to success, the digital divide continues. This is an indication that the issues of race, class, and culture still need to be important issues in teacher preparation and technology integration. Without this

emphasis, the emergence of the new technologies will only contribute to the ever-widening digital divide.

Identifying technology proficiency levels can be beneficial for all stakeholders. All prospective teacher education students can improve their ability to use technology resources. The results from this question support Swain and Pearson's (2002) study that technology can enhance learning even when there are deficiencies. The knowledge of their skill level can provide opportunities for learning and create the conditions that optimize learning for all prospective teacher education students and for their future students.

The frequency and effectiveness of various technology-mediated strategies are addressed in the third research question. The third research question asked, "*What are the differences in prospective teacher education students' perceptions of the frequency and effectiveness of technology mediated instructional strategies".* The results for the differences in perceptions of frequency and effectiveness revealed a correlation between frequency and effectiveness of technology-mediated instructional strategies.

Prospective teacher education students indicated that the frequency of strategies influenced the effectiveness of the strategy. The technology-mediated instructional strategies, word processing and internet for educational purposes by students, were more effective than the other ten instructional strategies. However, the technology-mediated instructional strategy, simulation (computer-based) and computers for synchronous communication were the least effective

instructional strategies. This question supports the premise that many colleges of education may not have technology-enhanced classrooms that would allow instructors to routinely model the use of various technologies (Milken, 2001).

Prospective teacher education students often have limited experiences and skills in integrating technology into their teacher preparation program. Over half of the new teachers who were recent graduates have had more exposure to new technologies; however, many of them had not gone beyond word processing and low-level games for drills and patterns. Few had used multimedia, on-line networks, simulations, and problem solving applications. Students need to develop skills and strategies in designing lessons that will be educational. Teacher preparation instructors in community colleges and teacher education instructors in universities need to stay current on the latest and best technology so that they can model skills and strategies effectively and frequently. By changing the way instructors work with students in using technology, they can teach prospective teachers to be change agents in the classroom and beyond.

"*What is the perceived level of preparedness prospective teacher education students have to implement technology skills?"* is the fourth research question. This question queried prospective teacher education students about their perceived level of preparedness to implement six technology skills in their future classrooms. The six dimensions included: 1) computer applications; 2)

internet correspondence; 3) presentations skills; 4) information searching; 5) practice drills; and 6) classroom instruction.

The first item queried prospective teacher education students' perceptions to use computer applications such as word processing and spreadsheet. The second item queried prospective teacher education students' perception to use internet correspondence. This includes being prepared to assign work that involves corresponding with experts, authors, students, etc via e-mail or Internet. The third item queried prospective teacher education students' perception to use presentation skills. Presentation skills involved being prepared to present materials graphically (PowerPoint, Hyperstudio, VCRs, DVDs, etc.) The fourth item queried prospective teacher education students' perception to use information searching to assign work that incorporates search strategies using the Internet. The fifth item queried prospective teacher education students' perception to use practice drills. This technology skill involved being prepared to assign computer work for drill and practice. The sixth item queried prospective teacher education students' perception to use computers and the Internet for classroom instruction.

Twenty percent (20%) of new teachers were inadequately prepared to use computer-based technologies for instructional purposes (OTA, 1995; Swain and Pearson, 2002). In 1999, a National Center for Educations Statistics (NCES) survey was commissioned to identify teachers' perceptions of their own preparedness to use various tools in their classes. Even though the results for

this study queried prospective teacher education students, the discussion that follows compares these results to the results of the 1999 NCES survey for teachers. Prospective teacher education students' perceptions of preparedness may indicate the extent to which their training prepares them for their future classrooms.

Thirty-three percent (33%) of prospective teacher education students reported being "well prepared" to assign work using computer applications such as word processing and spreadsheet. In the NCES survey of teachers, thirty-three percent (33%) of teachers also reported being "well prepared" to assign work using computer applications. Thirty-three percent (33%) of the prospective teacher education students in this survey indicated they are "well prepared" to assign work that involved Internet correspondence. Incidentally, thirty-four percent (34%) of teachers in the NCES survey also reported feeling "well prepared" for the same technology skill. Thirty-four percent (34%) of prospective teacher education students felt "somewhat prepared" to present materials graphically compared to thirty-eight percent (38%) of teachers in the NCES survey.

Thirty-four percent of the teachers from the NCES survey indicated feeling "well prepared" to assign work using the Internet. However, thirty-five percent of prospective teacher education students felt "well prepared" to deliver the same assignment. Fifty-four percent of teachers surveyed reported being "somewhat prepared" to assign computer work for drill and practice. However,

only thirty-seven percent (37%) of prospective teacher education students felt that they could assign the same work. In the NCES survey, twenty-three percent (23%) reported feeling "well-prepared" to use computers or the Internet for classroom instruction. When prospective teacher education students were queried about the same dimension, thirty-five percent (35%) perceived their level of preparedness to also be "well prepared" to use computers or the Internet for classroom instruction.

By comparing the prospective teacher education students to the teachers in the NCES study, the results indicate that the students' perceptions align with the perceptions of teachers. Prospective teacher education students may be equipped with knowledge and skills in using various technologies. However, focusing on technology skills alone does little to move students to a point where they are prepared to use technology meaningfully in their classrooms.

The success of implementing curriculum with instructional technology depends upon the perceptions of the students' and their preparedness to use the technology. Prospective teacher education students' feelings of preparedness may provide insight into the extent to which their coursework prepares them to meet many challenges in teaching. Understanding how prospective teacher education students at community colleges perceive their skills and preparedness to integrate technology into their future classrooms is important. Exposing students to skills, strategies, and experiences will enable future teachers to effectively teach with technology. Thus, the role of teacher

preparation instructors in modeling technology usage is important for teacher preparation.

Many prospective teacher education students plan to enter a teacher education program at a four-year institute upon completion of their coursework at a community college. Community colleges can develop teacher preparation methods that equip prospective teacher education students to confidently embed these tools into their teaching practices. The transition from teacher preparation programs to teacher education programs can be an enhanced evolution that connects technology to core content and higher order thinking. Community colleges can be the necessary conduits in the quest for knowledge about the role of technology in teacher preparation programs.

Conclusions and Recommendations

It can be concluded that the use of technology for the delivery of instruction, coupled with intensive experiences in the field, supports teaching and learning as a collaborative process. Slotte and Tynjälä (2005) argued that collaboration provides opportunities for learners to develop "higher-order thinking skills and problem-solving skills in the construction of their ideas about practice" (p. 193). By working together, prospective teacher education students, instructors, and classroom teachers are able to teach with and not to each other. Thus, by providing mutual support, constructive feedback about the learning outcomes can be enhanced.

The schools in which today's prospective teacher education students will be employed will require the ability to research, analyze, create and communicate using technology. By understanding how proficient prospective teacher education students are at integrating technology, teacher preparation administrators and instructors will know how to increase understanding and enhance learning. Thus, a "deeper understanding of the complexity of both the *how* and the *why* of technology integration in relation to teaching and learning" will be understood (Lock & Clark, 2004, p. 6). This will enable teacher preparation programs in community colleges the ability to aid in the training of a diverse teaching force. However, several issues related to incorporating and integrating technology into teacher preparation programs for prospective teacher education students need to be addressed.

At the community college level, the difficulty of teaching is magnified by the challenge of responding to students who many not have been successful in previous academic experiences (Cox, 2003). Due to their prior personal and educational exposure to technology, students come to education courses with diverse needs, desires, and skills toward technology. There is not a systematic plan to determine which technology to use in the teacher preparation programs to build on prior knowledge and skills of prospective teacher education students and include diverse experiences with various technologies. Pre-assessment measures need to be developed. When students enter the program or course, the instructor can design technology-related assignments that are appropriate to

the students and the technology standards.

As the latest technological tools become available, teacher preparation instructors need to develop new methods for infusing and integrating the technology into the curriculum for prospective teacher education students. Within the teacher preparation courses, the technology experiences need to vary across the courses within the prospective teacher education student's development and preparation.

Prospective teacher education students need to be shown the educational value of technology for communicating, collaboration, conducting research, and problem solving. In addition, Kay (2006) argued “every effort [must] be made to model and construct authentic teaching activities” (p. 394). The modeling of this work within teacher education programs is a critical factor to be addressed.

Students also need opportunities to design and implement lessons with technology. Prospective teachers can begin to design learning experiences for their students that appropriately integrate technology based on the modeling and experiences they have observed and experienced in their teacher education programs.

Technology integration is complex (Koehler & Mishra, 2007), but the results from this study can benefit prospective teacher education students, educational administrators, and teacher preparation instructors. All of whom will be able to devise strategies that address the integration of technology in the

teacher preparation program. Research indicates that changes in ways of preparing teachers will result in changes in classroom performance. The challenge for teacher preparation instructors is to select and implement the most effective teaching procedures that prepare future teachers to use technology in their classrooms.

Prospective teacher education students may be able to use the findings from the research study in their studies in several ways. Students can develop the ability and confidence to learn new software applications on their own. By learning to use various software packages as tools, they develop intuitive skills that will help them feel more prepared to use applications in their future classrooms. Thus, faculty can build experiences that simultaneously increase a student's knowledge of technology and their capabilities for self-directed learning. Without a strong foundation in the knowledge and skills for using technology effectively, prospective teachers entering teacher education programs and schools will not meet the “highly qualified teacher” expectations (Fulton, K., Glenn, A. D., & Valdez, G., 2003). Even the best teacher preparation programs need to continually review, renew, and revise their program to ensure they are responsive to changing expectations for future teachers.

Implications for Future Research

This is definitely the time to evaluate and make changes to community college and university teacher preparation and education curriculum in order to equip prospective teachers with the skills they need for today's classroom. Technology is so much more advanced today that media centers and classrooms are equipped with more than an overhead projector and a filmstrip projector. Whether we are referring to CD-ROMs, videodisk players, or computers, we are looking to a classroom which is vastly different than the ones 10-15 years ago.

Will new teachers be prepared to teach in a digital age? They certainly should be able to if teacher education programs make the commitment to insure a curriculum which is rich in technology introductions, technology applications, and technology integrations. Future research must address the question of why teachers should use technology-based methods. The emerging theory base demands that studies look at technologies not as delivery systems, but as components of solutions to educational problems (Roblyer & Knezek, 2003).

The following implications may serve to guide the selection of instructional practices, the development of curriculum, and the assessment of problem solving instruction in teacher preparation programs. The following research should be considered as a follow-up to this study:

1. This study consisted of a limited number of prospective teacher education students in a teacher preparation program in community

colleges located in southeastern Texas. This study could be replicated using a random sample of prospective teacher education programs nationally making the results generalizable to a larger prospective teacher education population.

2. This study could also be replicated for prospective students entering other professional organizations, colleges, and universities.
3. A research study to identify technology instructional methods that would be useful to teacher education educators in preparing prospective teacher education students to use technology in the classroom with their future students may be beneficial.
4. Technology implementation could be examined using higher-level thinking skills, e.g., evaluation, synthesis, and analysis. For example, a research study could be conducted using a multi-item scale to measure higher-level thinking skills of prospective teacher education students' use of technology.
5. Further examination needs to take place regarding the relatively low proficiency level in technology use for database, ethical use understanding, and spreadsheet found in this study among prospective teacher education students.
6. Further examination also needs to take place to determine how technology-mediated instructional strategies involving simulation

(computer-based) and computers for synchronous communication regarding this study can be more effective teaching tools.

Summary

Technology continues to change and evolve. New technologies that have become more prevalent in our global knowledge and information age society include include interactive media, virtual reality, and artificial intelligence. Predicting the latest and greatest technological advance has proven to be difficult when it comes to the nature of technology. It is also difficult to predict how these new technologies will be utilized for learning in new and innovative ways. Teachers need to be privy to the latest technological advances and create lines of communication with peers to share ideas. However, it is time to examine teacher preparation and education programs to insure our future teachers graduate from these programs being able to practice their skills and incorporate the best technologies available in their classrooms.

Instructional technology can provide powerful tools for student learning, but their value depends upon how effectively teachers use them in teaching and learning. Well-trained, competent, and confident teachers are necessary to be able to integrate various technologies proficiently. However, “telling students about what is possible is not enough; they must see technology used by their instructors, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these tools effectively in

their own teaching" (The Office of Technology Assessment, 1995, p. 185).

In teacher preparation programs, the pendulum is moving from only offering separate technology courses to infusing technology into pedagogy courses throughout the programs. Community colleges have the challenge in preparing prospective teachers to effectively integrate technology to enhance the learning process. Technology in teacher preparation needs to be threaded throughout the program which will allow students to analyze the world, access information, interpret and organize their personal knowledge, and represent what they know to others (Reeves, 1998). As technology is integrated throughout the program for prospective teacher education students in community colleges, students will learn how to apply technology to teaching and learning within their field of study.

Teacher education students have opportunities to access and acquire knowledge through various formats. Opportunities to exchange ideas and opinions, solve problems, create, innovate, and express themselves through the skillful use of a variety of technologies also exist. As computers, software, and materials are integrated, physically as well as in their use, into methods classes or other classes (Dipietro, 2004), prospective teacher education students are better able to learn to be technologically proficient teachers.

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APPENDIX A

14618 Geronimo Lake Court
Houston, Texas 77047

September 9, 2004

Project: Dissertation Research

Topic: *Preparing Prospective Teacher Education Students at Two-year Postsecondary Institutions: An Assessment of Proficiency in Technology Usage*

Researcher: Pamela Cavenall, Doctoral Candidate, Texas A&M University

Participant Institution:

To Whom It May Concern:

I am completing a doctoral dissertation at Texas A&M University entitled "Preparing Prospective Teacher Education Students at Two-year Postsecondary Institutions: An Assessment of Proficiency in Technology Usage". I recently received approval on my dissertation proposal, and hope to begin data collection this fall. My research will focus on instructional technology being used at community colleges and how this technology is integrated into classroom instruction for prospective teacher education students to be proficient in technology usage.

I am writing to request your permission to contact students and to administer a questionnaire to students who are considering teaching as a profession. The questionnaire takes approximately 15 minutes to complete. Your support in this endeavor is greatly appreciated. If this meets with your approval, please sign this letter below and keep the enclosed copy for your records. Thank you very much for your attention to this matter.

Sincerely,

Pamela Cavenall

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

Institutional Representative: _____ Date: _____

APPENDIX B

Informed Consent Form for Prospective Teacher Education Students

Preparing Prospective Teacher Education Students at Two-year Postsecondary Institutions:
An Assessment of Proficiency in Technology Usage

I have been asked to consent to participate in a research study to investigate prospective teacher education students' proficiency in technology usage.

1. I have been given an explanation of the procedures to be followed, which includes my completing a Prospective Teacher Education Student Survey. The survey takes approximately 20 minutes to complete. I understand that the survey will enable the researcher to assess what type of instructional technology is being used at two-year postsecondary institutions (community colleges) and how this technology is integrated into classroom instruction for prospective teacher education students to be proficient in technology usage. Approximately 100 people have been asked to participate in this study. I was selected to participate because I am a student at a Texas community college.
2. I have been offered an answer to any questions I have concerning the procedures.
3. I am aware that this information is for doctoral dissertation purposes and may be available to the general public in the form of conference presentations, journal articles, newspaper articles, or in books. I will not be personally identified in any reports.
4. I understand that I am free to drop out of the research study at any time, without penalty. If I drop out of the study, my data will be included in aggregate form in the dissertation but will not be included in any other reports. If I am asked any questions that make me uncomfortable, I may refuse to answer, without penalty.
5. I have been assured that steps will be taken to ensure confidentiality of my answers. My answers to these questionnaires will be available only to Pamela Cavenall and members of her dissertation committee. Results will be reported only for group data and not for individuals.
6. I understand that participation in this study poses no risk. The individual information gathered during the study will not be shared with my instructors or peers.
7. I have been given a copy of this informed consent form for my own review.

"I understand that this research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 845-8585 (mwbuckley@tamu.edu)."

Please indicate your decision by placing a check in the appropriate place:

_____I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

_____I do not consent to participation in this study.

_____	_____
Signature	Date
_____	_____
Pamela Cavenall - researcher pcavenall@yahoo.com; (713) 734-6014	Date
_____	_____
Dr. Norvella Carter: Committee –Co-Chair ncarter@tamu.edu; (979) 862-3802	Dr. Stephanie Knight: Committee-Co-Chair s-knight@tamu.edu; (979) 862-2008
_____	**_____**
Date	**Date**

APPENDIX C

Prospective Teacher Education Student Survey

The purpose of this survey is to assess your skills in the use of instructional technologies. The information you provide will help the teacher preparation program to decide what kinds of activities should be implemented to assist future teachers to acquire better technology skills before they enter the classroom.

I. BACKGROUND

*Course Name:*_____ *Community College:*_____

*Major:*_____

*Semester:*_____ *Year:*_____

Sex: M F

Ethnicity: Black Hispanic White Asian Native American Other

Do you intend to transfer to a four-year university? Y N Undecided

Do you intend to enter the teaching profession? Y N Undecided

How many technology courses have you taken at the community college? _____

Do you agree to participate in the study? Y N
(Please sign informed consent)

II. TECHNOLOGY PROFICIENCY

Please respond to each of the following items. Check the circle next to the number of the level that corresponds to your current level of technology use. For example, checking Level 3 indicates that you are proficient in the skills indicated in previous levels as well as the skills in Level 3.

1. ***Basic Computer Operation***
   - *o* Level 1 - I do not use a computer
   - o Level 2 - I can use the computer to run a few specific, pre-loaded programs. It has little effect on either my work or home life. I am somewhat anxious I might damage the machine or its programs.
   - o Level 3 - I can set up my computer and peripheral devices, load software, print, and use most of the operating system tools like the scrapbook, clock, notepad, find command, and trash can.
   - o Level 4 - I can run two programs simultaneously, and have several windows open at the same time. I can customize the look and sounds of my computer. I use techniques like ALT-TAB to work with multiple programs. I look for programs and techniques to maximize my operating system.

2. ***Email Use***
   - o Level 1 - I do not use electronic mail, nor can I identify any uses or features they might have which would benefit the way I learn.
   - o Level 2 - I send occasional requests for information and messages using e-mail – mostly to friends and family.
   - o Level 3 - I use e-mail on a regular basis and/or participate in online e-mail discussions via listserves.
   - o Level 4 - I involve others in using e-mail and listserves to communicate with others regardless of location.

3. ***Web Browser Operation & Internet***
   - o Level 1 - I do not use the Web, nor can I identify any of its uses or features that would benefit the way I learn.
   - o Level 2 - I use Web searching software and other Internet resources to locate important sources of information.
   - o Level 3 - I am able to use Web searching software as well as lists of Internet resources to explore educational resources.
   - o Level 4 - I can create my own HTML pages and hot-lists of resources.

4. ***Information Searching***
   - o Level 1 - I am unlikely to seek information when it is in electronic formats.
   - o Level 2 - I can conduct simple searches with the electronic encyclopedia and library software for major topics.
   - o Level 3 - I have learned how to use a variety of search strategies on several information programs, including the use of “logical operators” such as “and” and “or” to help target the search and find just the right information in the most efficient manner. I can use search engines like Infoseek, Excite, Lycos, Google, and Web Crawler.
   - o Level 4 - I have incorporated logical search strategies with others, showing them the power of such searches via the internet.

5. ***Presentation Skills***
   - Level 1 - After completing a project, I am unlikely to use electronic technologies to save, format, or share my findings.
   - Level 2 - I would feel comfortable presenting my project in a single application program, such as a word processor, a spreadsheet or a publishing program.
   - Level 3 - I am proficient at incorporating and sharing my projects using multimedia presentation software (e.g., PowerPoint, Hyperstudio) which combine elements from a number of applications (e.g., Netscape, graphics, word processor, database).
   - Level 4 - I can use of a variety of applications to present projects.

6. ***Word Processing***
   - Level 1 - I do not use a word processor, nor can I identify any uses or features it might have which would benefit the way I learn.
   - Level 2 - I occasionally use the word processor for simple documents. I generally find it easier to handwrite or type most written work I do.
   - Level 3 - I use the word processor for nearly all my written work. I can edit, spell check, and change the format of a document. I feel my work looks professional.
   - Level 4 - I have taught others to use a word processor and often help others with formatting problems.

7. ***Spreadsheet***
   - Level 1 - I do not use a spreadsheet, nor can I identify any uses or features it might have which would benefit the way I learn.
   - Level 2 - I understand the use of a spreadsheet and can navigate within one. I can create a simple spreadsheet that adds a column of numbers.
   - Level 3 - I can use a spreadsheet for several applications. These spreadsheets use labels, formulas and cell references. I can change the format of the spreadsheets by changing column widths and text style. I can use the spreadsheet to make a simple graph or chart.
   - Level 4 - I use the spreadsheet to improve my own data keeping and analysis skills. I also use the spreadsheet to explore questions and the power of mathematical relationships.

8. ***Database***
   - Level 1 - I do not use a database, nor can I identify any uses for features it might have which would benefit the way I learn.
   - Level 2 - I understand how to use a database and can locate information within one which has been pre-made. I can add or delete data in the database.
   - Level 3 - I use databases to collect and analyze data. I can create a database from scratch, including defining fields and creating layouts in order to support inquiry. I can sort and print the information in layouts which are useful to me.
   - Level 4 - I can use formulas with my database to create summations of numerical data. I use the database to gather and analyze data to explore questions.

9. Graphics Use

- o Level 1 - I do not use graphics in my word processing or presentations, nor can I identify any uses or features they might have which would benefit the way I learn.
- o Level 2 - I can open, create, and place pictures into documents using painting and drawing programs.
- o Level 3 - I can open, create, modify, and place graphics into documents in order to help clarify projects.
- o Level 4 - I can manipulate and interpret graphics using image processing software (such as CAD, GIS or Photoshop) for the purpose of design or analysis.

10. Ethical Use Understanding

- o Level 1 - I am not aware of any ethical issues surrounding computer use.
- o Level 2 - I know that some copyright restrictions apply to computer software.
- o Level 3 - I clearly understand the difference between freeware, shareware, and commercial software and the fees involved in the use of each.
- o Level 4 - I am aware of other ethical issues involving technology use including medical and equitable access ones. I have a personal philosophy I can articulate regarding the use of technology.

III. TECHNOLOGY-MEDIATED INSTRUCTIONAL STRATEGIES

Which of the following activities did you experience at the college and how effective for your learning did you think the activities were? First circle the number next to each strategy listed that indicates the extent to which you experienced it. Then circle the number corresponding to your opinion of the effectiveness of the strategy for your own learning. If you are not familiar with a technology, please check the box in the first column "Don't know what this is" and do not mark anything in the "How Often?" and "How Effective?" boxes.

		How often?				How effective?			
	Don't Know What This Is	***Never***	**Sometimes**	Often	Almost Always	Ineffective	Somewhat Effective	Effective	Very Effective
1.	internet for educational purposes (by teacher)	1	2	3	4	1	2	3	4
2.	internet for educational purposes (by students)	1	2	3	4	1	2	3	4
3.	presentation software (e.g. Power Point) by teacher	1	2	3	4	1	2	3	4
4.	presentation software (e.g. Power Point) by students	1	2	3	4	1	2	3	4
5.	multimedia presentations (e.g. DVDs, VCRs, slide projectors) by teacher	1	2	3	4	1	2	3	4
6.	multimedia presentations (e.g. DVDs, VCRs, slide projectors) by student	1	2	3	4	1	2	3	4
7.	computers for communication (asynchronous)*	1	2	3	4	1	2	3	4
8.	computers for communication (synchronous)**	1	2	3	4	1	2	3	4
9.	computers for drill and practice	1	2	3	4	1	2	3	4
10.	spreadsheets (eg. ExCEL, Lotus)	1	2	3	4	1	2	3	4
11.	word processing	1	2	3	4	1	2	3	4
12.	simulation (computer-based)	1	2	3	4	1	2	3	4

*refers to communication such as email that does not require both parties to be online at the same time
**refers to communication such as chat rooms that is based on simultaneous interaction

IV. TECHNOLOGY PERCEPTIONS

Please respond to each of the following items. Check the circle next to the number of the level that corresponds to your perceived level of preparedness to implement technology skills.

1. Computer applications
   - o I am not at all prepared to assign work using computer applications such as word processing or spreadsheet.
   - o I am somewhat prepared to assign work using computer applications such as word processing or spreadsheet.
   - o I am well prepared to assign work using computer applications like word processing or spreadsheet.
   - o I am very well prepared to assign work using computer applications such as word processing or spreadsheet.

2. Internet correspondence
   - o I am not at all prepared to assign work that involves corresponding with experts, authors, students, etc via e-mail or Internet.
   - o I am somewhat prepared to assign work that involves corresponding with experts, authors, students, etc via e-mail or Internet.
   - o I am well prepared to assign work that involves corresponding with experts, authors, students, etc via e-mail or Internet.
   - o I am very well prepared to assign work that involves corresponding with experts, authors, students, etc via e-mail or Internet.

3. Presentation skills
   - o I am not at all prepared to present materials graphically (PowerPoint, Hyperstudio, VCRs, DVDs, etc.)
   - o I am somewhat prepared to present materials graphically (PowerPoint, Hyperstudio, VCRs, DVDs, etc.)
   - o I am well prepared to present materials graphically (PowerPoint, Hyperstudio, VCRs, DVDs, etc.)
   - o I am very well prepared to present materials graphically (PowerPoint, Hyperstudio, VCRs, DVDs, etc.)

4. Information searching
   - o I am not at all prepared to assign work that incorporates search strategies using the Internet.
   - o I am somewhat prepared to assign work that incorporates search strategies using the Internet.
   - o I am well prepared to assign work that incorporates search strategies using the Internet.
   - o I am very well prepared to assign work that incorporates search strategies using the Internet.

5. Practice drills
   - o I am not at all prepared to assign computer work for drill and practice.
   - o I am somewhat prepared to assign computer work for drill and practice.
   - o I am well prepared to assign computer work for drill and practice.
   - o I am very well prepared to assign computer work for drill and practice.

6. Classroom instruction
    - o I am not at all prepared to use computers and the Internet for classroom instruction.
    - o I am somewhat prepared to use computers and the Internet for classroom instruction.
    - o I am well prepared to use computers and the Internet for classroom instruction.
    - o I am very well prepared to use computers and the Internet for classroom instruction.

VITA

Name:	Pamela Elaine Rogers Cavenall
Address:	Crossroads Alternative Technology School, 12360 Bear Ram Road, Houston, TX, 77072
Email Address:	Pamela-elaine-cavenall@neo.tamu.edu
Education:	B.S., Biology, Stephen F. Austin State University, 1992 M.S., Biology, Stephen F. Austin State University, 1996