PRE-SERVICE TEACHER'S PERCEPTIONS OF STUDENT-CENTERED APPROACH TO INTEGRATING TECHNOLOGY IN CONTENT AREAS

by

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Dedication

This dissertation is dedicated to my mother, Dorothy L. Cyrus (1921–2003) and to my two daughters, Dayna Keniece-Rolyn and Robyn Kimara Michawn (1967-2005). Their belief in me and their loving support always encouraged me to be ambitious and to achieve my goals. Lastly, this project would not be complete without the loving support and assistance from my friend for life and housemate for the duration of this doctorate project, Ida L. Rodgers.

ABSTRACT

This research study investigated two concerns. First, with what technology skills did pre-service teachers enter the technology applications course? The self-reported technology skills knowledge mean gain scores increased on all of the 10 subscales of the Technology Questionnaire. Secondly, what did pre-service teachers perceive their roles to be in the classroom without computer use compared to the classroom within a computer environment? The study results showed no significant difference in mean gain scores between pre-service teachers' perceptions of teacher-centered roles and their perceptions of student-centered roles in classrooms without computers. There was a significant difference for student-centeredness in environments using computers. The expectation was for there to be a shift in perspective back to teacher-centeredness when asked for choice of computer uses. However, when asked to report on their choice of computer uses in classrooms using computers, pre-service teachers maintained their student-centeredness approaches. The pre-service teachers would more likely use the computer as a student-centered tool after instruction in a learner-centered technology integration class.

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INTRODUCTION

Overview

Digital technology has become a part of a college student's daily life. Students interact with this technology on a continuous basis, from digital alarm clocks to microwave ovens, from cell phones to touch key pads at dormitory and apartment building entrances, and from digital watches to digital cameras. As the price of technology continues to drop, computers and other digital devices have become integral parts of college classrooms and curricula. The digital technologies of today bring the tools of empowerment into the hands and minds of those who can demonstrate some facility with them. Graduates of education programs are no exception. Pre-service teachers exit their training programs and graduate from colleges with the expectation that they will be hired by school districts and boards of education that are impressed with their skills in their content areas, e.g., math, science, social studies, language arts, etc. During the last decade, pre-service teachers have needed to become competent as well in the use of digital technology.

Many pre-service teachers have, indeed, learned the basics of computer technology in previous high school classes or in college courses, some of which are pre-requisites for graduation. It is common in undergraduate and graduate courses for instructors to require that term papers and projects be submitted via a text processing program. Instructors often use presentation software (or handouts from these files) to present lesson objectives and activities. Yet, digital technology, if it is integrated into the curriculum, revolutionizes the learning process (Gray, 2001). More and more studies show that technology integration in the curriculum improves students' learning processes and outcomes. When pre-service teachers were introduced to computers as problem-solving tools, it changed the way they perceived teaching (Zhiting & Hanbing, 2001). They observed that instruction can change from a behavioral approach to a more constructivist approach (Beyerbach, Walsh, & Vannatta, 2001). When pre-service teachers become engaged in their own learning, they perceive that their own students can become engaged in their learning using these powerful digital tools (Culp, Keisch, Light, Martin, & Nudell, 2003). Pre-service teachers, therefore, need to experience becoming proficient with integrating technology into their content areas not only for personal gain but because digital technology integration promotes project-based learning styles which engages students in their own learning processes. In this kind of educational setting, students can acquire and use higher-order thinking, analysis, and problem-solving, and they take responsibility for their own learning outcomes. Teachers can become a guide and facilitator, e.g., “a guide from the side,” rather than “a sage from the stage” (King, 1993). Digital technology lends itself as the multidimensional tool that assists this learning process; and when pre-service teachers learn how to integrate digital technology into their content areas, they assist in helping the learners acquire higher-order thinking skills, whereby the learners become constructors of their own knowledge (Yost, McMillan-Culp, Bullock, & Kuni, 2003).

Statement of the Problem

Pre-service teachers emerge from educational programs with sufficient instruction in their content areas. Although technology use has increased during the past decade, it has not kept abreast within academia and particularly for elementary school-age educators (Bielefeldt, 2001); (Brush et al., 2003). Teaching standards for using technology for teacher education have been endorsed by the National Council for Accreditation of Teacher Education (NCATE, 2000, 2002, 2003 2003 #673)), the Texas Education Association (T.E.A.) [http://www.tea.state.tx.us/teks/], and the International Society for Technology in Education (I.S.T.E.) [http://cnets.iste.org/ncate/] organizations. They have adopted technology standards that graduating elementary educators should attain prior to graduation from college and certification to teach. However, many pre-service teachers do not feel comfortable incorporating technology into their content areas (Carlson & Gooden, 1999b); (Lumpe & Chambers, 2001); (Jones, 2002)). The concern for this study is whether or not pre-service teachers will perceive that they will be able to incorporate the technology into their content areas using student-centered activities after completing a one-semester technology applications course.

Previous research with pre-service teachers integrating technology into their content areas focused on students' perceptions of their abilities to use digital technology. Minimal research attention has been directed toward using a task-based or problem-solving approach with technology integration classes (Beyerbach et al., 2001; Zhiting & Hanbing, 2001). A review of the literature indicates that technology coursework can change pre-service teachers' attitudes toward and confidence with technology (Abbott & Faris, 2001; Molebash & Milman, 2000; Rizza, 2000). Technology courses can also provide the pre-service teachers with skills that they did not previously possess. However, the literature also suggests that one course alone is probably insufficient to change teachers' practice either immediately or over time (Cuckle, Clarke, & Jenkins, 2000). Furthermore, research indicates that pre-service teachers revert from the preferred student-centered pedagogy to the less-preferred teacher-centered pedagogy when tested on their preference of computer uses (Wang, 2002b).

Existing studies of pre-service teachers report both qualitative and quantitative results that focused on teaching the skills of technology tools and not the integration of the technology into the content areas. Pre-service teachers exited technology courses and workshops with little confidence in their abilities to integrate the newly-learned skills into their curricula areas (Medcalf-Davenport, 1998; Whetstone & Carr-Chellman, 2001). This research study proposes to ascertain: (a) what the technical abilities of the pre-service teachers are upon entering the technology applications class, (b) whether these pre-service teachers perceive that they will be able to integrate technology into their content areas after completing the technology applications course, and (c) whether the technology applications course, using a constructivist framework for teaching and learning, will make a difference in their perceptions about using technology to create student-centered activities with digital technology.

By examining this area of research about the technology integration perceptions of pre-service teachers, faculty and administrators of education programs, especially methods course faculty, can prepare prospective teachers better for the integration of technology into the content areas. Specifically, knowledge about pre-service teachers' abilities and how the technology applications can impact their perceptions about the teaching and learning process is important. This research will provide insight into the concerns about how prepared these students are to incorporate technology and whether or not, after a semester-long course, they perceive that they will be able to incorporate their technical skills into a student-centered learning environment. The results of this study are important primarily because knowledge about the perceptions of pre-service teachers will provide educational technologists and education administrators with information about how to design curricula appropriate for the digital technology incorporation needed for modern K-12 classroom instructors.

Background to the Problem

During the late 1990s, researchers observed that pre-service teachers reported little opportunity to see technology use modeled in a college classroom setting by university faculty or in a student-teaching setting by supervising teachers (Marcinkiewicz, 1995, 1998). About half of the practicing teachers responding to survey inquiries reported not using computers for teaching, but that almost all of the pre-service teachers expected to use computers for teaching (Carlson & Gooden, 1999; Carlson & Gooden, 1999a). Indeed, preliminary results showed that very little had actually changed in the attitudes of teachers toward the uses of technology in the classroom even after a technology skills course was taken (Medcalf-Davenport, 1998). Many states still were not requiring a technology integration course for pre-service teachers, although the majority of all states (71.6%) did require their pre-service teachers to take a technology course prior to taking teaching methods courses (ITRC, 1998). According to this 1998 report of the respondents to the survey, all of the Florida institutions did require technology integration courses, and it was the only state reporting 100% requirement. In Virginia 50% of the educational institutions required the technology integration course, whereas in South Carolina only 55.6% did so, with Mississippi listing only 40% that did likewise (ITRC, 1998). Given such dismal statistics for the end of the twentieth century, researchers gathered data to discern how to upgrade the technology skills of emerging pre-service education students.

By the end of the century, many institutions began to integrate technology skills along with methods courses, institutions such as Vanderbilt, the University of Virginia and Arizona State University (Glazewski, Brush, Ku, & Igoe, 2002). Researchers discovered that with the intervention of a technology integration course, pre-service teachers' attitudes about technology use changed (Pepper, 1999; Yildirim, 1999), comfort and confidence levels with technology improved over time after technology instruction (Christensen, 1997; Ropp, 1999), and that pre-service teachers had more positive perceptions of the effectiveness of technology resources in improving education (Huang & Padron, 1999). Results from international researchers discovered similar results in instructional settings as disparate as Canada (Doiron, 1999; Hannaford, 1999; Ross, Hogaboam-Gray, & Hannay, 1999), Spain (Hidalgo, Lu, & Miller, 2000), Guam (Wang, 2000a), and China (Zhiting & Hanbing, 2001). There seems to be ample evidence and little doubt that education program administrators and pre-service teachers believe that "technology is a necessary and beneficial component in higher education programs, or that students can learn better if technology is used effectively" (Cassady & Pavlechko, 2000).

So the issue facing researchers is not how and what technology to teach pre-service teachers; it is how to teach them to integrate technology into the curricula. The major implication is that although computers are seen as important, pre-service teachers were not preparing themselves to implement the technology successfully and powerfully into classrooms (Whetstone & Carr-Chellman, 2001). In fact, teachers' practices were often based more on their own personal beliefs about teaching than on the best practices described in the literature (Ertmer, Gopalakrishnan, & Ross, 2000). A change in the perception of technology use in the classroom requires a change in the perception of the learners' role in his/her own learning. Changing pre-service views of technology infusion from thinking that they would teach and learn about technology, some researchers suggest, to thinking they would use technology to support student learning (Beyerbach et al., 2001) would be the optimal teaching strategy. For example, students were not always able to transfer their skills to use in the classroom, although they often used technology in preparing both classroom materials and assessing coursework (Cuckle et al., 2000). Quite often, pre-service teachers perceived that they were likely to engage in teacher-centered activities and student-centered activities on an equal basis when teaching in classrooms with computers. "Nevertheless, when tested on their choice of computer uses, pre-service teachers shifted to teacher-centered computer uses" (Wang, 2001). In order to equip pre-service teachers with the necessary skills to incorporate the digital technology fully into their future classrooms (El-Amin et al., 2002), technology integration training courses should support student-centered constructivist teaching pedagogy and explicitly address pre-service teachers' delivery methods Wang (Wang, 2000b, 2002b).

Context of the Problem

In the teaching program for this study, the format followed was that the pre-service teachers took the necessary course work to understand learning theories and practices that provided them with a deeper understanding of the teaching and learning profession. These courses were known as 'methods' courses. This process included a set sequence of courses, called blocks. Pre-service teachers completed Block #1 in the first semester of their junior year and Block #2 in the second semester of their junior year. Block #3 was usually completed in the first semester of the senior year and Block #4, the actual student teaching placement, usually occurred during the last semester of the senior year. A course in technology applications was usually taken within Blocks #1 through Block #3. Once the background had been provided, via the methods courses, student teachers were placed in classrooms with veteran teachers to learn further the profession of teaching and learning. It was usually preferable for the integration of multimedia and technology into a program to come at the forefront of the educational process, during Block #1, and subsequently with advisor consent, during Block 2 and Block 3.

The course framework of choice for this study was the course format offered by INTEL®'s Teach to the Future (ITF), a course format created to support the professional development initiative and focus on improving K-12 pre-service teachers' integration of technology into their classrooms (Culp et al., 2003). The ITF curricula supported problem-based, task-based, and student-centered learning frameworks.

Technology integration was defined for this study as the use of digital technology resources such as, computers, digital cameras, hand-helds, CD-ROMs, software applications, the Internet, etc., in the daily lesson activities in a classroom and in the management of the curriculum. It was the transparent use of these digital tools that demonstrated the integration process. It was integration when the use of technology was routine, not the exception. Technology integration occurred when a learner didn't stop to think that s/he was using a computer or researching via the Internet, or that the project needed graphics to help illuminate the main points (Harris, 2002-3). When integrated effectively into curriculum, digital technology tools could extend learning in powerful ways. These digital tools, along with an Internet-connected computer and multimedia applications, could provide learners and teachers with access to current primary and secondary resources and opportunities for collaborating with other learners, instructors and field experts in various parts of the world.

The ITF curriculum was the course framework used as the intervention for this research design (See Appendix A). The course criteria were based upon the ITF principles of using 'essential questions' to frame problem-based projects for the pre-service teachers, who in turn, designed problem-based projects for their prospective students.

Purpose of the study

Elementary pre-service teachers (ECE to 4) entered the technology applications course in the first semester of their junior year, in Block 1. Sometimes Grade 4 to 8 pre-service teachers were not able to fit the technology applications course into their schedule until the second semester of the junior year, Block 2, or as late as the first semester of their senior year, in Block 3 of the program. While a pre-requisite technology course was encouraged, it was not a requirement. So the pre-service teachers entered the technology applications course with a variety of technology experiences. This study wished to ascertain how comfortable the pre-service teachers were with using several different kinds of software: text processing, communications (such as e-mail, chat rooms, etc.), publishing, presentation, browser/World-wide Web, data analysis, programming/coding, and action/role-playing games (RPGs). College students are usually the most knowledgeable about and comfortable with text processing programs and with sending and receiving e-mail. Demographic information retrieved from the Technology Questionnaire [http://educdata.data.ttu.edu/jcyrus/index.asp] would offer information concerning what software comfort the pre-service teachers possessed when they entered the technology applications course. Research question #1 addressed the concerns about how knowledgeable the pre-service teachers felt about various applications. The three research questions for this design were as follows:

(1) Were there differences in self-reported technology efficacy (TQ) in pre-service teachers based on educational level and teaching experience?
(2) Were there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TC) versus student centeredness (SC) in classrooms without computer availability?
(3) Were there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TCC) versus student centeredness (SCC) in classrooms using computers?

Given these guiding research questions, the purpose of this study was to investigate the following overall research topic: In what ways did the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (TC compared with TCC and SC compared with SCC) change while using the theoretical framework of a learner-centered constructivist approach to curriculum and instruction during their semester-long course of integrating technology into the content areas?

Limitations and Constraints of the Study

Efforts were been made to give technology integration instruction to all education majors, including secondary, masters' degree, and post-baccalaureate students. However, only early childhood education (ECE), elementary and middle school education majors (Grade 4 to 8) enrolled in the required technology applications course that taught technology integration, 'Applications of Technology in Elementary Education'. This study focused on these pre-service teachers; consequently, the results might not be generalizable to pre-service teachers in other disciplines and at other levels. Additionally, because the pre-service teachers were not randomly selected from the population of education majors, the results might not be generalizable to all teacher education populations. Therefore, this study purported to assess the impact on pre-service perceptions of technology integration within a semester-long technology application course with only those learners who were instructed on how to incorporate technology into their content areas using student-centered activities.

Chapter #1 Summary

Pre-service teachers exit their training programs and graduate from colleges with the expectation that they will be hired by school districts that are impressed with their skills in their content areas -- science, social studies, language arts, etc. With the introduction of computers into the education curriculum, school administrators have begun to look for additional technological experience in their new-hires. During the last decade, pre-service teachers have needed to become competent in the use of technology in combination with their skill areas. The topic for this research study was the area of pre-service teachers integrating technology into their content areas.

Successful integration of technology into the established methods courses, however, required more than mastering a suite of programs to complete an assignment. A significant amount of research showed that teacher-education technology courses and programs had a limited impact on how teachers thought about and implement technology supported teaching. Teacher educators, including program administrators and educational technologists, need to be able to facilitate the learning by pre-service teachers so that the learning process can incorporate the understanding and integration of technology successfully into curricula. For this project, I examined the research problem of what pre-service teachers perceived their roles to be in the classroom without computer use and in the classroom within a computer environment.

Glossary

Constructivism— theory of learning that assumes knowledge does not exist independent of the learner, and that knowledge is constructed. (Piaget, 1970); (Vygotsky, 1978). Constructivism can be viewed as the polar opposite of Objectivism along a continuum (Vrasidas, 2000).

Information technology — includes traditional computer applications (computer-assisted instruction — CAI, tools) and communication tools such as e-mail and World-wide Web (www) resources

Information communication technology (ICT) refers to a range of digital technologies, data types, and their associated distributive technologies.

In-service teachers — practicing teachers

Intel Teach For The Future (ITF) — a set of instructions designed to meet the technology goals of NCLB (No Child Left Behind) by ensuring that teachers are equipped to integrate technology into a standards-based curriculum in order to improve teaching and student achievement (Harris, 2001)

Pre-service teachers — students in a teacher education preparation program

Self-efficacy — encompasses beliefs by an individual in his or her capabilities to organize and execute a course or courses of action that will result in achievement of an intrinsic goal or objective (Bandura, 1997)

Student-centeredness — an approach to instruction in which students have considerable say in the issues they address and how to address them (Ormrod, pg. 430); students make meaning and develop insight while the teacher shows them how to navigate and reason through the labyrinth of new sources, as the “guide at the side”

Teacher-centeredness — a strategy in which the teacher calls most of the shots, choosing what topics will be addressed, directing the course of the lesson, etc. (Ormrod, pg. 430)

Technological efficacy — the use of digital technology resources such as, computers, digital cameras, hand-helds, CD-ROMs, software applications, the Internet, etc., in the daily lesson activities in a classroom and in the management of the curriculum

Technology integration — the process of determining which electronic tools and which methods for implementing them are appropriate for given classroom situations and problems (Roblyer, 1997), pg. 8)

CHAPTER 2

REVIEW OF LITERATURE

Overview

The designs and creations of technology application courses for pre-service teachers are based upon learning theories, instructional design methods, and instructional models. This chapter is a review of literature that supports the research principles used to create and assess technology application integration for pre-service teachers in the following sections: (a) pre-service teacher technology skills standards, (b) learning frameworks, (c) instructional design models, (d) instructional methods, (e) taxonomy for technology integration, (f) theory to practice – a model for integration, and (g) the statement of the research problem.

The underlying assumption of the literature review will be that the instructional and procedural models and instructional design methods are based upon established learning theories (See Figure 2.1). Instructional models, such as the ASSURE model, are constructed in the systematic approach within an instructional design method, such as ADDIE, whose foundations are based upon learning theories, such as behaviorism, cognitivism, and constructivism.

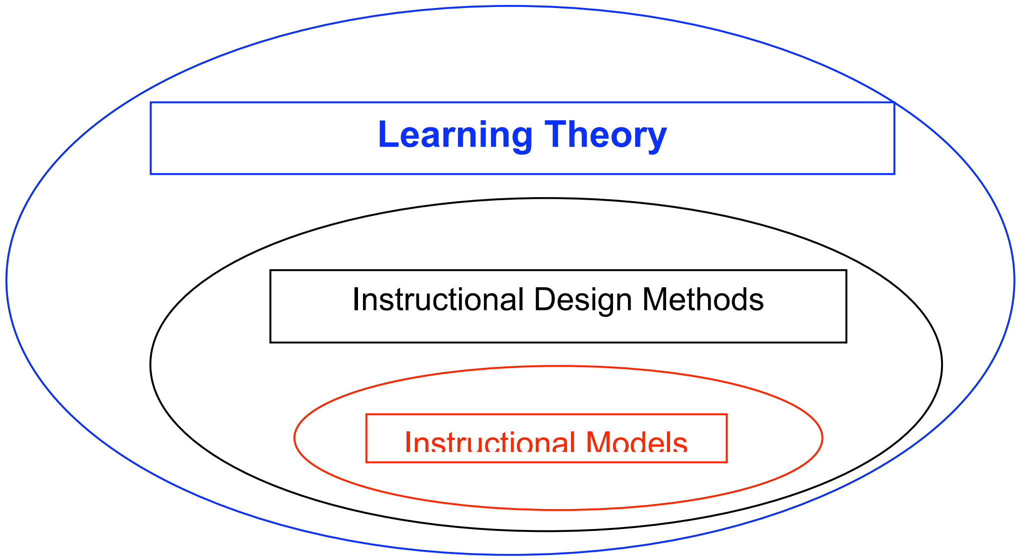


Figure 2.1. Graphical Representation of Learning Theory, Instructional Design Methods and Instructional Models

Pre-service teacher technology skills standards

The National Council for Accreditation of Teacher Education (NCATE) governs teacher preparation programs. Technology application instructions within these programs for pre-service teachers are guided by standards suggested by the International Society for Technology in Education (ISTE). The standards, National Education Technology Standards for Teachers (NETS-T), with the support of NCATE, define a template for pre-service teacher education, and by doing so, define the fundamental concepts, knowledge, skills, and attitudes for applying technology in educational settings (NCATE, 2000, 2002, 2003 2003 #673). These standards suggest that all candidates seeking certification or endorsements in teacher preparation should meet these educational technology standards (NCATE, 2002). The six standards are: (1) technology operations and concepts, (2) planning and designing learning environments and experiences. (3) teaching, learning, and the curriculum, (4) assessment and evaluation, (5) productivity and professional practice, and (6) social, ethical, legal, and human issues. The six standards areas with performance indicators are designed to be general enough to be customized to fit state, university, or district guidelines and yet specific enough to define the scope of the topic within schools and colleges of education (See Appendix B, Table 2.1). Performance indicators for each standard provide specific outcomes to be measured when developing a set of assessment tools for the learner (Lever-Duffy, McDonald, & Mizell, 2005). The standards and the performance indicators also provide guidelines for faculty and administrators currently teaching in the classroom (NCATE, 2002). These pre-service technology standards form the underlying structure for the syllabus in the technology applications course used for the design of this research project. These NETS-T standards are based upon principles derived from established learning theories. The learning theory of interest for this research design is concerned with the support of learner-centered activities performed as part of social interactions within the learning environment.

Learning Frameworks

Interaction is the key ingredient for teaching how to integrate technology within content areas. There are teacher-learner, learner-learner, and learner-content interactions, all mediated via the technology. This view of social interaction was articulated as social constructivism by the Russian philosopher, Lev Vygotsky (Vygotsky, 1978) and Albert Bandura (Bandura, 1986). These early researchers proposed that learning is a social construction (Vygotsky) and a result of group collaboration (Bandura) for a group of learners whose efforts are to construct a common core of knowledge (Lever-Duffy et al., 2005). There have been other learning paradigms such as, anchored instruction attributed to Bransford (J. D. Bransford & al, 1990; J. D. Bransford, Sherwood, & Hasselbring, 1990), which encouraged learners and instructors to pose and solve complex, realistic problems. In a like vein, Lave & Wenger (Lave & Wenger, 1990) argued for another learning paradigm which asserted that learning normally occurred as a function of an activity, context and culture in which it occurs, that is, in which it is situated.

Early modern constructivist principles have been, however, attributed to Vygotsky (1978), who proposed the foundation of social constructivism (1978) with these two strategies: the zone of proximal development (ZPD) and scaffolding. The major theme of Vygotsky's theoretical framework was that social interaction played a fundamental role in the development of knowledge. The first supporting strategy of Vygotsky's theory was the idea that the potential for knowledge development occurred within a certain time span, which he called the `zone of proximal development' (ZPD), whereby challenging tasks promoted maximum cognitive growth. Students have different zones of proximal development within different tasks; therefore, the strategy suggested that teachers design some tasks that learners could perform successfully only with the assistance of others (Ormrod, 2003). Additionally, full knowledge development during the ZPD depended upon full social interaction. Therefore, the range of skills that could be developed with additional guidance or peer collaboration should exceed what could be attained alone. Scaffolding, the second strategy, was a way of building support as the learner performed the tasks within their individual zone of proximal development. As learners developed increasing competence, the scaffolding support mechanisms were gradually withdrawn, eventually allowing learners to become independent and self sufficient (Ormrod, 2003). Utilizing these two strategies, teachers could facilitate group projects within technology application courses.

Instructional Design Model

Building upon the theoretical principles of social constructivism, the ADDIE instructional design model was used as reference for the underlying structure of the proposed framework for instruction by educational technologists to create effective schema and systematic approaches to design and develop instructional design models.

ADDIE

The “ADDIE” instructional design model is a colloquial term used to describe a linear, but systematic approach to instructional development (Molenda, 2003). The model seems not to have a single author, but rather it seems to have evolved informally through oral tradition (Gustafson & Branch, 2002). It is not a specific, fully elaborated model in its own right, but rather an umbrella term that refers to a family of models that share a common underlying structure and intent, that is, to develop and design a formal system for the design of instruction. ADDIE is an acronym referring to the major processes that comprise this generic process: analysis, design, development, implementation, and evaluation.

In the analysis stage of the instructional design, the learning deficiencies are ascertained. This information is used to scaffold the subsequent output in the form of learning objectives. Where the deficiencies occur, learning objectives are created in order to formulate the instructional plan. Within the design phase of the ADDIE model, the creation of the content in consort with the learning objectives are used as a blueprint to sequence the instructional methods and materials. The development component of the instructional design model offers steps to convert the sequences into instructional materials and procedures to be used by the learners. Implementation of the materials and procedures are accomplished in this stage of the instructional design. The final stage of the instructional design model, evaluation, can include summative evaluation input that support revision decisions. Formative assessment can occur at any of the stages of the design, thereby, offering an opportunity for revision (Gustafason & Branch, 2002).

Instructional Methods

Once the theoretical foundation and systematic instructional plans have been formulated, procedural methods for designing instructions include the taxonomy of learning, devised by a team of psychologists. A systematic approach to delivering the instruction is proposed by the ASSURE model of instruction.

Taxonomy of Learning

The taxonomy of learning, created by a group of psychologists from the University of Chicago (Bloom et al, 1956) has been utilized for categorizing the level of intellectual behavior important in learning. The group of researchers originally separated the levels of thinking and learning into six competency categories. The levels of competency are listed from least complex, e.g., simple recall or recognition of facts, through increasingly more complex and abstract mental levels, to the highest order -- knowledge, comprehension, application, analysis, synthesis, and evaluation. The taxonomy provides a useful structure in which to categorize stages of development within an academic process, such as classroom assignments or learning with a specific tool or technology skill (See Table 2.2).

Table 2.2: Taxonomy of Learning – Bloom et al (1956)

Level	Skills Demonstrated	Sample Prompts
Knowledge	- a starting point that includes both the acquisition of information and the ability to recall information when needed	arrange, collect, define, duplicate, describe, examine, identify, label, list, memorize, name, order, quote, relate, recall, repeat, reproduce, show, tabulate, tell
Comprehension	- the basic level of understanding that involves the ability to know what is being communicated in order to make use of the information	classify, contrast, describe, differentiate, discuss, distinguish, explain, express, estimate, explain, extend, identify, indicate, interpret, locate, predict, report, review, summarize, translate
Application	- the ability to use a learned skill in a new situation	Apply, calculate, change, choose, classify, complete, demonstrate, dramatize, examine, employ, illustrate, interpret, modify, operate, practice, schedule, sketch, solve, use, write
Analysis	- the ability to show relationships, to predict and draw	analyze, arrange, appraise, calculate, categorize, compare, connect, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, infer, order, question, separate, test
Synthesis	- the ability to combine existing elements in order to create something original	arrange, assemble, collect, combine, compose, construct, create, design, develop, formulate, generalize, integrate, invent, manage, modify, organize, plan, prepare, propose, rearrange, rewrite, set up, substitute, what it?, write
Evaluation	- the ability to make a judgment about the value of something by using a standard	appraise, argue, assess, attach, choose, compare, conclude, convince, decide, defend, discriminate, estimate, evaluate, grade, judge, measure, predict, rank, rate, recommend, select, summarize, support, test, value

<u>ASSURE</u>

The ASSURE model of instructional delivery (Smaldino, Moreno, Heinich, Russell, 2005) offers a systematic plan for effective incorporation of media and technology into lesson activities. (Smaldino, 2005, p. 49). The ASSURE model puts a heavy emphasis on active student engagement in the planned learning activities. ASSURE is an acronym for the six steps of the planning model, described as follows: analyze learners, state the objectives, select methods, media, and materials, utilize media and materials, require learner participation, and evaluate and revise.

Comparison of learning theory, instructional methods and models

The procedures for implementing instruction are incorporated within the taxonomy of learning instructional model, itself incorporated with the design principles of the ADDIE instructional design model, which is situated with the theoretical framework of constructivist learning theory of social constructivism (See Figure 2.1). The theoretical design and instructional models and methods of delivery for this research project suggested the framework for assisting learners in creating meaningful learning goals that were consistent with educational objectives and professional standards. The stage of learning within the ZPD was consistent with the first three stages in the ADDIE instructional design model and the first three procedures of the ASSURE instructional model (See Table 2.3). Additionally, the scaffolding stage of constructivist learning is consistent with the implementation stage of the ADDIE instructional design model and the first five stages within the taxonomy of learning. Likewise, the scaffolding coincides with the ‘utilize’ and ‘require learner participation’ stage of instruction in the ADDIE model. Finally, the ADDIE model, taxonomy of learning, and ASSURE models all require an evaluation stage of instruction, which is absent from the social constructivist schema.

Table 2.2: Comparison of Learning Theory with Models of Instructional Design and Methods of Instructional Implementation

Learning Theory (Constructivist; Vygotsky, 1978)	Instructional Design Model (ADDIE)	Instructional Method (Taxonomy of Learning; Bloom et al, 1956)	Procedural Method (ASSURE; Smaldino et al, 2005)
Proximal Zone of Development	A – analysis		A – analyze
	D – design D – develop		S – state objectives S – select media
	I – implementation	K – knowledge C – comprehension	U – utilize
Scaffolding		A – application A – analysis S – synthesis	R – require learner participation
	E – evaluation	E – evaluation	E – evaluate and revise

<u>Taxonomy for Technology Integration</u>

What technology tools should pre-service teachers learn in order to integrate technology into their content areas? A set of suggested standards (NETS-S, 2003) have been proposed the National Educational Technology Standards in conjunction with (See Appendix B). A growing body of information asserts that students must be able to work with evolving technology applications which has changed the focus of classroom instruction (Jones, 2002). Technology instruction, therefore, must build on basic skills so that students learn how to find, access, and assess information to address various academic issues, some of which are yet to be defined (Kellenberger, 1997). Several versions of taxonomies for technology integration have been proposed (Levin, 1999); (Bledsoe, 2002; Bruce & Levin, 1997); (Tomei, 2003) that offer faculty, administrators and teachers ways of assessing the various steps necessary in becoming proficient with classroom activities involving technology use. A taxonomy can be a productive step in the process of understanding and explaining what researchers and administrators can utilize by organizing perceptions about technology use into categories that can be useful in incorporating the stages of technology integration into content areas. Two examples of a technology taxonomy are discussed as models for evaluating how technology has been implemented into actual classroom environments, the Stages of Teaching with Technology (STT) and the Levels of Technology Integration (LOTI). These taxonomies, in fact, offer step-by-step examples of how technology appears as it is integrated into content areas.

Stages of Teaching with Technology (STT)

In 1998, the county of Fayette in Kentucky, developed a district-wide assessment for teaching with technology designed in separate and distinct stages of progression towards mastery, based on the 'New and Experienced Teacher Standards.' The five stages are as follows: Stage 1: Entry; Stage 2: Adoption; Stage 3: Adaptation; Stage 4: Appropriation; and Stage 5: Invention [http://teach.fcps.net/stt/Intro.htm]. The stages were designed for teachers to move from one stage to the next. Like child learning and development theories, stages 2 through 5 are predicated upon mastery of the previous stage. However unlike these theories, Stage 5 (Invention) is not necessarily the end goal. In keeping with constructivism principles, each stage has its appropriate delivery and audience. In addition, the stages represent a progression towards student-centered instruction, from the least student-centeredness (Stage 1) to the most student-centeredness (Stage 5). Each stage offers a short 2-5 minute demonstration video clip of a sample application in a real classroom with real practicing teachers.

By looking at this implementation model for in-service teachers, this researcher compared the progression that pre-service teachers could take in gaining competence with integrating technology into their content areas.

Stage 1 – Entry

In this beginning stage, the teachers begin to learn the basics of technology [http://teach.fcps.net/stt/stage1.htm]. This step might include learning how the computer and operating system work and how to use a suite of programs, such as AppleWorks, Corel, or Microsoft Office.

Stage 2 – Adoption

By Stage 2, teachers have learned how to use one or more productivity tools such as text processing, e-mail, and electronic administration of grades or lesson planning software [http://teach.fcps.net/stt/stage2.htm]. Instruction is teacher-centered.

Stage 3 – Adaptation

During Stage 3, the frequency of use is the main distinction between this stage of progression and the previous stage [http://teach.fcps.net/stt/stage3.htm]. Instruction at this stage is still very teacher-centered.

Stage 4 – Appropriation

“In Stage 4, technology tools are being selected for their unique capabilities rather than just supporting tasks that could be done by hand” [http://teach.fcps.net/stt/stage4.htm]. This is the first stage of student-centered activities.

Stage 5 – Invention

By this stage, the progression from teacher-centered instruction to student-centered instruction is now complete [http://teach.fcps.net/stt/stage5.htm]. “Working in small groups or individually, students select a specific topic relevant to the class, and select a medium (video, PowerPoint, brochure, or even a non-technology-using media such as a work of art) to display the research on that topic.”

The STT stages of implementation offer distinct examples of what kinds of classroom activities embrace each stage of development. In comparison to the STT stages of integrations, the LOTI (Levels of Technology Implementation) levels offers another way of utilizing a taxonomy for integrating technology into content areas.

Levels of Technology Implementation (LOTI)

One of the early adopters of encouraging technology integration into classroom activities was Dr. Christopher Moersch, who developed the Levels of Technology Implementation (LOTI) scale in an effort to accurately measure authentic classroom technology use [http://www.lotilounge.com/mainwindow.html]. “This scale focuses on the use of technology as an interactive learning medium because this particular component has the greatest and lasting impact on classroom pedagogy and is the most difficult to implement and assess. The challenge is not merely to use technology to achieve isolated tasks (e.g., word processing a research paper, creating a multimedia slide show, browsing the Internet), but rather to integrate technology in an exemplary manner that supports purposeful problem-solving, performance-based assessment practices, and experiential learning–all vital characteristics of the Target Technology level established by the CEO Forum on Education and Technology" (Moersch, 1994).

Level 0

The description of Level 0 is that of non-use of the electronic technology by the instructor because of a perceived lack of access to technology-based tools (e.g., computers) or a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based (e.g., ditto sheets, chalkboard, overhead projector) in a totally teacher-centered environment [http://www.lqhome.com/newlotilounge/level0.html].

Level 1

With the advancement to Level 1, the instructor uses the available classroom computer(s) exclusively for teacher productivity (e.g., email, word processing, grading programs) or to embellish lectures, presentations, and demonstrations with multimedia applications, or as curriculum management tools that are used extensively to generate standards-driven lesson plans [http://www.lqhome.com/newlotilounge/level1.html].

Level 2

At this next level of implementation, technology-based tools are used to supplement the existing instructional program (e.g., tutorials, educational games, basic skill applications) or to complement selected multimedia and/or web-based projects (e.g., internet-based research papers, informational multimedia presentations) at the knowledge/comprehension level. "The electronic technology is employed either as extension activities, enrichment exercises, or technology-based tools and generally reinforces lower cognitive skill development relating to the content under investigation" [http://www.lqhome.com/newlotilounge/level2.html].

Level 3

The major component of this level of implementation is the use of technology-based tools to complement selected instructional events based upon multimedia/web-based projects at the analysis, synthesis, and evaluation taxonomy of learning levels (Bloom et al, 1956). Emphasis is “placed on higher levels of cognitive processing and in-depth treatment of the content using a variety of thinking skill strategies (e.g., problem-solving, decision-making, reflective thinking, experimentation, scientific inquiry)” [http://www.lqhome.com/newlotilounge/level3.html].

Level 4

Implementation at the fourth level is divided into two sections: a and b. Within Level 4a, technology is used as a tool to identify and solve authentic problems as perceived by the students relating to an overall theme or concept, as directed by the teacher. Even though emphasis is placed on student action and on issues resolution that require higher levels of student cognitive processing and in-depth examination of the content, the direction is still very much teacher-centered [http://www.lqhome.com/newlotilounge/level4a.html].

At Level 4b, teachers can readily design and implement learning experiences that empower students to identify and solve authentic problems relating to an overall theme or concept using the available technology with little or no outside assistance. “Emphasis is again placed on student action and on issues resolution that require higher levels of student cognitive processing and in-depth examination of the content” [http://www.lqhome.com/newlotilounge/level4b.html].

Level 5

An important incremental level progression is when the technology access is extended beyond the classroom in order to network with other schools, business enterprises, governmental agencies, research institutions, and universities. Use of technology at this level expands student experiences directed at problem-solving and other higher-order thinking activities, e.g., analysis, synthesis and evaluation [http://www.lqhome.com/newlotilounge/level5.html].

Level 6

Technology use at this level of implementation is perceived as a process, product and/or tool for students to find solutions related to an identified "real-world" problem or issue of significance to them. At this level the direction of investigation is student-centered and there is no longer a division between instruction and technology use in the classroom [http://www.lqhome.com/newlotilounge/level6.html].

These two technology taxonomies, the STT developed by the Fayette Country School District, and the Levels of Technology Implementation, developed by Christopher Moersch, are illustrative steps of technology integration that occur for practicing in-service teachers to accomplish. It was a giant leap of faith to expect pre-service teachers to enter application technology courses at the beginning stages of technology efficacy and expect them to be able to incorporate their newly learned skills into curricula without some direct instruction about how the process occurs. These two technology taxonomies illustrated the possible steps involved. The design for this research project with the technology applications course using constructive, student-centered principles as an intervention tool, in fact, was to offer a course as an intervention in order to instruct and delineate how to incorporate technology into the pre-service teachers' content areas. It was important to remember that, although the pre-service teachers would emerge with the technical proficiency to implement their technology activities, the expectation was for them to move beyond teacher-centered activities toward more student-centered activities, possibly at Stage 3 of the STT model or Level 4 of the LOTI model (See Table 2.4).

At the end of the teacher education courses, it was hoped that pre-service teachers would be able to develop content activities and to integrate the use of technology as a tool to enhance the learning in their content areas or multidisciplinary classroom settings. The pre-service teachers could expect to be able to incorporate the technology to enable students to learn in ways not previously possible such as, collaborations with group members in various locations. Effective integration of technology, therefore, is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally (NETS-S, 2003). These were higher order learning objectives proposed within the 'taxonomy of learning.' The technology tools and concomitant abilities could become an integral part of how the classroom functions — as accessible as all other classroom tools.

Table 2.3: Stages of Teaching with Technology (STT) Compared with Levels of Technology Integration (LOTI)

STT Stages*	LOTI Levels **
	0 – Non-Use
1 – Entry - learn basic of computer technology	1 – Awareness - used exclusively for teacher productivity, multimedia applications to embellish classroom lectures, teacher presentations
2 – Adoption - request students type up their final papers in a word processor - use a website to illustrate an instructional idea - use simple MS PowerPoint slides for lectures	2 – Exploration - create projects (e.g., designing web pages, research via the Internet, creating multimedia presentations, creating graphs and charts) - focus on lower levels of student cognition
3 – Adaptation - assign students a subject to research, given a specific list of websites to examine and construct PowerPoint to display what they've learned	3 – Infusion - used primarily for analyzing data, making inferences, and drawing conclusions from an investigation or related scientific inquiry
4 – Appropriation - collaborate in small groups to construct a PowerPoint on a given topic, using materials they research and provide	4a – Integration (Mechanical) - heavy reliance on prepackaged materials and/or outside resources that aid in management of curriculum 4b – Integration (Routine) - design and implement learning experiences that empower students to identify and solve problems 5 – Expansion - technology access is extended beyond the classroom to network with others
5 – Invention - select a specific topic relevant to the class, and select a medium to display the research on that topic	6 Refinement - provides a seamless medium for information queries, and problem-solving

* Stages of Teaching with Technology (STT): Developed for Fayette County, KY [http://teach.fcps.net/stt/Intro.htm]

** Levels of Technology Integration (LOTI): Developed by Christopher Moersch [http://www.lotilounge.com/lotibreak.html]

Theory to Practice – A Model for Technology Integration

INTEL – Teach to the Future

One of the recent practices in pre-service technology integration training is the adoption and adaptation of the Intel-Teach-to-the-Future (ITF) teacher-training curriculum (Yost et al., 2003); (Zhiting & Hanbing, 2001), Funded by Intel Corporation, the ITF project represents an international effort to train teacher educators to enhance pre-service teachers' competence for integrating technology into their classrooms. The goal of the freely-donated curriculum is to train classroom teachers how to promote inquiry-based learning and to integrate effectively the use of computers into their existing curriculum so that their students will increase their learning and achievement.

Needlesstosay, having a positive attitude toward technology does not necessarily ensure that teachers will be able to integrate the technology in the classroom (Necessary, 1996; Beyerbach et al., 2001). Passerini and Granger (2001) conducted research that proposed that greater learning can be promoted by delivering instruction through a variety of media and through the use of interactive technology applications. Constructivist principles (such as those suggested by Dewey (1966), Vygotsky (1978), Piaget (1973), Jonassen (Jonassen, Howland, Moore, & Marra, 2003), among others, may be compatible as instructional guidelines to support mediation to develop cognitive literacy skills in technology pedagogy settings. These principles may be important because they focus attention on integrating social and cultural context factors in the construction of knowledge and in understanding one's own and others' perspective through interpersonal communication, ways of knowing, and ways of thinking; that is, creating a context for learning in a socially constructed environment — the computer lab. One of the recent practices on pre-service training in many colleges of education is the adoption and adaptation of the Intel-Teach-to-the-Future (ITF) teacher-training curriculum (Culp et al., 2003). The goal of the curriculum is to train classroom teachers how to promote inquiry-based learning and effectively integrate the use of computers into their existing curriculum so that the students will increase their learning and achievement. In other words, the INTEL structure teaches the pre-service teachers how to integrate the technology into their own curricula using student (or learner)-centered projects. The learners design and create their self-initiated projects and use the best technology available with which to demonstrate their efforts. Pre-service teachers can exit their technology applications course at Stage 4 – Appropriation of the STT stages of instructional development or Level 5 – Expansion within the LOTI levels of technology integration.

Framework Guiding Research Questions

Previous studies of the perceptions of pre-service teachers' abilities to incorporate technology into their curricula were met with negative results, possibly stemming from the fact that the technology was taught via instructivist (or teacher-centered) principles and in isolation from content areas. Wang (Wang, 2002b) studied pre-service teachers' perceptions of the teacher's role in classrooms with computers. The teacher's role was measured as teacher centeredness versus student centeredness. The study findings showed no significant difference between pre-service teachers' perceptions of teacher-centered roles and their perceptions of student-centered roles in classrooms with computers, although it appears that the instruction for the pre-service teachers was very teacher-centered. The pre-service teachers perceived that they were likely to engage in teacher-centered activities and student-centered activities on an equal basis when teaching in classrooms with computers. However, when these students were tested on their choice of computer uses, pre-service teachers shifted to teacher-centered computer uses. "There was a significant difference between the pre-service teachers' choice of teacher-centered computer use and student-centered computer use. The pre-service teachers would more likely use the computer as a teacher-centered tool than as a student-centered tool" (Wang, 2002).

Several studies have assessed the perceptions of pre-service teachers and looked at such demographic data as attitudes towards and anxiety about computers (Bronack, Kilbane, Herbert, & McNergney, 1999) (Christensen, 2002); (Keiper, Harwood, & Larson, 2000); (Lumpe & Chambers, 2001); (El-Amin et al., 2002)), and the pre-service teachers' perceptions of their abilities to transfer their skills to use in the classroom (Cuckle et al., 2000); (Doering, Hughes, & Huffman, 2002-3). Data suggested that while learners were pleased with their newfound technical skills, they were not as comfortable in their abilities to integrate these new skills into their content areas.

Since 2000 there has been a concerted effort to integrate technology into methods curricula for pre-service teachers. Initial efforts were focused on providing pre-service teachers with opportunities to develop, implement, and evaluate their own instructional activities that utilize technology effectively and appropriately in authentic situations, to give them the myriad of tools necessary to integrate technology into teaching and learning activities (Brush, 1998). A plethora of studies examined methods of ascertaining if a change would occur given specific education techniques. Researchers (Gunter, 2001) studied the importance of technology-enriched curricula for pre-service teacher education that evaluated quantitatively and qualitatively the effectiveness of a redesigned introduction to technology course for pre-service teachers and offered the results of more positive student attitudes toward computers and less anxiety after completion of the Web-enhanced course. Completion of short courses (Abbott & Faris, 2001) were enough to change attitudes and anxiety reports. Using quantitative and qualitative data analysis techniques to investigate the attitudes of a group of undergraduate education majors toward their use of technology (Rizza, 2000) revealed that pre-service teachers' comfort with the technology and attitude of competence did improve over time but that perceptions of knowledge about computers remained the same. Even comparison methods of traditional methods and online courses (Gurbuz, Yildirim, & Ozden, 2000/2001) revealed that there were changes in attitudes of the student teachers and their beliefs about computers in education; likewise, similar findings were found with two-year evaluation studies of pre-service teacher technology infusion projects (Beyerbach et al., 2001). One long-range study conducted at the University of Virginia (Milbrath & Kinzie, 2000) found several sufficient attitude changes when the researchers examined pre-service teachers' changes in computer anxiety; perceived usefulness of computer technology; frequency of using word processing, email, spreadsheets, database management, statistical packages, and CD-ROM databases; and perceived overall self-efficacy in technology use. Lack of sufficient preparation (Whetstone & Carr-Chellman, 2001) was seen as a great hindrance as was sufficient pre-preparation seen as a great aid (Molebash & Milman,

2000) to computer confidence.

Educational beliefs about their own philosophies of teaching, such as student-centeredness compared with teacher-centeredness were reflective in their perceptions of the teachers role in classrooms with computers (Lumpe & Chambers, 2001; Minor, Onwuegbuzie, Witcher, & James, 2000) and to some degree related to the number of computer courses taken, perceived past computer experience and success of past computer experience (Kellenberger, 1997). Wang (Wang, 2001; Wang & Holthaus, 2000) found that there was a significant difference between the pre-service teachers' choice of teacher-centered computer use and student-centered computer use. The pre-service teachers would more likely use the computer as a teacher-centered tool than as a student-centered tool.

This research was designed to use the principles of social constructivist learning (Vygotsky, 1978) as the underlying bases for which the instructional components are created and utilized by the INTEL Teach To The Future program. In additional the taxonomy of learning model (Bloom et al, 1956) and ASSURE instructional methods (Smaldino et al, 2005) along with the state standards (NETS-T, 2002; NCATE, 2003) was used as the basis for the pre-service instructional integration syllabus components (See Appendix C). The design of the application technology course, EDIT 3318, served as the intervention for this quantitative study, which was taught with the social constructivist principles of constructivist learning theory.

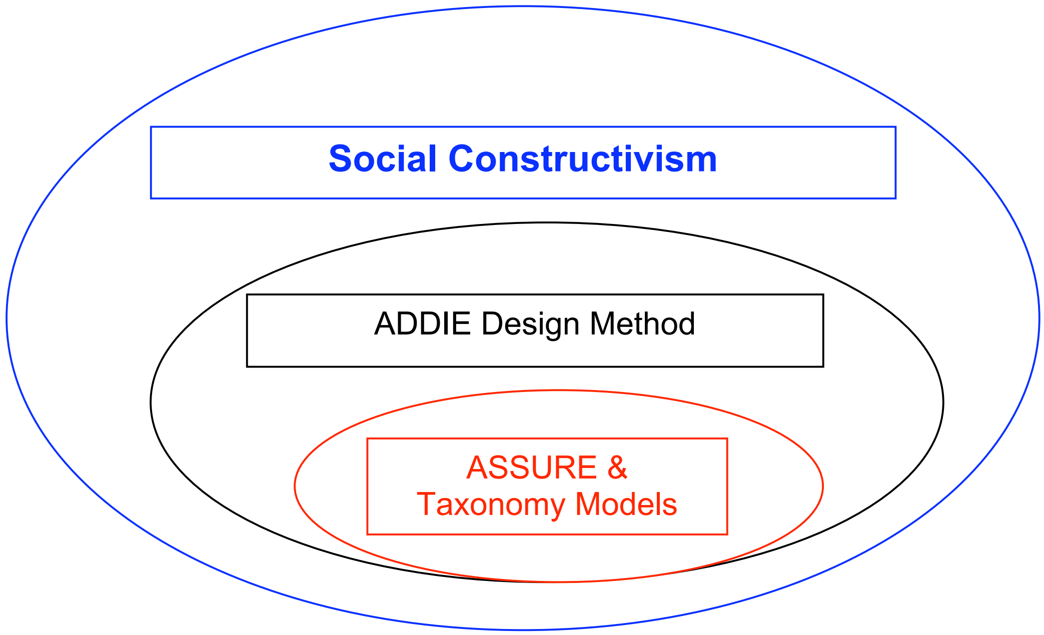


Figure 2.2: Graphical Representation of Social Constructivism, ADDIE Design Method, and ASSURE & Taxonomy Models

This research design looked at the technical skills of the pre-service teachers in order to ascertain the technical efficacies (TQ) of the pre-service teachers at each level of their methods education courses. Secondly, the design offered a glimpse into whether or not the constructivist principles used to teach the course and used to teach integration of the technology would, in fact, influence the pre-service teachers to teach using similar student-centered activities (SCC) versus traditional teacher-centeredness activities with (TCC) with technology incorporation. The purpose of this research study is thusly: In what ways do the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (SC versus TC) change while using the theoretical framework of a learner-centered constructivist approach to curriculum and instruction during their semester-long course of integrating technology into the content areas?

Chapter 2 Summary

While technology skills competencies have been required to meet high school and college graduation requirements, it is far from adequate training simply to require pre-service teachers to master a set of computer skills. Successful integration of technology into the established methods courses requires more than mastering a suite of programs to complete an assignment. Teacher educators, including program administrators and educational technologists, need to be able to facilitate the learning by pre-service teachers so that the learning process can incorporate the understanding and integration of technology successfully into curricula. This integration should be based upon established student-centered learning theories and instructional design methods coordinated with state standards.

Chapter 2 Glossary

Anchored instruction – constructivist term for learning environment that focuses on meaningful, real-life problems and activities (Roblyer, 2003)

Method – a procedure of instruction selected to help learners achieve their objective or to internalize a message (Smaldino et al, 2005)

Model – a conceptual and communication tool that can be used to visualize, direct and manage processes for creating a comprehensive theory (Gustafson & Branch, 2002)

INTEL – Teach To The Future (ITF) -- Funded by Intel Corporation, the ITF project represents an international effort to train teacher educators to enhance pre-service teachers' competence for integrating technology into their classrooms (Yost, 2003).

Instructional technology – using hardware, software, and/or processes to facilitate learning (Smaldino et al, 2005)

ISTE - The International Society for Technology in Education (ISTE) is the professional education organization responsible for recommending guidelines for accreditation to NCATE for programs in educational computing and technology teacher preparation [http://www.iste.com].

NCATE - The National Council for Accreditation of Teacher Education (NCATE) is the official body for accrediting teacher preparation programs [http://www.ncate.org/ncate/m_ncate.htm].

Problem-based instruction – learner-centered, inquiry-based instruction based on real situations (Smaldino et al, 2005)

Student-centered learning -- This concept derives from a teaching approach, which emphasizes the importance of providing control over the learning experience with the learner, rather than with the teacher or instructor.

Taxonomy of Learning (Bloom et al) – a method for categorizing differences in thinking skills; it includes six levels of cognition ranging from recall of knowledge to evaluation of knowledge (Lever-Duffy et al, 2005)

Technology instruction -- defined as instruction in how to use information technology as an integral part of classroom curricula.

Theory – a scientific statement of beliefs about an event or a cause usually supported by a large amount of experimental or observational evidence (Lever-Duffy, 2005)

Zone of proximal development – term coined by learning theorist Lev Vygotsky to refer to the difference between two levels of cognitive functioning: adult or expert and child or novice (Roblyer, 2003)

CHAPTER 3

METHODOLOGY

Introduction

Research indicates that technology integration is more successful in student-centered learning environments (Wang, 2002). This constructivist approach to instruction necessitates a fundamental change in the perception of teachers' roles in the classroom. The purpose of this study is to investigate how pre-service teachers' perceptions of increased technology efficacies and classroom roles change when using the theoretical framework of a learner-centered constructivist approach to curriculum and instruction during their semester-long course of integrating technology into the content areas.

The research design for this study is a within-group design (Creswell, 2002), p. 317), whereby only one group, with 2 sub-groups of pre-service teachers, will receive the treatment, which is the semester-long applications technology course. The group of pre-service teachers will be subdivided into 2 sub-groups, or levels: teaching experience and educational experience. This design will look at whether the student-centered technology applications course will make a difference in the perceptions of these 2 groups of pre-service teachers in how they will integrate technology into their own curricula. The remainder of this chapter will contain information about the background for the research design, the research design and the research questions.

Background

This research study is a partial replication of the original research conducted by Bichelmeyer and her colleagues (Bichelmeyer, Reinhart, & Monson, 1998) and Wang (Wang, 2002b). The original Bichelmeyer instrument was designed to measure how teachers perceived their roles. Bichelmeyer et al conducted a preliminary study of in-service teachers to gauge general patterns of use and perceptions of ability to integrate technology after completion of a technology course. Wang (Wang, 2001, 2002), using the Bichelmeyer survey with minor changes, researched pre-service teachers enrolled in technology courses in Guam and the University of Alabama to investigate the pre-service teachers' perception of the teacher's role when teaching in classrooms where computers were available. Wang found that there was no significant difference between the pre-service teachers' perceptions of the teacher-centered role versus the student-centered role in classrooms. However, "(w)hen tested on their choice of computer usage, the pre-service teachers shifted to teacher-centered computer uses" (Wang, 2002, pg 154). She made the following recommendations: (1) the study should be replicated with pre-service teachers at the entry level in order to develop relevant intervention strategies, (2) the technology applications course should serve as an intervention to shape and change the pre-service teachers' perceptions of the role of teachers integrating technology into their content areas, and (3) that the same survey questionnaire be administered to pre-service teachers both at the beginning and at the end of the technology applications course to measure the change in pre-service teachers' perceptions of the teacher's role in classrooms with computers (Wang, 2002, pp. 158).

This research study is a partial replication of the Wang study. Unlike the participants in the Wang study, these pre-service teachers were enrolled in the technology applications course near the beginning of their teacher education courses. Undergraduate pre-service elementary teachers enrolled in either the ECE (early childhood) to Grade 5 tract or the MDS (multiple disciplinary studies) in the Grade 4 to 8 tract. In the EC-4 tract, pre-service teachers enrolled in all 3 Block 1 courses at once during the first semester of their junior year. Exceptions to this policy were made only with the consent of their advisors. Pre-service teachers in the Grade 4-8 tract had a little more flexibility in required classes, and with consent, enrolled in Block 1 classes during subsequent semesters. The majority of pre-service teachers enrolled in the technology applications course were expected to be in Block 1.

The semester-long technology applications course served as an intervention to see if this instruction would change their perceptions of the role of technology within the classroom. Participants were asked to complete a Technology Questionnaire [http://educdata.educ.ttu.edu/jcyrus/index.asp] near the beginning and at the end of this course. Statements on the Technology Questionnaire ask the participants to rate their comfort level using ten different kinds of technology tools. In addition, based on the revised Wang instrument, the participants were asked to complete a Teaching Survey near the beginning and near the end of the course to ascertain changes in their perceptions of the role of teaching with technology in an environment with computers.

Purpose

The purpose of this study was to investigate the ways the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (TC versus TC-C and SC versus SCC) change while using the theoretical framework of a learner-centered approach to curriculum and instruction during their semester-long course of integrating technology into content areas. The research design for this study was a quasi-experimental design with repeated measures for within-groups. The participants for this study were enrolled in the spring semester of a required course for elementary education pre-service teachers. The course, Technology Applications for Elementary Education, served as the intervention between the pre-test (n=82) and post-test (n=61) instruments.

EDIT 3318, Technology Applications for Elementary Education, was the required course for elementary pre-service teachers in this educational setting. It was usually taken in Block 1 of the program, at the beginning of educational methods preparation for those in the ECE-5 tract and near the beginning (or with consent for later semester enrollment) for those in the Grade 5-8 tract. This course was usually taught by graduate part-time instructors (GPTIs), who were doctoral students in the Educational and Instructional Technology program within the College of Education. One of these instructors was asked to participate in this research study. This instructor had five years of experience teaching this course and taught 4 sections of this course during the semester in which the research was conducted.

Participants

The target population will be pre-service teachers enrolled in a semester-long technology applications course. In this non-probability (or convenience) sampling (Creswell, p. 164), the participants will be selected because they represent the population of pre-service teachers who enroll in this course. Each of the four sections of this technology applications class will have a maximum of 23 pre-service teachers enrolled, for a possible total of 92 participants. This proposed research project will be conducted within the College of Education at a large southwestern university. The educational level of the pre-service teachers is categorized by the 'block' of education courses in which they are currently enrolled. All pre-service teachers in Block 1 enroll in the same 3 courses: EPSY 3331, EDCI 3320 and EDIT 3318 (See Table 3.1). Block 2 and Block 3 courses vary according to the educational tract (ED-4 or Grade 4-8 MD-S) (See Grade 4-8 Certification Plans in Appendix F) [http://www.educ.ttu.edu/certification/prospective/undergraduate/4-8.htm].

Table. 3.1. EC-Grade 5 Undergraduate Certification Plan

Block 1 – Fall	Block 2 – Spring	Block 3 – Fall	lock 4 – Spring
EPSY 3331	EDCI 3375	EDCI 4375	EDEL 4000
EDCI 3320	EDCI 3370	EDBL 3205	EDCI 4325
EDIT 3318	EDLL 3353	EDSP 3205	
EDLL 4380			

Variables

The two independent variables for this research design were the educational level (EL) and teaching experience of the pre-service teachers. The first independent variable, teaching experience, was divided into low (Low TE) and high (High TE) levels of experience. The second independent variable, educational level, was divided into EL-1 (Block #1 only) and EL-2 (all other students). The three dependent variables were technology efficacy (TQ), teacher-centeredness (TC) and student-centeredness (SC). The 10 sub-levels of the Technology Questionnaire were the levels of comfort in the following areas: Operating System, Technology Tools, Word Processor, Communications, Online Resources, Presentation/Imaging, Manage Data, Desktop Publishing, Webpage Design, and Multimedia Projects. The Teacher Survey had 2 levels that are used for dependent variables: teacher centeredness (TC) and student centeredness (SC).

Instruments

The research study utilized two instruments to collect data on the pre-service teacher's technology competencies and their perceptions of their roles in the classroom with and without computer technology. The first instrument, the Technology Questionnaire, was used to collect descriptive data on how the pre-service teachers rated their efficacy with technology tools . Participants were asked to rate their comfort level in using specific kinds of technology tools. They were asked to respond to the statement in each of 10 categories, e.g., "Please use this scale to indicate your comfort level with: Operating System, Technology Tools, Word Processor, Communications, Online Resources, Presentation/Imaging, Manage Data, Desktop Publishing, Webpage Design, and Multimedia Projects." The scales were Likert-like scales, calibrated from 0 (No Knowledge) to 5 (Very Knowledgeable).

In the Word Processing category, for example, participants rated their comfort level with the following types of options: (1) Create a new document (2) Work with headers or footers (3) Format text (style, font, spacing, margins, tabs, and ruler settings) (4) Create and format a table (5) Use spell checker tool (6) Create a multiple column layout (7) Insert a graphic, and (8) Print a document. For the Communications category, participants rated their comfort level in abilities to: (1) Create a new e-mail message (2) Send a new e-mail message (3) Reply to an e-mail message. (4) Use carbon copy (cc) to send one message to multiple people. (5) Use blind carbon copy (bcc) to send anonymously to multiple people (6) Attach a word document to a message and send it (7) Initiate a new chat or instant message (IM) session (8) Invite several people to a new session (9) Invite additional people to join in an existing chat session (10) Send a file as an attachment in an IM session (11) Accept and open a file in a chat session (12) Participate in a video conference in a chat session.

The Online Resources category offered participants choices of rating their comfort with the following options: (1) Access a webpage by typing in the URL (2) Bookmark webpages (3) Save an image from a webpage (4) Set a web page as the default home page (5) Use a search engine (such as, Yahoo, Google, Dogile, etc.) to locate information (6) Follow hyperlinks to access information.

Options for the Presentation/Imaging section were: (1) Insert a new slide (2) Change the font/text on a slide (3) Change the background color (4) Insert a graphic (5) Create hyperlinks to move to WWW pages (6) Scan and save an image (7) Import the scanned image into a new document (8) Change the size of a scanned image.

In the Manage Data section, participants rated their comfort level with the following options: (1) Create and edit a new worksheet (2) Enter data (3) Use formulas and functions (4) Sort data (5) Get column and row totals (6) Print tables from the spreadsheet data (7) Create charts and graphs.

Desktop Publishing options were two: (1) Create a multi-column or multi-section document with a variety of text-wrapped frame formats and (2) Use graphic tools found in draw and paint toolboxes or menus.

The Webpage Design section asked participants to rate their comfort level with these options: (1) Create a new web page (2) Insert text (3) Format text (4) Insert tables (5) Use tables to assist in layout (6) Insert graphics (7) Add additional pages (8) Create a navigational bar to link web pages. (9) Create hyperlinks to link between pages (10) Create hyperlinks to link to WWW web pages.

The final section, Multimedia Tools, had only one option for the participant to self rate their comfort level: Design and create multimedia projects for a specific audience (or age group) that includes audio. video, text, and graphics. (See Table 3.1).

With the online Technology Questionnaire, the research study examined what level of self-reported skill levels the pre-service teachers had and if there would be a difference in self-efficacy skills between the different levels of educational level and teaching experience.

Table 3.1: Pre-service teachers' self-efficacy rating categories of technology skills

Subscales	Items
Operating System	(1) Turn on/off the computer (2) Create a new folder (3) Rename a file or folder (4) Duplicate a folder (5) Delete items (6) Move items between folders (7) change window view to lists or icons (8) Minimize and expand a window

Subscales	Items
Technology Tools	(1) Digital camera (2) Scanners (3) Camcorders (4) Insert & remove disks (5) Use flash drives
Word Processor	(1) Create new document (2) Work with headers/footers (3) Format text (4) Create and Format table (5) Use spell checker tool (6) Create multiple columns (7) Insert graphic (8) Print document
Communication	(1) Create new message (2) Send new message (3) Reply to a message (4) Use carbon copy (cc) (5) Use blind carbon copy (bcc) (6) Attach word document (7) Initiate new chat session (8) Invite several people (9) Invite additional people (10) Send file (11) Accept and open file (12) Participate in video conference
Online Resources	(1) Access webpage – typing URL (2) Bookmark web pages (3) Save image from webpage (4) Set web page as default page (5) Use search engine (6) Follow hyperlinks
Presentation/Imaging	(1) Insert new slide (2) Change font/text (3) Change background color (4) Insert graphic (5) Create hyperlinks between slides (6) Create hyperlinks – WWW (7) Scan and save image (8) Import scanned image (9) Change size of scanned image
Manage Data	(1) Create and edit new worksheet (2) Enter data (3) Use formulas and functions (4) Sort data (5) Get column and row totals (6) Print tables (7) Create charts and graphs
Desktop Publishing	(1) Create multi-columns (2) Use graphic tools
Webpage Design	(1) Create new web page (2) Insert text (3) Format text (4) Insert tables (5) Use tables – layout (6) Insert graphics (7) Add additional pages (8) Create navigational bar (9) Create hyperlinks between pages (10) Create hyperlinks -- WWW
Multimedia Projects	(1) Multimedia projects

The original paper Technology Questionnaire was constructed and piloted by the researcher in 1998 for use in a southwestern university with students enrolled in a first-year composition class taught in a Macintosh computer lab. Data was collected from 169 students with 6 different instructors during the academic year of 1998-99. In 2002, the paper questionnaire was administered to approximately 90 pre-service secondary teachers in another southwestern university with some slight modifications, such as eliminating listservs, newsgroups and bulletin boards as choices. The questionnaire has now been put online with additional small modifications, such as the addition of the data management and communications categories, and subsequently piloted with another 33 participants. This online version of the Technology Questionnaire, [http://educdata.educ.ttu.edu/jcyrus/index.asp], also contains a demographic section for gathering information regarding participants' gender, primary or first language, age, major, and whether or not they have had computer instruction prior to enrollment in the Technology Applications for Elementary Education class.

The second instrument for this study was an online Teacher Survey modified from (Wang, 2001), itself an adaptation from one originally developed by Bichelmeyer, Reinhart, and Monson (1998) at Indiana University to measure teachers' beliefs about the teacher's role when teaching with technology. The Teaching Survey contained the second and third parts of the original Wang survey [http://tyr.tltc.ttu.edu/TakeSurvey.asp?PageNumber=1&SurveyID=147]; the first part of the original survey contained a demographic section that will not be needed and was supplanted by the online Technology Questionnaire. Bichelmeyer et al created this instrument to use with 225 school teachers, and Dr. Wang modified the survey to use with pre-service teachers in two different sites, Guam and Alabama, with approximately 80 participants. Their instrument contained 4 sections with 6 questions in each section, for a total of 24 questions, in which the participants rated each question on a Likert-like scale from 'Strong Agree' to 'Strongly Disagree'. Wang used the Cronbach's coefficient alpha (a) to assess the reliability of the constructs surveyed with the instrument: 1) teacher-centered role; 2) student-centered role; 3) teacher-centered computer use; and 4) student-centered computer use. For these four constructs, Wang reported her Cronbach alpha (a) to be in the acceptable range (Wang, 2001, pp 224). (See Table 3.3.)

Table 3.3. Teacher Survey Reliability

Construct	Number of Items	Cronbach Alpha

Teacher-centered role	6	.94
Student-centered role	6	.93
Teacher-centered computer use	6	.86
Student-centered computer use	6	.93

(Wang, 2001, pg 424)

The Teacher Survey, revised by Wang (2001, 2002), was used for this research project and accessed online. There were four constructs: teacher-centered role without computers, student-centered role without computers, teacher-centered role with computer use, and student-centered role with computer use. Each participant was asked to rate their perceptions of their roles in classrooms without computers and in classrooms with computer use on a Likert-like scale from Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree.

Testing of Pilot Project

To assess the technical skills of pre-service teachers taught by the researcher during Summer II, 2003, students were asked to complete an earlier version of the Technology Questionnaire on the first day of class and again during the last day of the technology applications class. Using a paired-samples ***t*** test, there was a significant difference for 2 applications: word processing and graphics/presentations. The test was significant, $p<.001$ for word processing $t(17) = 6.56$ and for graphics/presentations $t(17) = 6.01$. The results indicated that the mean of knowledge level for word processing (2.50) and graphics/presentations applications (5.11) were significantly greater at the end of the course compared to that knowledge level at the beginning of the course. The pre-service teachers reported that they knew these 2 kinds of applications better by the end of the course.

To ensure that there are no technical difficulties with the online stability of the Technology Questionnaire and the Teacher Survey and electronically collecting the data from the server, a pilot project was conducted with 17 students during Summer II - 2004 in the College of Education. Each instrument was collected only once – the Technology Questionnaire at the beginning of the course and the Teacher Survey at the end of the course. This pilot project also afforded the researcher one final opportunity to ensure that the survey instrument was clear, easy to read and follow and could be completed easily online. Additionally, this pilot allowed the researcher to ascertain that the data collected from the website would, indeed, be collected appropriately using the Microsoft Access database program.

Procedures

The research design used 2 instruments, the Technology Questionnaire and the Teacher Survey, to collect data from the participants. This research was a pre-test and post-test design for each instrument. Participants were asked to complete the Technology Questionnaire during the first week of class; during the second or third week of class, the participants were asked to complete the Teacher Survey. During the final 2 weeks of class, participants will be asked to complete again the Technology Questionnaire and the Teacher Survey.

First week of class

The researcher introduced and described the project to each section of the technology applications course and asked for participation. The participants were given the information about the research and a request for them to participate (See Appendix D and Appendix E). The data collected at the beginning of the semester constituted the 'pre-test.' The Technology Questionnaire was to be completed first to gauge the participants' perception of their technology skills before any course projects and tasks began. Participants were given an explanation of the project and an online consent form.

Second or third week of class

During the second or third week of class, the participants were asked to complete the Teacher Survey. By this time, participants will have had an idea of what kinds of projects they would be asked to complete in their education classes. They would have been introduced to their methods courses in Educational Psychology, Curriculum and Instruction, and Language and Literacy. The participants needed to be comfortable with the course requirements and how the technology class fitted into their curricula before being asked to project about their teacher outcomes.

Similarly to the procedures for the Technology Questionnaire, the participants were given another online consent form to read. Upon clicking the box to show consent, the participants went to the beginning of the Teacher Survey. The researcher remained in class in order to answer any questions.

At the conclusion of the Teacher Survey, participants were asked to click the 'Done' button to exit the survey. Students were thanked for their cooperation and reminded that the second part of the research would be conducted with the same 2 instruments at the end of the semester.

Second through twelfth week of class –Treatment

The treatment for this research design was the course, EDIT 3318 – Applications of Technology in Elementary Education (See Appendix C). "This is a basic course to engage the undergraduate student in the use of technology as an educational tool. Students will have the opportunity to explore and utilize technology applications that enhance the teaching/learning process. The design, development and delivery of effective communications and learning activities will be emphasized. The objectives for this course have been based on the Teaching Standards for Texas Teachers and the ISTE Foundation Technology Standards for all teachers. These standards reflect professional studies in education that provide fundamental concepts and skills for applying information technology in educational settings" (EDIT 3318 course syllabus, Fall 2004 [http://www.ecc.ttu.edu/edit3318/]).

The basic tenets of the INTEL Teach For The Future is that the curricula supports student-centered learning which is consistent with cognitive constructivism (Piaget, 1973) and social constructivism (Vygotsky, 1978). Cognitive constructivism is consistent with principles that support the teacher-student interaction and the student-content interaction to model or scaffold understanding and performance (Ormrod, 2003). The emphasis of learning activities requires learners to draw upon their own cognition and representation of their world in order to solve problems. Social constructivism supposes that learners learn within socially constructed environments and learn by negotiating meaning (Hannafin, Hannafin, & Land, 1997). The INTEL model of curricula instruction used a small number of modules or projects with which to construct the content of the technology course. Each project encouraged teacher to student, student to student, and student to content interactions in order to complete each assignment.

Each of the 4 class project assignments required incorporating effective use of principles and elements of design and the illustration of technology integration application for K-12 learners. The assignment for the newsletter was to create a 2-page newsletter incorporating word-processed text and graphics with the effective use of the principles and elements of design. Pre-service teachers were required to produce the newsletter from the prospective of their own target students' perspective, thereby illustrating a technology integration application for K-12 learners. For example, a 4^{th}-grade teacher created the newsletter from the perspective of a 4^{th} grader; that is, what would one of his/her 4^{th} graders include in such a newsletter? The pre-service teachers learned how to create a newsletter using text and graphics. It was the first project because the pre-service teachers were fairly comfortable using the word processing application. By creating the newsletter from their students' perspective, it offered the pre-service teachers an easy venue in which to see a student-centered activity. The second project involved using Microsoft Power Point slide presentation software to create a linear slide/non-linear slide presentation, with a minimum of 36 slides. The project incorporated word processing, graphics, effective use of the principles and elements of design, and the illustration of technology integration for K-12 learners. Similarly to the first project, the pre-service teachers created the linear/non-linear slide presentation from the perspective of their own student learners. These projects allowed the pre-service teacher to begin to understand that student-centered learning can involve technology that could be engaging, age appropriate, beneficial to student learning, and supportive of higher-order thinking, not simply recalling facts (a lower order of thinking).

Project 3 was the creation of a website on which all of their projects were to be linked. Pre-service teachers were shown various websites, created by elementary students to demonstrate their projects and lesson activities. Pre-service teachers created a web-based lesson activity for their students as well as an electronic portfolio for themselves. Project 4 was the creation of a web quest that was also linked to their newly-created web site. Both projects 3 and 4 included learning objectives that were explained through essential and guiding questions. These questions helped to focus pre-service teachers' (and eventually their own students') attention on meaningful activities that led to desired learning. The projects promoted higher-order thinking processes (interpretation, synthesis, prediction, and evaluation). Usually in technology applications classes, the students learn how to use the technology; in the INTEL-based technology integration class, the students learned how to make technology integral to the learning activities, not separate from them. The course objectives were student-centered. By INTEL design, the objectives compelled learners, both elementary students and pre-service teachers, to make choices as they planned their path to understanding. The pre-service teachers prepared their projects for a class presentation at the end of the course.

Last week of class

Participants were asked to complete the second part of the research project. They were given the same consent forms and given the URL to the Technology Questionnaire first. Then they were given the URL to the Teacher Survey. Responses from the Technology Questionnaire and the Teacher Survey were collected and stored in a Microsoft Access database.

Data Analysis

Data was analyzed using SPSS database software. Demographic data from the Technology Questionnaire (gender, primary language, age, major, completion of other technology courses) was described with descriptive statistics. All of the rest of the data from the Technology Questionnaire was analyzed using an analysis of variance (ANOVA). All of the data collected from the Teacher Survey was analyzed using a multiple analysis of variance (MANOVA).

This research study involved examining data collected from two online instruments: the Technology Questionnaire and the Teacher Survey. The two independent variables were educational level (EL) and teaching experience (TE) and each independent variable had 2 levels. The educational level had the two levels of EL-1 and EL-2. The teaching experience variable had the two levels of Low TE and High TE. The dependent variables were the mean gain scores on the Technology Questionnaire and Teacher Survey.

Given the 2 levels of the independent variable and the 2 dependent variables, a MANOVA was chosen as the statistic for analysis of this research data. The MANOVA was used to evaluate whether the population means on the set of dependent variables varied across levels of a factor or educational levels (Green & Salkind, 2003). “A one-way MANOVA tests the hypothesis that the population means for the dependent variables are the same for all levels of a factor, that is, across all groups” (Green & Salkind, pp. 203).

Research Questions

Research Question #1 – Educational levels (EL) compared with teaching experience efficacy (TE)

The research design using a MANOVA supported questioning to reflect on the mean differences between the variables.

The research question was: Are there differences in self-reported technology efficacy in pre-service teachers based on educational level and teaching experience? The researcher hypothesized that the results from this analysis might show no significant difference between the knowledge levels of the pre-service teachers for word processing and communications proficiencies, which would probably have had a high comfort level rating. Likewise, the prediction was for there to be no significant difference in the knowledge levels for data management and multimedia design, which probably would have had a low comfort rating. Where there might have been a predicted significant difference was in the level of comfort using the World-wide Web and presentation/graphics applications. Pre-service teachers might have had more educational experience using these applications in course projects.

Research Question #2 –Teachers centeredness (TC) compared with student centeredness (SC)

The research question #2 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TC) versus student centeredness (SC) in classrooms without computer availability? The independent variables were the education levels (EL) and teaching experiences of the pre-service teachers. The 2 dependent variables were (1) the rating scores from teacher centeredness (TC), and (2) the rating scores from student centeredness (SC).

Research Question #3 –Teachers centeredness (TCC) compared with student centeredness (SCC)

The research question #3 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TCC) versus student centeredness (SCC) in classrooms using computers? The independent variables were the education levels (EL) and teaching experiences of the pre-service teachers. The 2 dependent variables were (1) the rating scores from teacher centeredness with computer use (TCC), and (2) the rating scores from student centeredness (SCC).

The null hypothesis was that there will be no difference in the means of teacher centeredness and student centeredness between the educational levels in classrooms with computer use.

Research suggested (Bichelmeyer, 1998; Wang, 2001, 2002, 2003) that the results from this analysis might show no significant differences between how pre-service teachers perceive their roles in classrooms without computer technology (TC compared with (SC). Researchers (Bichelmeyer 1998; Wang, 2001, 2002, 2003) have reported that pre-service teachers revert to the teacher-centered roles when using computer technology in classroom activities (TCC compared with SCC). The expectation for the results from this study was that there may be a significant difference in the teacher roles after completing the semester-long constructivist course of technology integration. If the second hypothesis in the two-way MANOVA was rejected, then further post hoc analysis should reveal if there was a difference in the pairs of means, or if there was a more complex combination of differences among the means.

Chapter 3 Summary

A goal of this study was to explore and expand understanding of the self-efficacy technology skills and perceptions of pre-service teachers in their abilities to integrate technology into student-centered activities. Previous researchers have suggested that student-centeredness is the most successful learning environment. Additionally, researchers discovered that pre-service teachers engaged in student-centered activities equally with teacher-centered activities; however, when they had access to computer technology, the pre-service teachers reverted to teacher-centered activities. The focus of this research design is to ascertain whether a technology applications course created with constructivist principles would influence the pre-service teachers about their roles as teachers as they integrate technology into their content areas.

This chapter described the two data collection procedures and statistical analyses utilized in the study. The treatment for this study was the Technology Applications for Elementary Education course required for elementary pre-service teachers in the College of Education. The first instrument utilized was the Technology Questionnaire that gathered information about how the participants perceived their comfort level with 10 applications, designated as their technology efficacies (TQ). The second instrument is the Teacher Survey that was designed to elicit information about how the pre-service teachers perceived their roles to be in classrooms with and without computer availability. Research questions asked if there was a difference in the perception of teacher centeredness and student centeredness between the educational levels and teaching experiences of pre-service teachers. The independent variables were the levels of educational experience and teaching experiences of the pre-service teachers. The dependent variables are (1) teacher centeredness versus student centeredness (TC compared with SC), and (2) teacher centeredness with computer use versus student centeredness with computer use (TCC compared with SCC).

CHAPTER IV
RESULTS

Overview

The purpose of this study was to investigate the ways the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (TC versus TC-C and SC versus SCC) change while using the theoretical framework of a learner-centered approach to curriculum and instruction during their semester-long course of integrating technology into content areas. The research design for this study was a quasi-experimental design with repeated measures for within-groups. The participants for this study were enrolled in the spring semester of a required course for elementary education pre-service teachers. The course, Technology Applications for Elementary Education, served as the intervention between the pre-test (n=82) and post-test (n=61) instruments.

In the following sections of this chapter, the pre-test and post-test descriptive statistical results of the pre-service teachers' participation are described. Descriptions of the results are explained for the Technology Questionnaire and the Teacher Survey. The results of inferential statistics are described for the 3 research questions.

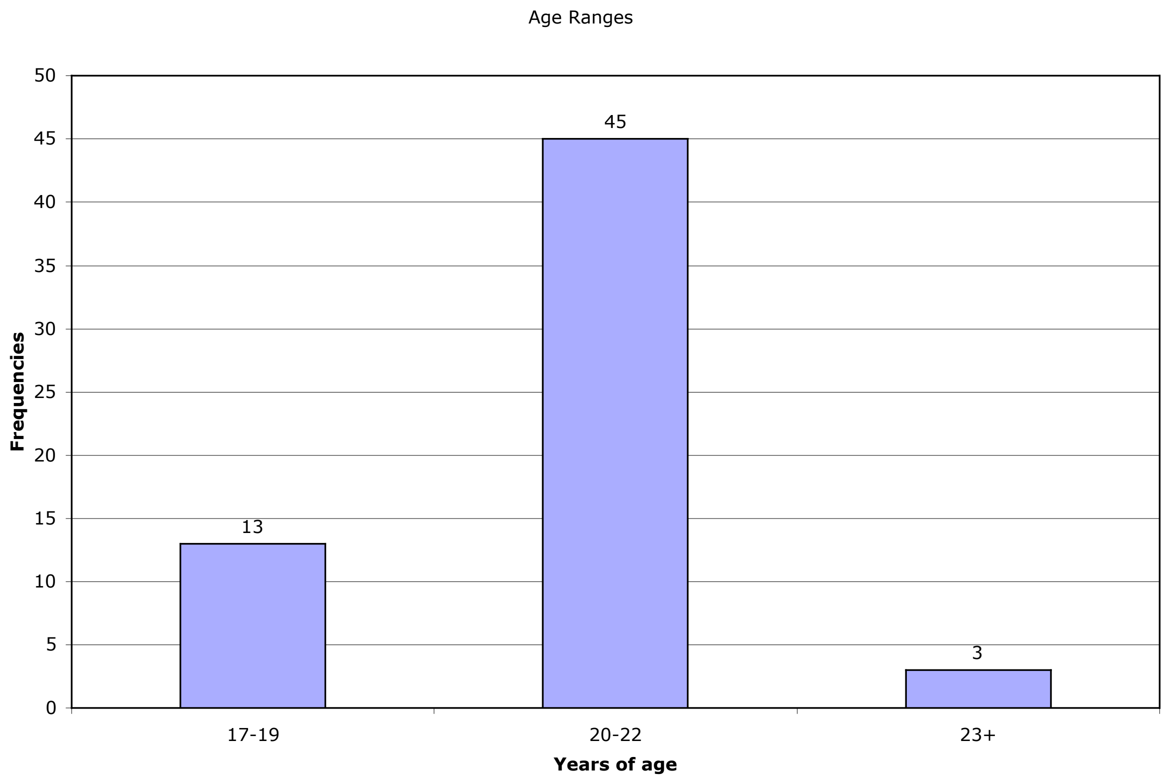
Participants

The target population was an undergraduate required, entry-level course, Technology Applications for Elementary Education, taught during the spring semester. This course is offered each semester and each of the 2 summer sessions. The participants were asked to complete 2 separate online instruments at the beginning of the semester and again at the end of the semester. The first instrument, the Technology Questionnaire, requested participants to report their amount of teaching experience and their technology knowledge level in 10 areas. The second instrument, the Teacher Survey, requested participants to report how they would respond to classroom situations in environments with and without computer availability.

Two independent variables emerged, each with two levels. The first independent variable was teaching experience, which was divided into low (Low TE) and high (High TE) levels of experience. The second independent variable was educational level, divided into EL-1 (Block #1 only) and EL-2 (all other students). The dependent variables were defined as technology efficacy, teacher-centeredness and student-centeredness in environments using computers and teacher-centeredness and student-centeredness without computer availability. This within-subjects design groups the participants into each of 2 independent factors whereby each participant is observed on all 4 dependent variables across each of the 2 independent factors (See Table 4.1).

The demographic information for the participants was requested only for the pre-test Technology Questionnaire submission. However, data is reported only for the 61 participants who completed both instruments at the end of the semester, unless otherwise so noted. The median age of the participants was 20.5 years. The age range was 17 to 30 years (See Figure 4.1). With one exception, all of the participants who completed the post-test instruments were native English speakers; the exception was one native speaker of Spanish. The participants who completed the pre-test Technology Questionnaire and pre-test Teacher Survey consisted of 80 females and 2 males; only one male student completed both instruments at the end of the semester. The native Spanish speaker also completed both instruments at the end of the semester. Of the pre-test participant completions, only 18.3 percent (15) had previously taken EDIT 2318, a course in which elementary education advisors strongly encourage pre-service teachers to enroll; similarly, only 6.1 percent of participants were concurrently enrolled in EDIT 2318 during the Spring semester of this study. Only two participants did not report any such classes. Students reported being engaged in other activities using computers, such as playing games, watching videos, chatting, shopping, and editing photos.

Figure 4.1: Bar chart of age range and frequencies of ages



<u>Educational Levels</u>

The educational level was one of the 2 independent variables. For those who completed the pre-test submissions of the Technology Questionnaire, the majority of the participants (39) were elementary education majors (47.6 percent) taking their first block of required courses, which included the Technology Applications class. Twenty-seven participants were not yet taking classes within their method block of classes and 7 were not education majors at all (See Table 4.1).

Of the 21 students who did not participate in the post-test submission of the online instruments, only 5 were in Block #1. Two students did not complete most of the items from the post-test instruments, so their submissions could not be included. All of the other students withdrew from the class (See Table 4.1).

Table 4.1: Education Level For Those Completing The Pre-Test And Post-Test Submission Of The Online Instruments

Educational Level	Pre-Test		Post-Test	
	Frequency	Percent	Frequency	Percent
Block #1	39	47.6	34	55.7
Block #2	2	2.4	1	1.6
Not in blocks yet	27	32.9	18	29.5
Non-Education Major	7	8.5	4	6.6
Multi-Disciplinary Studies 4-8	6	7.3	4	6.6
Other	1	1.2	0	0
Total	82	100.0	61	100.0

The division between those participants who were currently enrolled in their first block of required Block #1 classes, 55.7 percent (34), was closely split with those 27 participants who were not education majors or those who were in other block assignments (44.3 percent). The participants were re-assigned to 2 levels of educational experience – EL-1 category was designated for the participants formerly described as Block #1 students, and EL-2 was designated for the category of participants formerly described as students in other block assignments or non-education majors (See Table 4.2).

Table 4.2: Re-Assignment Of The Levels Of Education

Educational Level	Frequency	Percent
EL-1 (formerly Block #1)	34	55.7
EL-2 (formerly Block #2 and Others)	27	44.3
Total	61	100.0

Teaching Experiences

Teaching experience was the second independent variable. There were 7 items in the Teaching Experience subscale (See Table 4.2). Seventy-two percent (44) of the participants had no experience teaching as a sports coach. Forty-three percent (34) of the participants had teaching experience in church, faith-based school events; likewise, 68 percent (50) participants had teaching experience with Sunday school and Bible study lessons. Seventy percent of the participants had no teaching experience involving sororities or fraternities. Sixty-three percent of the participants (37) had teaching experience in work-related environments. Sixty-six (41) of the participants had teaching experience in other paid environments; similarly, seventy-eight percent of the participants (48) had teaching experience in other volunteer environments (See Table 4.3).

Table 4.3: Percentage Of Participants With Teaching Experiences As A Category Of Years Of Experiences; N=61

	0 years	1or less	2 years	3 years	4 years	5 or more
Sports Coach	72.1 (44)	14.8 (9)	8.2 (5)	0	4.9 (3)	O
Church, faith-based	43.3 (26)	20.0 (12)	8.3 (5)	5.0 (3)	6.7 (4)	16.7 (10)
Sunday school	32.8 (20)	19.7 (12)	18.0 (11)	8.2 (5)	4.9 (3)	16.4 (10)
Sorority/Fraternity	70.5 (43)	18.0 (11)	3.3 (2)	4.9 (3)	0	3.3 (2)
Work-related	37.3 (22)	33.9 (20)	8.5 (5)	8.5 (5)	6.8 (4)	5.1 (3)
Other (paid)	33.3 (20)	20.0 (12)	18.3 (0)	3.3 (11)	11.7 (2)	13.3 (7)
Other (volunteer)	21.3 (13)	27.9 (17)	13.1 (8)	6.6 (4)	11.5 (7)	19.7 (12)

Note: Each table cell number is listed as a percentage with the actual count in parentheses (frequency).

Each subscale was summed across the category for number of years in the following manner. For 1 year or less, the score of 1 was given; for 2 years, a score of 2; for 3 years, a score of 3; for 4 years, a score of 4, and for 5 years or more, a score of 5. The range of summed scores was 7 through 37. The 25th, 50th, and 75th percentiles were calculated and designated as Group #1, Group #2, Group #3, and Group #4 for the remainder above the 75th percentile. Because each group frequency was so small, the number of years was collapsed into 2 categorical groups defined at the meridian.

Group #1 was re-designated for those scores below the 50th percentile as the group with less teaching experience, sums of less than 15; the new group frequency was 32. Group #2 was designated for those scores above the meridian with summed scores of 15 through 37; the new group frequency was 29 (See Table 4.4).

Table 4.4: Frequencies And Percentile Levels For The Independent Variable Of Group Designation In Terms Of Years Of Teaching Experience

Group Percentiles	Frequency	Percent
Group #1 - 25 Percentile Level	20	32.8
Group #2 - 50 Percentile Level	12	19.7
Group #3 - 75 Percentile Level	15	24.6
Group #4 - 100 Percentile Level	14	23.0
Total	61	100.0

The independent variable for teaching experience was subsequently redefined as the amount of teaching experience with the two levels of “low teaching experience” (Low TE) and “high teaching experience” (High TE), (See Table 4.5).

Table 4.5: Re-Defined Name Designations For Groups Describing Teaching Experience

Original Groups	Re-defined groups
Groups #1 and #2	Low teaching experience (Low TE)
Groups #3 and #4	High teaching experience (High TE)

Re-defining the descriptors for educational level (EL) and teaching experience (TE) results in 2 independent variables each with 2 levels. The educational independent variable has the 2 levels of EL-1 and EL-2. The teaching experience independent variable has the 2 levels of low teaching experience (Low TE) and high teaching experience (High TE).

Descriptive Results of Central Tendencies

This section describes the results of the subscales from the Technology Questionnaire and the Teacher Survey. Participants were asked to complete 2 online instruments, the Technology Questionnaire and Teacher Survey, at the beginning and at the end of the semester. There were 82 completed instruments at the beginning of the semester and 61 completed instruments at the end of the semester.

Technology Questionnaire

The main body of the Technology Questionnaire consisted of 11 subscales in which the participants rated the specific subscale on a Likert-like scale from 0 (zero) to 5: Teaching Experience, Operating System, Technology Tools, Word Processor, Communications, Online Resources, Presentation/Imaging, Manage Data, Desktop Publishing, Webpage Design, and Multimedia Projects (See Appendix A for individual frequencies of each subscale item). For computational reasons, the scales were recoded to values 1 through 6.

Nine of the ten Technology Questionnaire items were included in determining the Cronbach's alpha for the pre-test and post-test submissions. Teaching Experience was determined to result in demographic information only and, therefore, was not included in the data collection for Cronbach's alpha. Scale #11 (Integrate Multimedia Tools) only had one item and was, thereby, eliminated from this calculation. The alpha scores are reported in Table 4.1. The underlying assumption for internal consistency reliability was met; that is, the parts of the measure must be equivalent. Since the exact instrument was used for both the pre-test and post-test conditions, every item is equivalent in both samples. "All items should measure the same underlying dimension. If this assumption is met, differences in relative standing among respondents for different items should be due only to measurement error … such as unreliably responding" (Green & Salkind, pp 311). Pre-test alpha scale scores range from .68 to .99 while post-test scale scores range from .34 to .96.

Unexpected Results

Instances of unexpected reporting occurred within 3 of the scales for the Technology Questionnaire. These data are retained for the descriptive and inferential analysis and discussed for further comments in chapter 5. The post-test scores for the Word Processor scale (.34) and the Desktop Publishing scale (.44) might have unreliable self-reports from the participants. An Inter-Item correlation revealed that 5 of the 8 items for the Word Processor subscale had negative correlations for the post-test scores (-.032 to -.041). Three of the items for the Word Processor subscale were exactly the same: 1.00 correlation, which means that all of the participants reported exactly the same responses for these items of the post-test Word Processor subscale. Additionally, the second item in the Desktop Publishing subscale, Graphic Tools, had a malfunction in the online database and did not record some of the submissions. This malfunction could not be corrected so that the original input could be recaptured from the participants. The inter-item correlation for the post-test score of Online Resources was very low for 5 of the 6 items, from 0.52 to .56. The exception was for the correlation between the items "Follow hyperlinks" and "Use search engine" which revealed a correlation in the post-test score of .89. The post-test alpha scores for these 3 subscales, Word processor, Online Resources, and Desktop Publishing, posit further review for these items (See Table 4.6). The pre-test alphas differ from the post-test alphas possibly due to the items included or to the students' reaction to these items. Suggestions will be made in chapter 5 for re-visiting the subscales for the Technology Questionnaire.

Summary of Results

Of the 10 scales for the Technology Questionnaire, 7 of the scales showed consistent reporting by the participants. Alphas for the subscales of Manage Data (.94) and Webpage Design (.99) were the highest for the pre-test submissions, while Manage Data (.96), Communications (.87) and Webpage Design (.87) were the highest alpha scores on the post-tests. Table 4.6 shows all of the scales and pre-test and post-test alpha scores for the Technology Questionnaire.

Table 4.6: Comparison Of Alpha Reliability Scores For The Pre-Test And Post-Test Of Technology Questionnaire Subscales (N=61)

Variable Scale Name	N of Items	Pre-Test Alphas	Post-Test Alphas
Operating System	8	.80	.72
Technology Tools	5	.73	.73
Word Processor	8	.77	.34
Communication	12	.84	.87
Online Resources	6	.68	.58
Presentation/Imaging	9	.86	.86
Manage Data	7	.94	.96
Desktop Publishing	2	.74	.44
Webpage Design	10	.99	.87
Integrate Multimedia Tools (only 1 item)	1	--	--

Technology Efficacies

The main body of the Technology Questionnaire consisted of 10 subscales for self reporting for how knowledgeable the pre-service teachers perceived themselves to be with various technology tools. For each subscale the mean scores were calculated, and re-coded, from 1 (no knowledge) to 6 (very knowledgeable). The individual subscale frequencies (See Appendix A) were calculated for the number of respondents to each subscale. Subscale means for the pre-test and post-test scores were the highest for Operating System, Word Processor, and Online Resources (See Figure 4.2).

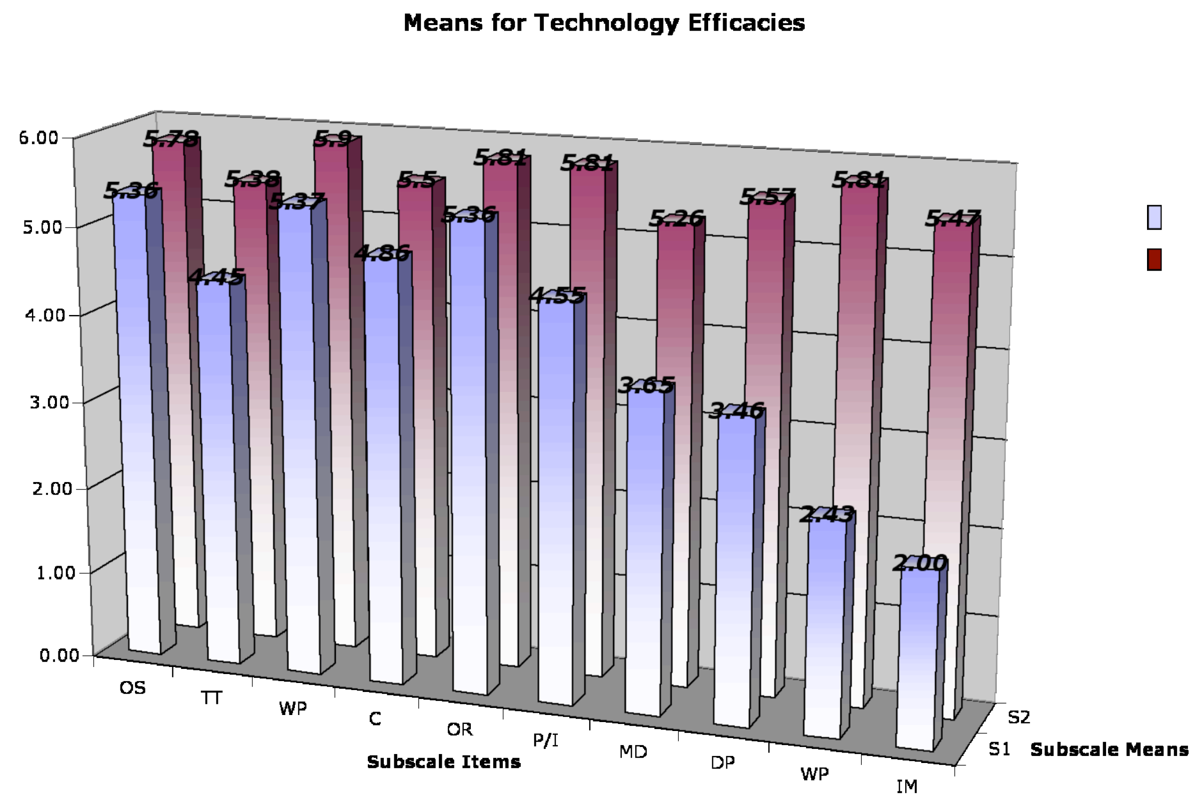


Figure 4.2: Means for the Technology Efficacies of the Pre-Test and Post-Test scores on the Technology Questionnaire

Gain Score Descriptives for the Technology Questionnaire

The “GAIN” scores for the Technology Questionnaire consisted of subtracting the pre-test means of each subscale from the post-test means of each subscale. There was a positive mean gain score for every subscale of the Technology Questionnaire (See Table 4.7).

The overall mean gain score for all of the items of the Technology Questionnaire subscales was 1.44 with a standard deviation of .98 (See Table 4.7). There was only one item for the Multimedia Project subscale and 2 participants did not give any submission for this subscale; therefore, the mean gain reflects scores for on 59 participants.

Table 4.7: Mean Comparisons of Pre-Test, Post-Test and Gain Scores for the Technology Questionnaire

Scale Name	n	Pre-Test		Post-Test		Gain Scores	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Operating System	61	5.42	.68	5.78	.37	.35	.82
Technology Tools	61	4.45	1.01	5.38	1.06	.93	1.32
Word Processor	61	5.58	.51	5.94	.15	.36	.54
Communication	61	4.87	.86	5.53	.64	.67	1.13
Online Resources	61	5.36	.76	5.81	.38	.45	.94
Presentation/Imaging	61	4.59	1.08	5.82	.43	1.23	1.17
Manage Data	61	5.26	1.03	3.71	1.21	1.56	1.63
Desktop Publishing	14	3.54	1.74	5.57	.68	2.03	1.96
Webpage Design	61	5.81	.38	2.48	1.59	3.33	1.70
Multimedia Projects	59	3.00	1.62	5.47	.98	2.47	1.95
TOTAL						**1.44**	**.98**

Cronbach's alpha was calculated for the gain scores on the 10 items in the subscales of the Technology Questionnaire with 59 cases as 0.88.

<u>Teacher Survey</u>

There were 37 items in the Teacher Survey instrument. The pre-test alpha scores ranged from .78 to .86; the post-test alpha scores ranged from .82 to .94 (See Table 4.8). The consistencies of these Cronbach alpha scores "…suggest that the scale scores are reasonably reliable for respondents like those in the study" (Green & Salkind, pp 315). TC and SC define the subscales for centeredness without computer availability. TCC and SCC mark the subscales for centeredness using computers. The Cronbach alpha scores are similar to those reported by Wang (2002).

Table 4.8: Comparison Of Alpha Reliability Scores For The Pre-Test And Post-Test Teacher Survey Subscales

Variable Subscale Name	N of Items	Pre-Test Alphas	Post-Test Alphas
TC – Without computers	6	.86	.82
SC – Without computers	6	.79	.84
SCC – Using computers	6	.81	.86
SCC – Using computers	6	.78	.86
TCC – Responses	6	.76	.94
SCC – Responses	7	.83	.92

Teacher Survey Gain Scores

There was a positive gain score for all of the items on the Teacher Survey subscales. The mean gain score for all of the items of the Teacher Survey subscales, the total post-test mean score minus the total pre-test mean score, was .24 (See Table 4.9).

Table 4.9: Mean and standard deviations for the pre-test, post-test and gain scores on the Teacher Survey

Scale Name	n	Pre-Test		Post-Test		Gain Scores	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
TC – Without	61	4.13		4.47		.34	.71
SC – Without	61	4.06		4.38		.31	.61
TCC – Using	60	4.12		4.34		.22	.60
SCC – Using	60	3.99		4.28		.28	.63
TCC – Responses	60	4.24		4.28		.24	.78
SCC – Responses	60	3.45		3.70		.04	.80
TOTAL						**.24**	**.69**

Cronbach's alpha was calculated for the overall mean gain scores on the 37 items in the subscales of the Teacher Survey with 60 cases as 0.66.

Inferential Statistics

The purpose of this study was to investigate the ways the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (TC versus TC-C and SC versus SCC) change while using the theoretical framework of a learner-centered approach to curriculum and instruction during their semester-long course of integrating technology into content areas. The research design for this study was a quasi-experimental design with repeated measures for within-groups. In this section, the results of inferential statistics are described for the 3 research questions.

Overview of Testing Procedures

The two independent variables were educational level (EL) and teaching experience (TE) and each independent variable had 2 levels. The educational level had the two levels of EL-1 and EL-2. The teaching experience variable had the two levels of Low TE and High TE. The dependent variables were the mean gain scores on the Technology Questionnaire and Teacher Survey.

The inferential statistic used for the first research question was the two-way analysis of variance (two-way ANOVA) whereby each participant had scores on two independent variables and one dependent variable. Each independent variable was divided into cases with two levels. For research questions 2 and 3, the multiple analyses of variance (MANOVA) statistic was calculated for each question whereupon each case was scored on 2 independent variables each with 2 levels and 2 dependent variables, each with 2 levels.

Research Question for Technology Efficacy (TQ)

Research Question #1

Research question #1 was: Are there differences in self-reported technology efficacy in pre-service teachers based on educational level and teaching experience?

The H_1 is: There are no differences in technology efficacies between the educational levels of EL-1 and EL-2 (See Table 4.10).

The results of the two-way ANOVA found no significant difference for the dependent variable of technology efficacy (TQ) for educational levels (EL), ($F(1, 60) = .01$, $p <91$).

The H_2 is: There are no differences in technology efficacies between teaching experiences – Low TE and High TE.

The result of the two-way ANOVA found no significant difference for the dependent variable of technology efficacy (TQ) with teaching experience (TE), ($F(1,60) = .03$, $p < .86$).

Table 4.10: Two-Way Analysis Of Variance (ANOVA) Of Overall Mean Gain Scores For Technology Efficacies (TQ) With Teaching Experience (TE) And Educational Levels (EL) (N=61)

Source	df	F	Sig.
Teaching Experience (TE)	1	.03	.86
Educational Level (EL)	1	.01	.91
TE * EL	1	4.99	.03**

** The overall mean gain score is significant at the .05 level

The H_3 is: There are no differences in technology efficacies between teaching experiences and educational levels.

The result of the two-way ANOVA found a significant difference for the interaction of teaching experience and educational level ($F(1, 60) = 4.99$, $p < .03$). A comparison of the mean gain scores shows significantly high means for Block #1 pre-service teachers with high teaching experience (1.77) and Block #2 with low teaching experience (1.78). See Table 4.11.

Table 4.11: Mean GAIN Scores Comparison For Significant Difference In Teaching Experience Of Technology Efficacies (TQ)

Teaching Experience (TE)		Block #1	Block #2
High (TE)	Mean	1.77 **	1.15
	Std Deviation	.32	.29
	n	9	11
Low (TE)	Mean	1.22	1.78 **
	Std Deviation	.19	.24
	n	25	16
Total	Mean	1.37	1.52
	Std Deviation	1.07	.85
	n	34	27

** The overall mean gain score is significant at the .05 level

Research Questions For Centeredness

Identical statistical procedures were used to analyze research questions #2 and #3. The two independent variables for this research question were educational level (EL) and teaching experience (TE) and each independent variable had 2 levels. The educational level had the two levels of EL-1 and EL-2. The teaching experience variable had the two levels of Low TE and High TE. The dependent variables for research question #2 were the mean gain scores on the teacher centeredness and student centeredness without computer availability (TC and SC). The inferential statistics used for research question #2 and research question #3 were an one-way multiple analysis of variance (one-way MANOVA) whereby each participant had scores on two independent variables and two dependent variables.

Research Question #2

Research question #2 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TC) versus student centeredness (SC) in classrooms without computer availability?

The H_4 is: There are no differences in teacher centeredness for teaching experience.

The result of the one-way MANOVA found no significant difference for the main effect of teaching centeredness without computer use for teaching experience ($F(1, 60) = .45$, $p <.51$).

The H_5 is: There are no differences in student centeredness for teaching experience.

The result of the one-way MANOVA found no significant difference for the main effect of student centeredness without computer use and teaching experience ($F(1, 60) = 3.26$, $p <.08$).

The H_6 is: There are no differences in teacher centeredness for educational level.

The result of the one-way MANOVA found no significant difference for the interaction of teaching experience and educational level ($F(1, 60) = .76$, $p <.39$).

The H_7 is: There are no differences in student centeredness for educational level.

The result of the one-way MANOVA found no significant difference for the interaction of teaching experience and educational level ($F(1, 60) = 1.96$, $p <.17$).

Table 4.12: Multiple Analysis Of Variance (MANOVA) For The Effects Of Student Centeredness (SC) And Teacher Centeredness (TC) On Teaching Experience And Educational Level In Environments Without Computers (N=61)

Source	df	F	Sig.
Teaching Experience (TE)			
TC (Without)	1	.45	.51
SC (Without)	1	3.26	.08
Educational Level (EL)			
TC (Without)	1	.76	.39
SC (Without)	1	1.96	.17
TE * EL			
TC (Without)	1	.31	.58
SC (Without)	1	.65	.42
Error	57		
Total	61		

Table 4.12 displays the results that in classroom environments without computer use, there was no significant difference in the gain scores for teaching experience or educational level.

Research Question #3

As with research question #2, research question #3 was analyzed with a multivariate analysis of variance (MANOVA) because there were two independent variables (TE and EL), each with 2 levels, and 2 dependent variables (TCC and SCC). The MANOVA evaluates whether the mean gain scores on the dependent variables vary across levels of the independent variables. The one-way MANOVA tests the hypothesis that the mean gain scores for the dependent variables (TCC and SCC) are the same for all levels of each independent variable (Green & Salkind, p. 203). The results of the overall MANOVA are described below.

Research question #3 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TCC) versus student centeredness (SCC) in classrooms using computers?

The H_8 is: There are no differences in teacher centeredness (TCC) for teaching experience.

The result of the multiple analysis of variance, MANOVA, found no significant difference for the main effect of teaching centeredness (TCC) and teaching experience ($F(1, 60) = .01$, $p < .91$) in environments using computers.

The H_9 is: There are no differences in student centeredness for teaching experience.

The result of the multiple analysis of variance, MANOVA, found no significant difference for the main effect of student centeredness (SCC) and teaching experience ($F(1, 60) = .14$, $p < .71$).

The H_{10} is: There are no differences in teacher centeredness for educational level.

The result of the multiple analysis of variance, MANOVA, found a significant difference for the main effect of teacher centeredness (TCC) and educational level ($F(1, 60) = 3.89$, $p < .05$).

The H_{11} is: There are no differences in student centeredness for educational level.

The result of the multiple analysis of variance, MANOVA, found a significant difference for the main effect of student centeredness (SCC) and educational level ($F(1, 60) = 6.63$, $p < .01$).

Table 4.13 shows the comparison of the series of MANOVAs for teaching experience and educational level for teacher centeredness and student centeredness in environments using computers. There was no significant difference for the main effect between teacher centeredness and student centeredness for teaching experience in environments using computers; however, there was a significant difference in the main effect of educational level for (TCC) and student centeredness for using computers (SCC).

Table 4.13: Multiple Analysis Of Variance (MANOVA) For The Effects Of Student Centeredness (SCC) And Teacher Centeredness (TCC) On Teaching Experience And Educational Level (n=61)

Source	df	F	Sig.
Teaching Experience (TE)			
TCC (Using)	1	.01	.91
SCC (Using)	1	.14	.71
Educational Level (EL)			
TCC (Using)	1	3.89	.05 **
SCC (Using)	1	6.63	.01 **
TE * EL			
TCC (Using)	1	.33	.57
SCC (Using)	1	.35	.56
Error	56		
Total	60		

** The overall mean gain score is significant at the .05 level

Table 4.14 shows the comparison of the significant differences for the mean gain scores for the educational levels of teacher centeredness and student centeredness in environments using computers.

Table 4.14: Mean Gain Scores And Standard Deviations Of Comparison In Educational Level For Student And Teacher Centeredness

Educational Level (EL)		TCC	SCC
EL-1	Mean	.38**	.49 *
	Std Deviation	.63	.66
	n	34	
EL-2	Mean	.02	.01
	Std Deviation	.50	.49
	n	26	
Total	Mean	.22	.28
	Std Deviation	.60	.63
	n	60	

* The overall mean gain score is significant at the .01 level.
** The overall mean gain score is significant at the .05 level.

Responses to the frequency of use of computers showed that the significant difference for frequency of responding to the use of computers (RES-SCC) was for EL-

1. Table 4.15 shows the comparison of the significant differences for the mean gain scores for the educational levels of responses to teacher centeredness and student centeredness in environments using computers. EL-1 participants (Block #1 entry-level elementary education students) reported a higher frequency for computer use when responding to how frequently they would use computers in the classroom; they did not revert back to teacher centeredness choices.

Table 4.15: Mean GAIN Scores and Standard Deviations of Comparison in Educational Level for Student and Teacher Centeredness

Educational Level (EL)		RES-TCC	RES-SCC
EL-1	Mean	-.07	.33 **
	Std Deviation	.92	.85
	n	34	34
EL-2	Mean	.17	.13
	Std Deviation	.58	.66
	n	26	26
Total	Mean	.03	.24
	Std Deviation	.80	.78
	n	60	60

** The overall mean gain score is significant at the .05 level.

CHAPTER #4 SUMMARY

Overview

The research design for this study was a quasi-experimental design using two instruments for repeated measures within-groups on each instrument. The pre-test and post-test results were subtracted, offering a gain score that was used for all of the descriptive and inferential calculations. The 2 independent variable, each with 2 levels, and the 4 dependent variables suggested 1 two-way ANOVA, 2 one-way multiple analyses of variance (MANOVA), and 1 Pearson product-moment correlation for the 4 research questions.

Technology efficacies

Using the mean gain score to assess the reported technology efficacies (TQ), all of the subscales on the Technology Questionnaire were positive (See Table 4.16). The smallest gain scores were reported for the Operating System subscale by participants with the least amount of teaching experience (TE), and the largest gain scores were reported for Webpage Design and Multimedia Projects by those participants in educational levels other than Block #1 (EL-2). See Figure 4.3.

Table 4.16: Comparison Of Gain Means For Teaching Experience And Educational Levels For Technology Efficacies (n=61)

Teaching Experience	OS	TT	WP	C	OR	P/I	MD	DP	WD	MP	TOT
Low TE	.30	.87	.32	.60	.40	1.30	1.71	1.95	3.40	2.49	1.44
High TE	.46	1.05	.43	.80	.57	1.11	1.25	2.05	3.19	2.56	1.42
EL-1	.36	.68	.41	.49	.45	1.13	1.72	1.75	3.22	2.32	1.37
EL-2	.34	1.24	.29	.89	.46	1.36	1.35	2.28	3.48	2.76	1.52
TOT Mean	**.37**	**.96**	**.36**	**.70**	**.47**	**1.23**	**1.51**	**2.01**	**3.32**	**2.53**	

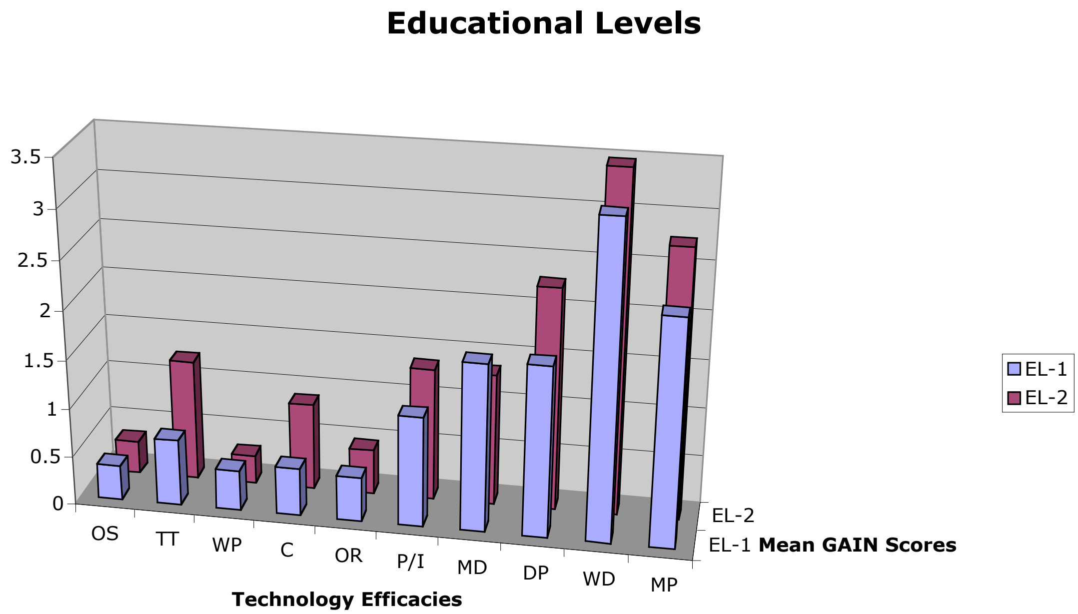


Figure 4.3: Frequencies of Mean GAIN Scores of Technology Efficacies for Educational Levels (EL-1 and EL-2)

<u>Centeredness</u>

All of the mean gain scores for the Teacher Survey subscales were positive. There were no significant differences in teaching experiences and educational levels for the technology efficacies. Research questions #2 and #3 were similar. Research question #2 asked if there were any differences in teaching experiences and educational levels for teacher and student centeredness in environments without computer availability. Research question #3 asked a similar question to research question #2, only for environments using computers. There were no significant differences among any of the groups for research question #2. There was a significant difference for teacher centeredness and student centeredness according to educational level (See Table 4.17).

The mean gain scores of the responses to teacher centeredness using computers (RES-TCC) were low with the 2 independent variables (Low TE) and (EL-1) showing negative gains. The mean gain scores of the responses to student centeredness using computers (RES-SCC) were all positive with the highest gain scores reported from the entry level pre-service teachers (EL-1).

Overall, the Technology Questionnaire and the Teacher Survey show positive gain scores for technical efficacies and for support of student-centered learning in environments using computers.

Table 4.17: Comparison Of Mean Gain Scores For Teacher Centeredness And Student Centeredness For Teaching Experience And Educational Level (n=61)

Teaching Experience and Educational Level	TC	TCC	SC	SCC	RES-TCC	RES-SCC	**TOTS**
Low TE	.23	.25	.42	.33	-.06	.23	**.26**
High TE	.36	.18	.09	.19	.25	.27	**.21**
EL-1	.37	.38**	.45	.49*	-.07	.33**	**.34**
EL-2	.21	.02	.14	.01	.17	.13	**.11**
Totals	**.29**	**.21**	**.28**	**.18**	**.29**	**.24**	

* The overall mean gain score is significant at the .01 level.
** The overall mean gain score is significant at the .05 level.

CHAPTER V
DISCUSSION

Overview

The purpose of this study was to investigate whether the pre-service teachers' perceptions of increased technology efficacies (TQ) and classroom roles (TC and TCC compared with SC and SCC) changed while using the theoretical framework of a learner-centered approach to curriculum and instruction during their semester-long course of integrating technology into content areas.

In this quasi-experimental design, the treatment consisted of the required technology applications integration class for elementary education majors. Two online instruments were used to assess technical efficacies and centeredness of classroom pedagogy. Mean gain scores were calculated from the post-test minus the pre-test mean scores. The technology efficacies were identified as the mean gain scores from the 10 subscales of the Technology Questionnaire. Centeredness was divided into teacher-centeredness and student-centeredness in environments without computer availability and in those classrooms using computers, thereby, utilizing 4 dependent variables for centeredness. The results showed important findings for teachers, researchers, and educational administrators.

For this study, research question #1 yielded 2 hypotheses and was tested with 2 two-way ANOVAs. Research questions 2 and 3 were tested in similar manners. Research questions #2 and #3 each had 2 levels and 2 dependent variables, supplying 4 hypotheses for each question; therefore, the multiple analyses of variance (MANOVA) was used.

As a result of this research study, 3 important findings were elicited from the 3 research questions. The first finding corroborated the results that technology application classes are beneficial to the course enrollees. The second finding reported that the significant level of impact for integrating technology into curricula is at the entry-level, Block #1 pre-service teachers. The third finding supported the efforts to teach with learner-centered approaches to the curricula. In the following sections, the research findings will be discussed, limitations of the study will be presented, conclusions drawn, and suggestions for further research will be offered.

Discussion of Results

The following summary examines the preceding analyses relative to the 3 research questions generated for this study.

The Effect of the Treatment on Technology Efficacies

Research question #1 was: Are there differences in educational level and teaching experience for pre-service teachers' self-reported technology efficacies? A comparison of the mean gain scores showed significantly high technology efficacy (TQ) mean gain scores for Block #1 pre-service teachers with high teaching experience (1.77) and Block #2 with low teaching experience (1.78). Block #1 pre-service teachers consisted only of students at the beginning of their education methods courses. The results offer the speculation that those students with more teaching experience reported higher mean gain scores in the subscales of the Technology Questionnaire. Likewise, those in Block #2, which included 18 pre-service teachers as yet to be enrolled in Block #1 methods classes, reported higher mean gain scores for those with less teaching experiences. The important finding is that with more teaching experiences, the entry-level pre-service teachers reported greater technology efficacies (TQ). Entry level pre-service teachers with more teaching experience reported mean gain scores that were significant at the .05 level. Others, including non-education majors, with low teaching experience, reported significant mean gain scores. The conclusion drawn here is that, "…preservice teachers' comfort with the technology and attitude of competence … improve(d) over time …" (Rizza, 2000).

Of additional interest is the fact that all of the mean gain scores were positive for the Technology Questionnaire; that is, the participants indicated higher reports of knowledge on the technology scales after the intervening class. Mean gain scores for Desktop Publishing, Webpage Design, and Multimedia Projects resulted in the highest scores. Previously, findings reported usefulness for multimedia presentations, student publications, and student websites (Keiper et al., 2000); (Ropp, 1999); (Culp et al., 2003). See Table 5.1.

Table 5.1: Comparison Of How Useful Each Of Selected Components Of The Faculty Training/Curriculum Review Was In Helping Pre-Service Teachers Learn How To Integrate Technology Into Teaching Practices (n=199)

	Not Useful	Somewhat Useful	Moderately Useful	Very Useful
Creating student multimedia presentations	4	18	44	133
	2.0	9.0	22.1	66.8%
Creating student publications	6	22	47	124
	3.0	11.1	23.6	62.3%
Creating student websites	11	30	49	109
	5.5	15.1	24.6	54.8%

(Culp, 2004, p. 24)

The lowest mean gain score was reported for Word Processor, indicating that participants were already very knowledgeable about this technology tool. These findings are similar to those reported by previous researchers examining pre-service technology abilities. (Cuckle et al., 2000) observed that students reported the most competence in using word processor and that 96% of the students used this tool for their own work.

The intervening course for this research study, Technology Applications for Elementary Educators, appeared to have accomplished several tasks, one of which was the opportunity to allow the participants to obtain more experience (comfort) in specific areas of technology, as suggested by the overall positive mean gain scores for technology efficacies (TQ).

The Effect of the Treatment on Centeredness in Environments Without Computers

Research question #2 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TC) compared to student centeredness (SC) in classrooms without computer use? In classroom environments without computer use, there was no significant difference in the mean gain scores for teaching experience or educational level. The mean gain scores for teacher centeredness and student centeredness in environments without computers was not significantly different for the participants based upon their level of education or amount of teaching experience. This result was anticipated from the previous research studies (Bichelmeyer et al., 1998); (Wang, 2000a, 2001, 2002) in which no significant differences were found between pre-service teachers' perceptions of teacher-centered roles and their perceptions of student-centered roles in the classroom without computers (Wang, 2000, 2001). The preservice teachers reported lower mean gain scores in response to items in which classrooms without computers should be both teacher centered and student centered (Wang, 2002).

The Effect of the Treatment on Centeredness Using Computers

The importance of this finding was two-fold: First, the research assumption for this study was that a student-centeredness intervention might offer differences from those found in previous studies in which participants reverted to teacher centeredness in environments using computers. Secondly, the expectation was that the course, used as an intervention, would assist in differentiating in which pre-service teacher sample could the significance be located. Given these research assumptions, the third research question was formed in the following manner.

Research question #3 was: Are there differences between teaching experience (TE) and educational level (EL) for teacher centeredness (TCC) versus student centeredness (SCC) in classrooms using computers? There was a significant difference in the main effect of educational level for teacher centeredness (TCC) and student centeredness (SCC) for using computers.

Significant differences were found for the entry-level participants, EL-1, for teaching centeredness in environments using computers (TCC) and for student centeredness in environments using computers (SCC). Responses to the frequency of use of computers showed that the significant difference for frequency of responding to the use of computers (RES-SCC) was for EL-1. These participants (Block #1, entry-level, elementary education students) reported a higher frequency for computer use when responding to how frequently they would use computers in the classroom; they did not revert back to teacher centeredness choices. The data showed that these pre-service teachers would be more likely to use the computer as a student-centered tool than as a teacher-centered tool. The comparison of the pre-service teachers' perception of classroom roles and their choice of computer uses showed a maintenance in choice, rather than a reversal, in terms of the student centeredness.

Researchers have, indeed, reported changes in awareness of and attitudes toward educational applications of computer-related technologies (Cassady, 2000) and changed views of technology infusion from thinking that pre-service teachers would teach and learn about technology to thinking they would use technology to support student learning (Beyerbach et al., 2001). However, many researchers have also found that pre-service teachers were "… not always able to transfer their skills to use in the classroom, although they very often used them in preparing … classroom materials …" (Cuckle et al, 2000). Additionally, previous research indicated that preservice teachers held naive conceptions (Hargrave & Sadera, 2000) and conflicted views (Wang, 2001) of how the computer could be used to enhance teaching and learning. Their view of technology used in classrooms was based upon the more traditional didactic instructional methods (Hargrave & Sadera, 2000) in teacher-centered environments. It was probably very difficult for pre-service teachers to envision a technology-rich learning environment where learners could work independently and/or cooperatively with teachers and fellow students as facilitators and learning partners.

Researchers and administrators began to advocate that instructional technology training courses should support student-centered constructivist teaching pedagogy (Wang, 2002). By situating instructional technology within educational methods classes, the enhanced structure would allow pre-service teachers to expand their technical skills in the context of a curriculum development process. By using the Intel Teach to The Future (ITF) pre-service program as the educational model upon which to require participants to create immediately relevant materials, the curriculum put "… the teachers' interests and concerns at the center of the training experience". (Culp, K. M. et al, (2004). The significant difference of the entry-level participants maintaining their student-centeredness in environments using computers suggested that using all or almost all of the ITF curriculum could be successful as the center of an instructional technology course (Culp, 2004, p. 6).

Implications for Classroom Practice

The increased knowledge of technology skills had an effect on all groups and all educational levels. Researchers reported similar analyses (Jones, 2002), which supported the results from this study that, as a whole, these pre-service teachers benefited from the technology integration class shown by their reports of a higher mean gain score for all of the subscales in the Technology Questionnaire.

The findings of this research supported the results and observations from previous studies (Culp, 2004; Wang 2002) that, in turn, supported pre-service teachers learning in a student-centered environment with an opportunity to familiarize themselves with content-oriented, research-oriented strategies of integrating technology. The Intel Teach to the Future (ITF) pre-service curriculum, specifically designed for use with pre-service teachers, was used in the instruction of pre-service teachers who are expected to use the materials in their methods courses. “This focus on pedagogically-based technology integration is an essential piece of Intel Teach to the Future’s success” (Yost, 2003).

As in other research studies that encompassed the ITF training, participants not only became familiar with the various technology tools, but also realized that effective integration of technology into instruction would enhance student learning effect and encourage higher level thinking abilities (Zhiting et al, 2001). At the end of an integrated technology course, the pre-service teachers should know more about technology-supported instructional innovations in student-centered environments, and should be able to design lesson plans demonstrating the integration of that technology.

Suggestions

There are a variety of positions on, and descriptions of, constructivist learning theory that vary in belief with respect to the extent that knowledge construction is subjective versus objective and the extent that knowledge construction is a social versus an individual process. However, “… there are also central beliefs common to each position in describing constructivism. Specifically, all concur that the learning environment should be learner-centered” (Kanuka & Anderson, 1999). Maintaining a constructivist, learner-centered, technology integration course appears to be an important structure in which the entry-level, pre-service teachers will be able to retain their student-centered focus in environments using computers. Technology integration is an essential component of a constructivist teacher education program, that is, students being responsible for their own learning, including reflecting on one's lesson activities or projects. Technology lends itself very favorably to individual and group reflection. Students should be asked to reflect often in class and through a variety of methods. Word processing is an obvious method for reflection, but emerging technologies such as web journaling (web logs, or blogs), and text/audio/video conferencing are other arenas enabling reflection. Examples of applying emerging technologies could ask students to converse with students in pre-service programs in other states or countries, reflecting on various issues essential to preservice teacher education. Technology links between the university and the schools for sharing and reflection should also be a goal for teacher education.

Another important component of constructivist programs is active student involvement. The integration of technology facilitates active student involvement. Class activities should be project based where students work individually or in cooperative groups to complete relevant activities. Examples might include: (a) research projects, (b) lesson and unit planning, (c) development of learning centers and other student-centered projects, (d) activities integrating management, commercial software games and simulations, (e) multimedia software, and (f) emerging technologies. Cooperative learning activities where students are encouraged to use the computers to gather research or interact through email or the Internet to acquire information or ask questions programs would facilitate the integration of technology and constructivist ideas in teacher education. The application word processing, data management, presentation, or multimedia would also help to achieve the goal of integration with active student involvement.

All of the participants in this study were familiar with communication tools; however, only e-mail was used in these classes and only for submitting assignments. Additional web or computer conferencing (asynchronous discussion groups/forums) might be included to support topic-based conversations using mailing lists, web-based discussion tools, or groupware. To foster communicative abilities of various technology tools, data collection/sharing/organization software might be included as avenues for repositories of resources, and projects using databases. Further interactivity can be built into the course content by implementing document sharing tools that allow users to display, discuss and collaborate on documents or artifacts using websites, annotation systems, revision tools in word processing systems, and electronic whiteboards (Shank, 2002).

An essential component of a constructivist classroom is student-centered and active involvement. The intent is for students to be responsible for constructing their own learning by having a curriculum that facilitates active involvement. The suggestion is for pre-service education to be project-based. Each project chosen can be modeled by the instructor and then the students present completed projects to class in small or large group format for reflection. Possible projects related to the curricular themes might be presented to the students at the beginning of the semester for discussion and lesson planniing. The class chooses projects to complete, prioritizes the projects and adds projects of their own. Examples for projects might include, (a) technology applications, (b) simulations, (c) community-based activities, (d) problem solving, (e) assessment of new technology tools, and (f) student-centered active learning activities for students with different physical and language abilities.

A technology integration model consistent with the constructivist focus includes the process of reflecting, applying, constructing, and evaluating for students who are in the entire learning situation. Thus, a change in attitudes regarding technology can occur; rather, a change in attitudes about learning with technology must occur. The real value of educational technology can be experienced by students who are able to apply technology in new situations. Students can become very knowledgeable with various technology tools and are then able to teach and share the tool with others. Change starts with the individual teacher, who, upon catching the vision, is willing to take risks. A risk might start with teaching pre-service teachers how to use a spreadsheet to count M & Ms by color and create a chart; the risk comes when the teachers are asked to creat a lesson plan in their content area using the spreadsheet. It requires ‘thinking outside of the box.’ Language arts, geography, and health/nutrition lesson plans can all be accommodated quite nicely when students are required to think and create their own ‘learning situation’ at a higher level on the Taxonomy of Learning (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), such as the ‘Applications’ level. It is important for administrators and researchers to remember that technology is not a subject. The focus of integration is on pedagogy — effective practices for teaching and learning. Pre-service teachers need to be able to make choices about technology integration without becoming technocentric by placing undue emphasis on the technology for its own sake without the three-way connections to learning, students, and the curriculum.

Limitations

The number of participants in this study was small. If this study is repeated in a fall semester when enrollments are between 120 to 160 students, the comparisons in learner centeredness might create a stronger significant difference.

Additional sections of the course will include additional instructors which might introduce co-variances for instructor differences and the sex of the instructor.

Conclusions

This research study was a replication of a study completed initially by Bickelmeyer et al (1997) and later with a change of focus from in-service to pre-service teachers by Wang (2000). Wang (2002) suggested the following for future research: (1) "… replicating (the) study with preservice teachers at the entry level …", (2) "… gathering information via use of survey questionnaires …", (3) "… using IT training courses as an intervention to shape and change the preservice teacher's perception of the teacher's role …", and (4) "… using the same survey questionnaire at the beginning and at the end of IT training courses to measure the change in preservice teachers' perceptions of the teacher's role in classrooms with computers (p. 157-8). The four suggestions by Wang were used as a basis for the initial design of this study. The quasi-experimental design of this study implemented the use of 2 online questionnaires for pre-service teachers at the beginning of their methods courses, used a technology applications course with a learner-centered approach as the intervention, and collected pre-test and post-test data on the 2 online instruments. The pre-service teachers' reported their perceptions of their knowledge levels on one of the online instruments, the Technology Questionnaire, and reported their perceptions of centeredness with and without computer availability on the second online survey, the Teacher Survey.

This research provided baseline data on preservice teachers' perceptions of the teacher's role in classrooms with computers (n=61). Pre-service teachers reported improved knowledge of technological efficacies within the technology integration course. There was a positive mean gain score across all scales of the Technology Questionnaire, and particularly so for the subscales titled Desktop Publishing, Webpage Design, and Multimedia Projects. Pre-service teachers may be encouraged to expand their views of how student-centered learning can co-exist within computerized environments. Pre-service teachers reported, to a significant degree for mean gain scores, a preference for student-centeredness in environments using computers. Results also suggested that the pre-service teachers would be more likely to use the computer as a student-centered tool after instruction in a learner-centered technology integration class; that is, the pre-service teachers reported that they would not revert to teacher-centeredness while using computers. The model of instructional delivery in this study used a three prong approach. First, preservice teachers were taught to use technology as part of their classroom projects, not as a prerequisite to it. Second, preservice teachers were required to create student-centered lesson plans what they had been taught. Third, and perhaps most important, the university faculty taught the methods course by modeling the use of technology, within student-centered activities, for the preservice teachers as what they expected from the preservice teachers. That is, the preservice teachers were taught the way they were expected to teach.

Overall, the Technology Questionnaire and the Teacher Survey online instruments reported positive mean gain scores for technical efficacies and for support of student-centered learning in environments using computers for entry-level pre-service teachers.

Suggestions for Future Research

Similar to Wang’s concluding suggestions (2002), researchers and administrators should consider what instructional technology training models contribute to maintaining the shift from teacher centeredness to student centeredness in the preservice teacher's choice of teaching methods using computers in their curriculum content areas. An additional study within the same institution using more class sections, possibly in the fall semesters of the course, should be replicated which would generate a larger sample population to address any perceived ambiguity of results. Additionally, a cross-institutional replication will also help to strengthen the validity of the data and the generalization of the results. Subsequently, a follow-up study could be designed for those former pre-service teacher participants to see how they perceive their classroom roles after 3 to 4 years of experience.

Chapter #5 Summary

Pre-service teachers venture into their methods courses, usually during their junior and senior years of undergraduate study. In addition, teachers and other professional adults undertake methods courses in order to become certified to teach. These teacher candidates arrive with a wide array of skills and competencies for using technology in educational settings. This research used an online Technology Questionnaire, based on the NETS standards for students, to solict self-report information about the technology comfort levels of pre-service teachers prior to them engaging in the required course for elementary educators. In 10 categories of technology tools, students were asked to report their comfort levels, from ‘0’ No Knowledge to ‘5’ Very Knowledgeable with: Operating System, Technology Tools, Word Processor, Communications, Online Resources, Presentation/Imaging, Manage Data, Desktop Publishing, Webpage Design, and Multimedia Projects (See Appendix A for individual frequencies of each subscale item). For computational reasons, the scales were recoded to values 1 through 6. In all 10 categories, there was a positive mean gain score; students reported more comfort using the technology at the end of the technology applications course. College administrators, faculty and researchers can cite these kinds of gains as adding value to existing curriculum reforms and proposed technology plan updates. Of equal importance, this research demonstrated that teaching pre-service teachers with constructivist, student-centered activities, encouraged students to report that they would retain student-centeredness in classrooms using computers.

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APPENDIX

APPENDIX A

Table 1

Independent and dependent variables for research data collection

Table 1: Independent (EL) and dependent (TE and TR) variables for research data collection

VARIABLES	**Technology Efficacy (TE)**	**Teacher Roles (TR)**	
	Pre-test: Online Technology Questionnaire – In class (Collected week 1)	Pre-test: Online Teacher Survey – In class (Collected during week 2)	Post-tests: Online Teacher Survey and Technology Questionnaire – In class (Collected during last week of class)
Experience Level **(EL)** Teaching Experience **(TE)**	Likert-like scale of technology knowledge **Group means for**: Operating System Technology Tools Word Processing Communications Online Resources Presentation/Imaging Manage Data Desktop Publishing Webpage Design Multimedia Projects	(1) Role in general (TC v SC) Teacher centeredness compared with Student centeredness (2) Role with computer use (TCC v SCC) Teacher centeredness w/ computer use compared with Student centeredness w/ computer use	

APPENDIX B

NCATE and ISTE Standards of performance for technology integration

Table 2.1. NCATE and ISTE: Six standards of performance for technology integration for pre-service teachers – NETS-T

Standards	Performance Indicators
Technology Operations and Concepts	- demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Education Technology Standards for Students) - demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.
Planning and Designing Learning Environments and Experiences	- design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners. - apply current research on teaching and learning with technology when planning learning environments and experiences. - identify and locate technology resources and evaluate them for accuracy and suitability. - plan for the management of technology resources within the context of learning activities. - plan strategies to manage student learning in a technology enhanced environment.
Teaching, Learning, and The Curriculum	- facilitate technology-enhanced experiences that address content standards and student technology standards. - use technology to support learner-centered strategies that address the diverse needs of students. - apply technology to develop students' higher order skills and creativity. - manage student learning activities in a technology enhanced environment.

Table 2.1. NCATE and ISTE: Six standards of performance for technology integration for pre-service teachers – NETS-T

Standards	Performance Indicators
Assessment and Evaluation	- apply technology in assessing student learning of subject matter using a variety of assessment techniques. - use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning. - apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.
Productivity and Professional Practice	- use technology resources to engage in ongoing professional development and lifelong learning. - continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in Standards Demonstration of understanding support of student learning. - apply technology to increase productivity. - use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.
Social, Ethical, Legal, and Human Issues	- model and teach legal and ethical practice related to technology use. - apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities. - identify and use technology resources that affirm diversity - promote safe and healthy use of technology resources. - facilitate equitable access to technology resources for all students.

ISTE NETS-T: [http://cnets.iste.org/teachers/t_stands.html]

APPENDIX C

EDIT 3318 – Applications of Technology in Elementary Education
Course Syllabus

EDIT 3318 - COURSE SYLLABUS
Applications of Technology in Elementary Education

JAMES HOGUE, TERESA BLODGETT

Office: ED 263
Phone: 742-1998 ext. 473; 742-1997 ext 294
E-mail: james.hogue@ttu.edu; tblodgett@ttu.edu
Office Hrs See web site for your section; also by appointment

Course Web site: http://www.ecc.ttu.edu/edit3318

CONTACTING YOUR INSTRUCTOR:
The easiest way to contact your instructor is by email. I am difficult to reach by telephone but check email several times a day. Please put **EDIT3318** on the subject line of you message because I reply to class messages first.

CATALOG DESCRIPTION:
Prerequisite: EDIT 2318 or pass computing competence examination. Applications of technology in elementary education. 3 hours, offered Fall, Spring and Summer sessions.

EXPANDED COURSE DESCRIPTION:
This is a basic course to engage the undergraduate student in the use of technology as an educational tool. Students will have the opportunity to explore and utilize technology applications that enhance the teaching/learning process. The design, development and delivery of effective communications and learning activities will be emphasized.

REQUIRED COURSE MATERIALS AND RESOURCES:
The following books can be purchased as a package at local bookstores.

1. Roblyer, M.D., (2002). Integrating educational technology into teaching (3rd Ed). Upper Saddle River, NJ, Prentice-Hall.

2. Roblyer, M.D., (2002). Starting Out on the Internet: A learning Journey for Teachers Upper Saddle River, NJ, Prentice-Hall.

The following software can be purchased at The High Tech Computer Store located in the basement of the Student Union Building.

Microsoft Office 2003 ($15.00)

or
Microsoft Office Professional XP ($10.00) & Microsoft FrontPage XP ($5.00)

Recommended Course Materials and Resources

1. A USB pen drive or one (1) zip disk. Floppy disks have a history of not being reliable in our labs. If you chose to use 3 diskettes, you do so at your own risk. Having a bad diskette is not an excuse for late assignments
2. A folder or three ring binder for handouts and other course materials.

OBJECTIVES:

The objectives for this course have been based on the Teaching Standards for Texas Teachers and the ISTE Foundation Technology Standards for all teachers. These standards reflect professional studies in education that provide fundamental concepts and skills for applying information technology in educational settings. All candidates seeking initial certification or endorsements in teacher preparation programs should have opportunities to meet these educational technology foundations standards. With successful completion of this class, the student will have acquired skills and knowledge in three areas. The objectives for this class are grouped according to these three core areas.

Basic computer/technology operations and concepts:

- Successfully use a variety of software packages.
- Use appropriate computer/technology terminology.
- Use scanners and other imaging devices (digital cameras, quick cam, etc.).
- Demonstrate knowledge of “real world” computer application.

Personal and Professional Use of Technology

- Use productivity tools (word processing, spreadsheet, database).
- Create multimedia presentations.
- Use email and Internet to enhance personal and professional productivity
- Use computers to support problem solving, data collection, information management, communications, presentations, and decision making.
- Demonstrate awareness of adaptive assistive devices for students with special needs.
- Demonstrate knowledge of equity, ethics, legal and human issues concerning computers and technology (copyright, AUPs, fair use).
- Identify computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator.
- Observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications.

Application of Technology in Instruction

- Explore, evaluate and use computer/technology resources (educational software, applications, tools).

- Describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.
- Design, deliver, and assess student learning activities that integrate computers/technology for a variety of student group strategies and for diverse student populations.
- Design student learning activities that foster equitable, ethical, and legal use of technology by students.
- Practice responsible, ethical and legal use of technology, information, and software resources.

METHODS:

The use of lectures, hands-on practice, small group discussions, text readings, activities and projects will assist undergraduate students in developing the skills needed to integrate technology into the elementary level learning environment.

Key Concepts:

- Integrating technology
- Designing and planning instruction with technology
- Facilitating and managing instruction with technology
- Technology as a tool for the teacher
- Creating effective instructional materials

ENTRY LEVEL REQUIRED COMPUTER SKILLS

Basic computer skills are listed in the course catalog as prerequisites for this course. If you do not already have these skills, plan on spending significantly more time completing your assignments

Email skills:

1. Composing and sending e-mails
2. Know how to Cc:
3 How to send File attachments

Microsoft Windows:

1. Save, copy & move files to different locations (A drive, zip drive, file servers)
2. Finding saved files
3. Finding and opening computer programs
4. How to create new folders

Microsoft Word:

1. Basic word processing skills
2. Changing font size and style
3. Insert, resize, graphics

4. Create & use multiple columns on one page
5. Change margins
6. Add borders
7. Basic Page Setup features (change margins, page layout, etc.)
8. How to create Headers and Footers
9. How to change tab settings

Microsoft PowerPoint:

1. Create and save a new presentation (Add, delete, duplicate, change the order of slides)
2. The different views (slide, slide sorter, outline, etc.)
3. Adding and changing slide layouts
4. Adding and formatting Text
5. Adding and formatting autoshapes
6. Insert clip art and other graphics
7. Add transitions to slide shows
8. Add custom animation to slides
9. Changing backgrounds

E-raider Accounts:

1. Know how to access your e-raider account with your user name and password.
2. Activate your e-raider web pages – know if the pages are available and working

GENERAL CLASS INFORMATION:

1. Doctrine of Logical Consequences

A major component of the educational process is learning to accept the logical consequences of one's actions or inactions. We often try to protect our children and students from their mistakes in order to make their lives easier and more pleasant. This prevents them from learning from their mistakes and encourages them to repeat their dysfunctional behaviors.

This course will be conducted based on logical consequences. If you attend class and turn in good assignments, you will earn a good grade. If you choose to skip class and to turn in sloppy work, you will receive the grade you earned.

2. All opinions will be respected Rudeness to other students, guests and instructors, displays of temper or disruptive behavior will not be tolerated. Improper behavior will result in the student being asked to leave the classroom. Grade reductions, a failing grade for the course and reporting the students conduct to University authorities could also result.

3. **ATTENDANCE IS REQUIRED.**

Technology requires hands-on learning. I would rather you be late to class than not come to class. However, **excessive lateness** will result in a **deduction** of Participation/Attendance points and will count towards an absence and a loss of a letter grade.

a. Each absence will result in a 3-point reduction in Participation/Attendance grade

b. **TWO** (2) absences will result in **A REDUCTION OF ONE (1) LETTER GRADE**; (e.g. from an "A" to a "B");

c. **THREE** (3) absences will result in **AN ADDITIONAL REDUCTION OF ONE (1) LETTER GRADE**;

d. **FOUR** (4) absences will result in **AN ADDITIONAL REDUCTION OF ONE (1) LETTER GRADE**, a recommendation to drop the course, and a letter to the Dean of the student's college concerning the student's excessive absences.

4. Your participation in class is important. You learn by doing and helping others. Be on time, complete reading assignments and come prepared to be an active participant in class discussions and critiques. **PARTICIPATION POINTS WILL BE LOST FOR NOT BEING PREPARED FOR CLASS.**

5. You will show your instructor and classmates the courtesy of paying attention when they have "the floor". **INATTENTION OF ANY KIND WILL RESULT IN A LOSS OF PARTICIPATION POINTS.**

6. You will be given some class time to work on projects. Working on anything other than EDIT 3318 assignments/projects will result in the **LOSS OF ALL** Participation/Attendance points for that class.

7. Assignments:
   a. All assignments/projects must be completed and turned in. **NOT** completing and turning in all assignments/projects will result in **AN "F" IN THE COURSE**.

   b. All assignments are due at the beginning of class. If you are going to print assignments in the lab the day the assignment is due, it must be printed prior to the beginning of class, not during the first 5 minutes of class. Technology does not always work. Putting off finishing or printing assignments until the last minute is a risky behavior.

   c. Assignments turned in late will receive a 10% deduction in points for each day it is late.

   d. It is **YOUR** responsibility to have the assignments printed and ready to turn in. The following & any similar excuses are the equivalent of "the dog ate my assignment" excuse and will not help you if your assignment is late:

1. There is something wrong with your 3" and you cannot open the files on the disk.
2. My home computer, my friend's computer, the computer in the lab, etc. did something and I lost everything in the file.

e. E-mailed assignments will **NOT** be accepted.

f. If you are absent the day of a quiz or the day a weekly assignment is done in class, you must have an "excused absence" to be able to make up the quiz or assignment.

8. All assignments and projects **must** be saved in your folder on the Public file.

9. The Microsoft Office XP or 2003 software is the course software. The computer lab does not have WordPerfect, Lotus, Corel, and/or Microsoft Works software. If you use one of these you will not be able to print your files in the computer lab and your work will be counted as late.

10. Based on your entry skill level, be prepared to spend an appropriate amount of time outside of class working with the different applications and projects. (Average minimum amount of time spent outside of class is 10 hours a week,)

11. Manage your time. Stay on top of projects. The semester has a habit of slipping away! Especially a summer session.

12. Ask for help or assistance. Communicate with your peers in class and/or email or visit with the instructor. We are there to help you gain the necessary skills and knowledge.

13. Take pride in your work. Materials produced should reflect a professional standard Points will be deducted for spelling, grammar or punctuation errors. Remember you will be sharing your work with your peers and it will be included in your Professional Portfolio.

14. **CHEATING** of any kind (this includes **PLAGIARISM AND COPYRIGHT VIOLATIONS**) will result in an automatic "F" in the course and Texas Tech disciplinary actions as outlined in the Texas Tech University Undergraduate/Graduate Catalogs and Standard Operating Procedures.

15. Reasonable accommodations will be made for students with special needs. Please notify your instructor if you need modifications or are an Access Tech client.

APPENDIX D

Procedures for Technology Questionnaire Completion Script: Procedures for Technology Questionnaire Completion

Hello. My name is Jacqui Cyrus. I am a doctoral candidate in the College of Education, in the EDIT program. Your teacher, Ms. Blodgett, has allowed me some time to ask you to participate in my research study. Your responses will provide valuable insight into the perceptions of pre-service teachers and their role in classrooms with and without computers.

My research consists of 2 parts: one part at the beginning of the semester and one part at the end of the semester. Each part also has 2 parts. These 2 parts are the online Technology Questionnaire and the online Teacher Survey. I would like for you to complete both of them so that I can see what your perceptions are at the beginning of this technology applications course and then compare them to your perceptions at the end of the course.

Dr. Nancy J. Maushak, of the College of Education here at Texas Tech University, is my academic advisor. If you have any questions, you may reach her in her office in the College of Education. Her phone number is 742-1997 x 287.

Confidentiality

No one but Dr. Maushak and I will see your answers. They will be kept in a locked file on my computer. After I input the answers into my data files, I will eliminate your name from the original files at Texas Tech. So, no one else from this college will ever know what your answers are.

Participating in these surveys is completely voluntary. No one can force you to participate, and you won’t lose anything if you decide not to participate. Your grade or standing in the class will not be affected. Also, you can quit anytime you want and you won’t lose anything.

Contact

Dr. Maushak can answer any questions you have about the study. For questions about your rights as a subject or about injuries caused by this research, contact the Texas Tech University Institutional Review Board for the Protection of Human Subjects, Office of Research Services, Texas Tech University, Lubbock, Texas 79409, or you can call (806) 742-3884.

Procedural Consent Steps

I would like for you to access the file that I have put into the public folder with my name. Double click on the Public icon on the desktop. Scroll down to the folder named CYRUS. Double click to enter the CYRUS folder. Double click on the TQ icon. The first page of the website is the consent form. Please read it. It contains everything that I have told you along with the contact information for Dr. Nancy Maushak. After you read this consent statement, check the box that you agree to participate and click the NEXT button. If you do not wish to participate, you may close the window of this website by clicking on the X in the upper right hand corner of the screen.

Procedures for completing the Technology Questionnaire

The Technology Questionnaire page should be white with Technology Questionnaire written in purple at the top of the page. Please complete this Technology Questionnaire by clicking in each appropriate circle below. If you have no knowledge of a specific piece of software, please mark in the '0' circle (also known as a 'radio button.') Please put a response in each section.

Double click on ‘LastName’ and type your last name. Double click on ‘FirstName’ and type in your first name. Select your gender. Type in your primary language and then any other languages in which you communicate.

Please use this scale to indicate your comfort level with Operating Systems, from 0 to 5 for the items listed below this purple shaded area.

Are there any questions or concerns? It’s pretty easy, isn’t it? Now, please use this scale to indicate your comfort level using Technology Tools, from 0 to 5 for the items listed below this area.

When you get to the bottom of the page, you're almost done. Just tell me a little bit more about you. What is your age and your major? Tell me whether or not you are taking EDIT 2318 or have already done so. What computer technology courses have you taken in high school? Where else have you taken computer classes? Please tell me anything else about your computer use, such as playing action games, role-playing games, etc.

Of course, your responses will remain anonymous. I will be back next week to ask you to participate in the Teacher Survey, and then not again until the end of the semester. Thank you very much.

APPENDIX E

Procedures for completing the Teacher Survey

The Teacher Survey page should be off-white with Teacher Survey written at the top of the page with a red apple and a computer mouse. Please complete this Teacher Survey by clicking in each appropriate circle below. The choices range from ‘Strongly Agree’ to ‘Strongly Disagree. Please mark in the circle (also known as a 'radio button.') Please put a response in each section.

Double click on ‘LastName’ and type your last name. Double click on ‘FirstName’ and type in your first name.

<u>Section 2</u>: This section asks questions regarding your perceptions of your role as a teacher when computers are not available. To make your choice, click on the radio button next to each statement for ONE of the choices from ‘Strongly Agree’ to ‘Strongly Disagree.’

Your perception of the teacher's role without computers

When I teach a lesson without using computers, I believe my role will be:

2.1 to provide resources for students to use during instructional activities
2.2 to provide the main directing force in class
2.3 to keep order and quiet in the classroom
2.4 to determine how often to change student sub-groups
2.5 to plan the sequence of instructional activities for the class
2.6 to collaborate with students to plan lessons

When I teach a lesson without using computers, I believe my role will be:

2.7 to provide planned presentations such as lectures and demonstrations
2.8 to assist students in giving feedback to other student's work
2.9 to use evaluation procedures that are different for each student
2.10 to direct my attention to the class as a whole
2.11 to define learning objectives for each student based on individual need
2.12 to use authentic assessments to see if students have met the lesson objectives

Are there any questions or concerns? It’s pretty easy, isn’t it?

Section 3: This section asks questions regarding your perceptions of what your role will be as a teacher when computers are available. For each statement, circle only one response that best reflects your agreement or disagreement.

When I teach a lesson using computers, I believe my role will be:

3.1 to provide the main directing force in class
3.2 to plan the sequence of instructional activities for the class
3.3 to use authentic assessments to see if students have met the lesson objectives
3.3 to use authentic assessments to see if students have met the lesson objectives
3.4 to provide resources for students to use during instructional activities

3.5 to keep order and quiet in the classroom
3.6 to define learning objectives for each student based on individual need

When I teach a lesson using computers, I believe my role will be:
3.7 to provide planned presentations such as lectures and demonstrations
3.8 to use evaluation procedures that are different for each student
3.9 to determine how often to change student sub-groups
3.10 to direct my attention to the class as a whole
3.11 to collaborate with students to plan lessons
3.12 to assist students in evaluating other student's work

Section 4 How you will use computers

Never (1) = At no time during a school year is the computer used as stated.
Rarely (2) = More than once a semester but less than once a month.
Sometimes (3) = More than once a month but less than once a week.
Often (4) = More than once a week but less than once a day.
Frequently (5) = More than once a day.

Select only one response per statement, and use the following scale to guide your responses:

4.1 My students will use a computer to present information to other students
4.2 My students will use a computer to communicate with others
4.3 I will use a computer to present information to students
4.4 My students will use a computer to complete assignments and evaluation activities
4.5 I will use a computer to produce assessment and evaluation instruments
4.6 I will use a computer to communicate with others

How you will use computers:
4.7 My students will use a computer to create resources for class activities
4.8 I will use a computer to produce instructional materials that will be used in class
4.9 My students will use a computer to find resources during instructional activities
4.10 My students use a computer for enrichment when not busy with other class activities
4.11 I will use the computer to find resources to support a lesson

4.12 My students will use educational computer programs in hands-on learning activities
4.13 I will use a computer to keep track of students' grades.

When you have finished, please click ‘Done.’

Of course, your responses will remain anonymous. I will be back at the end of the semester to ask you to participate in the Teacher Survey again. Thank you very much.

APPENDIX F

Certification Plan for Pre-service Elementary Teachers

Table. 3.2: Multidisciplinary Studies Majors 4-8 (MD-S): English/Language Arts/Reading

Block 1 – Fall	Block 2 – Spring	Block 3 – Fall	Block 4 – Spring
EPSY 3331	EDLL 4350	EDLL 4381	EDEL 4000
EDCI 3320	EDLL 4349	EDBL 3205	EDCI 4325
EDIT 3318	EDLL 3353	EDSP 3205	
		EDCI 4362	
		EDLL 3351	

Table. 3.2: Multidisciplinary Studies Majors 4-8 (MD-S): English/Language Arts/Reading/Social Studies

Block 1 – Fall	Block 2 – Spring	Block 3 – Fall	Block 4 – Spring
EPSY 3331	EDLL 4350	EDLL 4381	EDEL 4000
EDCI 3320	EDLL 4349	EDCI 4362	EDCI 4325
EDIT 3318	EDLL 3353	EDSP 3205	
	EDCI 3361	EDBL 3205	
		EDLL 3351	

Table. 3.2. Multidisciplinary Studies Majors 4-8 (MD-S): Math/Science

Block 1 – Fall	Block 2 – Spring	Block 3 – Fall	Block 4 – Spring
EPSY 3331	EDCI 3375	EDCI 4375	EDEL 4000
EDCI 3320	EDCI 3370	EDBL 3205	EDCI 4325
EDIT 3318	EDLL 3353	EDSP 3205	
		EDLL 4380	

APPENDIX G

Consent Form

Teachers and Technology Perception Survey -- Statement of Confidentiality

Thank you for taking the time to complete this survey. I am a doctoral student in the College of Education in the Educational and Instructional Technology program. Your responses will provide valuable insight into the perceptions of pre-service teachers and their role in classrooms with and without computers.

Dr. Nancy J. Maushak, of the College of Education here at Texas Tech University, is my academic advisor. If you have any questions, you may reach her in her office in the College of Education. Her phone number is 742-1997 x 287.

No one but Dr. Maushak and I will see your answers. They will be kept in a locked file on my computer. After I input the answers into my data files, I will eliminate your name from the original files at Texas Tech. So no one else from this college will ever know what your answers are.

Participating in these surveys is completely voluntary. No one can force you to participate, and you won't lose anything if you decide not to participate. Your grade or standing in the class will not be affected. Also, you can quit anytime you want and you won't lose anything.

Dr. Maushak can answer any questions you have about the study. For questions about your rights as a subject or about injuries caused by this research, contact the Texas Tech University Institutional Review Board for the Protection of Human Subjects, Office of Research Services, Texas Tech University, Lubbock, Texas 79409, or you can call (806) 742-3884.

APPENDIX H

Means, Standard Deviations and Frequencies of the Subscales on the Technology Questionnaire

The main body of the Technology Questionnaire consisted of 10 subscales for self reporting for how knowledgeable they perceived themselves to be using various technology tools. Each subscale listed below shows the mean scores from 1 (no knowledge) to 6 (very knowledgeable). The frequencies show the number of respondents to each subscale. In the following sections, the descriptive statistics for each pre-test subscale is described.

Operating System

There were 8 items in the Operating System subscale. The range of the mean scores was 4.65, “Duplicate folder” to 6.00, “Turn on/off computer;” the standard deviation ranged from .00 to 1.58. For the first item, “Turn on/off computer,” there was no differentiation among participants; they all answered in the same way on the pre-test (See Table 4.18).

Table 4.18: Pre-Test Frequencies, Means And Standard Deviations For The Operating System Subscales In The Technology Questionnaire

Operating System	1	2	3	4	5	6	n	M	SD
Turn on/off computer						61	61	6.00	.00
Create new folder				3	4	54	61	5.84	.49
Rename file or folder		1	1	4	4	50	60	5.68	.81
Duplicate folder	3	5	7	7	11	27	60	4.65	1.58
Delete items	1	1		2	5	52	61	5.70	.90
Move items between folders	2	4	2	6	14	31	59	5.02	1.40
Change window view	5	4	6	8	10	28	61	4.61	1.67
Minimize/expand window	1				2	58	61	5.89	.66
Totals								5.42	.68

Technology Tools

There were 5 items in the Technology Tools subscale. The range of the mean scores of the pre-test scales for Technology Tools was 2.87, “Use flash drives” to 5.54, with the highest mean reported for the item, “Insert and remove disks.” The range of standard deviation scores was .79 to 1.92 (See Table 4.19).

Table 4.19: Pre-Test Frequencies, Means And Standard Deviations For The Technology Tools Subscales In The Technology Questionnaire

Technology Tools	1	2	3	4	5	6	n	M	SD
Digital camera	2	6	3	9	18	23	61	4.70	1.44
Scanners	4	3	7	12	14	21	61	4.51	1.51
Camcorders	1	5	9	11	12	23	61	4.59	1.42
Insert & remove disks			1	8	9	43	61	5.54	0.79
Use flash drives	23	8	9	4	6	10	60	2.87	1.92
Totals								4.45	1.01

Word Processor

The range of the mean scores of the pre-test subscales for Word Processor was 4.84 to 6.00. Three items, “Create new document,” “Use spell checker tool,” and “Print document,” were all scored with the highest self-report rate of 6.00. The range of standard deviation scores was .00 to 1.56 (See Table 4.20).

Table 4.20: Pre-Test Frequencies, Means And Standard Deviations For The Word Processor Subscales In The Technology Questionnaire

Word Processor	1	2	3	4	5	6	n	M	SD
Create new document						61	61	6.00	.00
Work with headers/footers		1	1	4	11	44	61	5.57	.83
Format text				1	4	55	60	5.90	.35
Create and format table	1	1	3	10	14	32	61	5.15	1.14
Use spell checker tool						61	61	6.00	.00
Create multiple columns	5	1	5	7	13	60	61	4.84	1.56
Insert graphic	2	2	4	3	10	38	59	5.22	1.34
Print document						59	59	6.00	.00
Totals								5.58	.51

<u>Communication</u>

The range of the mean scores of the pre-test subscales for Communication was 2.57, “Participate in video conference,” to 5.98, “Reply to a message.” The range of standard deviation scores was .18 to 1.87 (See Table 4.21).

Table 4.21: Pre-Test Frequencies, Means And Standard Deviations For The Communication Subscales In The Technology Questionnaire

Communication	1	2	3	4	5	6	n	M	SD
Create new message					2	59	61	5.97	.18
Send new message					2	59	61	5.97	.18
Reply to a message					1	60	61	5.98	.13
Use carbon copy (cc)	4	1	4	12	12	27	60	4.80	1.46
Use blind carbon copy (bcc)	10	3	7	10	7	24	61	4.20	1.87
Attach word document	3		3	6	8	40	60	5.27	1.31
Initiate new chat session	5		1	3	6	46	61	5.34	1.45
Invite several people	8		10	9	7	27	61	4.44	1.76
Invite additional people	9	1	13	7	7	24	61	4.21	1.82
Send file	7	4	6	9	7	28	61	4.46	1.57
Accept and open file	5	3	1		10	42	61	5.18	1.57
Participate in video conference	28	7	9	6	2	9	61	2.57	1.84
Totals								4.87	.86

Online Resources

The range of the mean scores of the pre-test scales for Online Resources was 4.74, “Set webpage as default page,” to 5.97, “Use search engine.” The range of standard deviation scores was .26 to 1.72 (See Table 4.22).

Table 4.22: Pre-Test Frequencies, Means And Standard Deviations For The Online Resources Subscales In The Technology Questionnaire

Online Resources	1	2	3	4	5	6	n	M	SD
Access webpage – typing URL	1				3	57	61	5.87	.67
Bookmark webpages	4	2	4	9	6	36	61	4.95	1.54
Save image from webpage	5		5	8	7	36	61	4.97	1.55
Set web page as default page	6	3	5	6	8	33	61	4.74	1.72
Use search engine				1		60	61	5.97	.26
Follow hyperlinks	1	1		2	7	50	61	5.67	.91
Totals								5.36	.76

Presentation/Imaging

The range of the mean scores of the pre-test scales for Presentation/Imaging was from 3.28, “Create hyperlinks between slides,” to 5.62 “Change font/text.” The range of standard deviation scores was .96 to 1.92 (See Table 4.23).

Table 4.23: Pre-Test Frequencies, Means And Standard Deviations For The Presentation/Imaging Subscales In The Technology Questionnaire

Presentation/Imaging	1	2	3	4	5	6	n	M	SD
Insert new slide	1	2	2	3	9	44	61	5.44	1.33
Change font/text	1	1		4	6	48	61	5.62	.96
Change background color	1	1	1	4	5	48	60	5.58	1.01
Insert graphic	3	3		5	9	41	61	5.25	1.40
Create hyperlinks btwn slides	13	9	11	13	3	11	60	3.28	1.75
Create hyperlinks – WWW	15	8	6	11	7	14	61	3.48	1.91
Scan and save image	7	5	5	7	11	26	61	4.44	1.78
Import scanned image	11	6	5	12	5	22	61	3.98	1.92
Change size of scanned image	9	5	8	7	8	24	61	4.18	1.88
Totals								4.59	1.08

<u>Manage Data</u>

The range of the mean scores of the pre-test scales for Manage Data was 3.10, "Use formulas and functions," to 4.34, "Enter data." The range of standard deviation scores was 1.25 to 1.70 (See Table 4.24).

Table 4.24: Pre-Test Frequencies, Means And Standard Deviations For The Manage Data Subscales In The Technology Questionnaire

Manage Data	1	2	3	4	5	6	n	M	SD
Create and edit new worksheet	7		7	8	38	1	61	4.13	1.52
Enter data	4	1	8	5	42	1	61	4.34	1.25
Use formulas and functions	12	10	13	6	20		61	3.10	1.70
Sort data	12	6	16	10	16	1	61	3.13	1.69
Get column and row totals	8	9	11	6	26	1	61	3.52	1.65
Print tables	8	5	8	12	28		61	3.72	1.55
Create charts and graphs	7	6	14	10	23		60	3.55	1.50
Totals								5.26	1.03

<u>Desktop Publishing</u>

The range of the mean scores of the pre-test scales for Desktop Publishing, with only 2 items, was 3.50 to 3.57. The range of standard deviation scores is 1.70 to 1.77 (See Table 4.25). While both of the items appeared online, only data from the first item was collected in its entirety and stored in the database; the unreported, original data could not be retrieved. Therefore, there are only 15 self-report submissions for the second item, “Use graphic tools.”

Table 4.25: Pre-Test Frequencies, Means And Standard Deviations For The Desktop Publishing Subscales In The Technology Questionnaire

Desktop Publishing	1	2	3	4	5	6	n	M	SD
Create multi-columns	12	7	8	14	8	12	61	3.57	1.77
Use graphic tools	2	2	3	2	6		15	3.50	1.70
Totals								3.54	1.74

<u>Webpage Design</u>

The range of the mean scores of the pre-test scales for Webpage Design was 2.18, “Create navigational bar,” to 2.81, “Format text.” The range of standard deviation scores was .1.57 to 1.84 (See Table 4.26).

Table 4.26: Pre-Test Frequencies, Means And Standard Deviations For The Webpage Design Subscales In The Technology Questionnaire

Webpage Design	1	2	3	4	5	6	n	M	SD
Create new web page	28	11	5	9	1	7	61	2.43	1.73
Insert text	24	8	7	9	5	8	61	2.79	1.84
Format text	24	7	8	10	3	9	61	2.81	1.84
Insert tables	26	8	8	10	3	6	61	2.57	1.72
Use tables – layout	28	10	6	10	2	4	60	2.33	1.60
Insert graphics	27	5	10	11	2	6	61	2.57	1.71
Add additional pages	28	7	7	10	4	4	60	2.45	1.66
Create navigational bar	31	11	6	8		5	61	2.18	1.57
Create hyperlinks btwn pages	29	10	7	8	2	4	60	2.27	1.57
Create hyperlinks – WWW	29	10	8	7	2	5	61	2.31	1.62
Totals								2.48	1.59

Multimedia Projects

The mean score of the pre-test scale for Multimedia Projects, with only one item, was 3.00. The standard deviation score is .98 (See Table 4.27).

Table 4.27: Pre-Test Frequencies, Means And Standard Deviations For The Multimedia Projects Subscales In The Technology Questionnaire

Multimedia Projects	1	2	3	4	5	6	n	M	SD
Multimedia Projects	17	6	12	15	5	5	60	3.00	1.62
Totals								3.00	1.62

APPENDIX I

Technology Questionnaire Scale Items:

Post-Test Frequencies, Means and Standard Deviations

Operating System

There were 8 items in the Operating System subscale. The range of the mean scores was 5.31, “Duplicate folder,” to 5.98, “Turn on/off computer.” The standard deviation ranged from .00 to 1.58 (See Table 4.28).

Table 4.28: Post-Test Frequencies, Means And Standard Deviations For The Operating System Subscales In The Technology Questionnaire

Operating System	1	2	3	4	5	6	n	M	SD
Turn on/off computer					1	60	61	5.98	.13
Create new folder				2	1	58	61	5.92	.38
Rename file or folder				1	4	56	61	5.90	.35
Duplicate folder	1	1	1	9	12	37	61	5.31	1.07
Delete items					2	59	61	5.97	.18
Move items between folders	1		1	5	3	50	60	5.65	.92
Change window view			3	5	8	44	60	5.55	.85
Minimize/maximize window			1		1	59	60	5.93	.41
Totals								5.78	.37

Technology Tools

There were 5 items in the Technology Tools subscale. The range of the mean scores was 5.18, “Camcorders, “Insert/remove disks.” The standard deviation ranged from .99 to 1.41 (See Table 4.29).

Table 4.29: Post-Test Frequencies, Means And Standard Deviations For The Technology Tools Subscales In The Technology Questionnaire

Technology Tools	1	2	3	4	5	6	n	M	SD
Digital cameras		1	1	5	16	38	61	5.46	.85
Scanners		2	3	3	15	38	61	5.38	1.02
Camcorders		1	3	10	17	30	61	5.18	.99
Insert/remove disks	1	2	1		3	54	61	5.69	1.03
Use flash/keychain drives	3	1	4	7	5	41	61	5.18	1.41
Totals								5.38	1.06

Word Processor

The range of the mean scores of the post-test subscales for Word Processor was 5.74, "Create multiple column layout," to 6.00, "Create new document." The range of standard deviation scores was .00 to .84 (See Table 4.30).

Table 4.30: Post-Test Frequencies, Means And Standard Deviations For The Word Processor Subscales In The Technology Questionnaire

Word Processor	1	2	3	4	5	6	n	M	SD
Create new document						61	61	6.00	.00
Work with headers/footers				1	3	57	61	5.92	.33
Format text					1	60	61	5.98	.13
Create/format table				2	1	58	61	5.92	.38
Use spell checker						61	61	6.00	.00
Create multiple column layout	1		1	2	4	53	61	5.74	.84
Insert graphic					1	60	61	5.98	.13
Print document						58	61	6.00	.00
Totals								5.94	.15

Communication

The range of the mean scores of the post-test subscales for Communication was 4.59, "Participate in a video conference," to 5.98, for which 3 separate subscales had the same scores. The range of standard deviation scores was .13 to 1.49 (See Table 4.31).

Table 4.31: Post-Test Frequencies, Means And Standard Deviations For The Communication Subscales In The Technology Questionnaire

Communication	1	2	3	4	5	6	n	M	SD
Create new message					1	60	61	5.98	.13
Send new message					1	60	61	5.98	.13
Reply to message					1	60	61	5.98	.13
Use carbon copy (cc)	1		2	9	9	39	60	5.37	1.04
Use blind carbon copy (bcc)	2	2	3	8	9	36	60	5.13	1.33
Attach word document	1	2	1		2	54	60	5.70	1.03
Initiate new chat		2	1	2	3	53	61	5.70	.88
Invite several people	1	2	1	6	9	42	61	5.39	1.13
Invite additional people	2	1	1	8	7	42	61	5.34	1.21
Send file as attachment	1	1	3	5	4	46	60	5.47	1.13
Accept/open file		1	3	1	5	50	60	5.67	.88
Participate in video conference	3	3	7	12	11	23	59	4.59	1.49
Totals								5.53	.64

Online Resources

The range of the mean scores of the post-test subscales for Online Resources was 5.54, “Set web page as default” to 5.98, “Use search engine.” The range of standard deviation scores was .13 to 1.21 (See Table 4.32).

Table 4.32: Post-Test Frequencies, Means And Standard Deviations For The Online Resources Subscales In The Technology Questionnaire

Online Resources	1	2	3	4	5	6	n	M	SD
Access webpage			1		2	58	61	5.92	.42
Bookmark webpages		1	2	3	7	48	61	5.62	.86
Save image from webpage				3	2	55	60	5.87	.47
Set web page as default	3		1	3	4	50	61	5.54	1.21
Use search engine					1	60	61	5.98	.13
Follow hyperlinks				1	1	59	61	5.95	.28
Totals								5.81	.38

<u>Presentation/Imaging</u>

The range of the mean scores of the post-test subscales for Presentation/Imaging was 5.54, “Scan and save image,” to 5.98, a score reported on 2 separate subscales. The range of standard deviation scores was .13 to 1.03 (See Table 4.33).

Table 4.33: Post-Test Frequencies, Means And Standard Deviations For The Presentation/Imaging Subscales In The Technology Questionnaire

Presentation/Imaging	1	2	3	4	5	6	n	M	SD
Insert new slide			1			60	61	5.95	.38
Change font/text			1			60	61	5.95	.38
Change background					1	59	60	5.98	.13
Insert graphic					1	60	61	5.98	.13
Create hyperlinks betwn slides			1			57	58	5.95	.39
Create hyperlinks - WWW		1	2	1	1	56	61	5.79	.78
Scan/save image		2	3	3	5	48	61	5.54	1.03
Import scanned image			3	4	7	47	61	5.61	.82
Change size of scanned image			2	5	6	47	60	5.63	.78
Totals								5.82	.43

Manage Data

The range of the mean scores of the post-test subscales for Manage Data was 4.97, "Use formulas and functions," to 5.56, "Enter data." The range of standard deviation scores was .89 to 1.33 (See Table 4.34).

Table 4.34: Post-Test Frequencies, Means And Standard Deviations For The Manage Data Subscales In The Technology Questionnaire

Manage Data	1	2	3	4	5	6	n	M	SD
Change/edit worksheet		1	2	4	10	44	61	5.54	.89
Enter data		1	2	5	7	46	61	5.56	.90
Use formulas/functions	3	1	4	6	20	27	61	4.97	1.33
Sort data	1	3	5	6	15	31	61	5.03	1.29
Get column/row totals	1	3	3	6	13	64	60	5.15	1.26
Print tables from spreadsheet	1	1	3	4	12	39	60	5.37	1.10
Create charts/graphs	1	1	5	6	11	37	61	5.23	1.19
Totals								5.26	1.03

Desktop Publishing

The range of the 2 mean scores of the post-test subscales for Desktop Publishing was 5.28, "Multi-column document" and 5.87, "Use graphic tools." The range of standard deviation scores is .50 to 1.08 (See Table 4.35).

Table 4.35: Post-Test Frequencies, Means And Standard Deviations For The Desktop Publishing Subscales In The Technology Questionnaire

Desktop Publishing	1	2	3	4	5	6	n	M	SD
Multi-column document	1	1	2	7	15	35	61	5.28	1.08
Use graphic tools			1	1	3	56	61	5.87	.50
Totals								5.57	.68

Webpage Design

The range of the mean scores of the post-test subscales for Desktop Publishing was 5.47, “Create hyperlinks to the World-wide Web,” to 5.95, “Create a new webpage.” The range of standard deviation scores was .50 to 1.08 (See Table 4.36).

Table 4.36: Post-Test Frequencies, Means And Standard Deviations For The Webpage Design Subscales In The Technology Questionnaire

Webpage Design	1	2	3	4	5	6	n	M	SD
Create new webpage				1	1	58	60	5.95	.29
Insert text				1	2	58	61	5.93	.31
Format text			1	2	3	53	59	5.83	.56
Insert tables			1	4	6	50	61	5.72	.66
Use tables in layout				1	4	55	60	5.90	.35
Insert graphics			1	2	4	54	61	5.82	.56
Add additional pages			3	2	8	48	61	5.66	.77
Create navigational bar			1	1	1	57	60	5.90	.48
Create hyperlinks betwn pages				2	1	57	60	5.92	.38
Create hyperlinks - WWW			1	8	13	38	60	5.47	.79
Totals								5.81	.38

Multimedia Tools

The mean score of the post-test subscale for Multimedia Projects was 5.47. The standard deviation score is 1.62 (See Table 4.37).

Table 4.37: Post-Test Frequencies, Means And Standard Deviations For The Multimedia Projects Subscales In The Technology Questionnaire

Multimedia Projects	1	2	3	4	5	6	n	M	SD
Multimedia projects	1		2	5	11	41	60	5.47	.98
Totals								5.47	.98

APPENDIX J

Frequencies and means for the pre-test subscales of the Teacher Survey

Without Computer Availability

The pre-test descriptive means for the first set of subscales of teacher-centered and student-centeredness for teaching environments without computer availability ranged from 3.75 “Keep order and quiet in the classroom,” to 4.31, “Plan the sequence of instructional activities for the class.” The standard deviations ranged from .71 to 1.00 (See Table 4.38).

Table 4.38: Pre-Test Frequencies For The Subscales Without Computer Availability In The Teacher Survey

Without Computer Availability	1	2	3	4	5	n	M	SD
3.1 TC: Provide resources	1		2	26	32	61	4.44	.72
3.2 TC: Provide directing force	1	2	13	24	21	61	4.02	.92
3.3 TC: Keep order	1	6	15	24	15	61	3.75	.99
3.4 SC: Change in sub groups			14	30	16	60	4.03	.71
3.5 TC: Sequence of activities	1	1	2	31	26	61	4.31	.77
3.6 SC: Collaborate w/ students	2	2	10	23	24	61	4.07	1.00
Totals							4.10	.63

The pre-test descriptive means for the second set of subscales of teacher-centered and student-centeredness for teaching environments without computer availability ranged from 3.89, “Use evaluation procedures,” to 4.28, “Use authentic assessments.” The standard deviations ranged from .83 to 1.02 (See Table 4.39).

Table 4.39: Pre-Test Frequencies For The Subscales Without Computer Availability In The Teacher Survey

Without Computer Availability	1	2	3	4	5	n	M	SD
4.1 TC: Pre planned presentations	2	3	4	26	26	61	4.16	.99
4.2 SC: Students giving feedback	1	4	7	31	18	61	4.00	.91
4.3 SC: Evaluation procedures	1	5	14	21	20	61	3.89	1.02
4.4 TC: Direct my attention	2	1	10	23	25	61	4.11	.97
4.5 SC: Define learning ea student	1	2	4	26	28	61	4.28	.86
4.6 SC: Use authentic assessments	1	2	5	33	20	61	4.13	.83
Totals							4.09	.68

The pre-test descriptive means for the first set of subscales of teacher-centered and student-centeredness for teaching environments using computers ranged from 3.90, “Keep order and quiet,” to 4.21, “Provide resources;” the standard deviations ranged from .79 to .92 (See Table 4.40).

Table 4.40: Pre-Test Frequencies For The Subscales Using Computers In The Teacher Survey

Using Computers	1	2	3	4	5	n	M	SD
5.1 TCC: Main directing force	1	4	7	31	19	61	4.02	.92
5.2 TCC: Sequence instr activities	1	2	5	32	21	61	4.18	.79
5.3 SCC: Authentic assessments	1	1	4	32	23	61	4.15	.83
5.4 TCC: Provide resources	1	1	5	31	23	61	4.21	.80
5.5 TCC: Keep order and quiet	1	3	13	28	16	61	3.90	.91
5.6 SCC: Define learning objectives	1	1	8	24	27	61	4.23	.86
Totals							4.12	.64

The pre-test descriptive means for the responses to computer use in the subscales of teacher-centered and student-centeredness for teaching environments ranged from 3.82, “Student evaluating others,” to 4.23, “Planned presentation.” The standard deviations ranged from .72 to 1.01 (See Table 4.41).

Table 4.41: Pre-Test Frequencies For The Subscales Using Computers In The Teacher Survey

Using Computers	1	2	3	4	5	n	M	SD
6.1 TCC: Planned presentation		6	2	25	28	61	4.23	.92
6.2 SCC: Evaluation procedures		2	17	18	19	60	3.83	.99
6.3 SCC: Change sub groups		1	15	32	12	60	3.92	.72
6.4 TCC: Direct my attention	1	3	7	22	27	60	4.18	.95
6.5 SCC: Collaborate with students	2	3	9	25	22	61	4.02	1.01
6.6 SCC: Students evaluating others	1	5	12	29	14	61	3.82	.94
Totals							4.00	.64

The pre-test descriptive means for the responses to computer use in the subscales of teacher-centered and student-centeredness for teaching environments ranged from 3.15. “Student communicate” to 4.26, “Communicate with other;” the standard deviations ranged from .73 to .95 (See Table 4.42).

Table 4.42: Pre-Test Frequencies For The Subscales Without Computer Availability In The Teacher Survey

Responses to Computer Availability	1	2	3	4	5	n	M	SD
7.1 SCC: Present information		8	34	16	3	61	3.23	.74
7.2 SCC: Students communicate		11	33	14	3	61	3.15	.77
7.3 TCC: Present information others		1	18	31	11	61	3.85	.73
7.4 SCC: Complete assignments	1	4	35	18	3	61	3.30	.74
7.5 TCC: Assessment		5	10	22	24	61	4.07	.95
7.6 SCC: Communicate w/ others		3	9	18	31	61	4.26	.89
Totals							3.64	.53

The pre-test descriptive means for the responses to computer use in the subscales of teacher-centered and student-centeredness for teaching environments ranged from 3.33, “Create resources,” to 4.80, “Keep track of grades;” the standard deviations ranged from .72 to .87 (See Table 4.43).

Table 4.43: Pre-Test Frequencies for the subscales without computer availability in the Teacher Survey

Responses to Computer Availability	1	2	3	4	5	n	M	SD
8.1 SCC: Create resources		7	29	23	2	61	3.33	.72
8.2 TCC: Produce instr materials		1	11	31	18	61	4.08	.74
8.3 SCC: Find resources		5	26	22	8	61	3.54	.83
8.4 SCC: Enrichment		4	14	10	12	61	3.66	.87
8.5 TCC: Find resources for lessons			5	27	29	61	4.39	.64
8.6 SCC: Educational programs		1	19	25	16	61	3.92	.80
8.7 TCC: Keep track of grades			2	8	50	60	4.80	.48
Totals							3.81	.50