THE EFFECTS OF TECHNOLOGY INTEGRATION TECHNIQUES IN ELEMENTARY MATHEMATICS METHODS COURSES ON ELEMENTARY PRESERVICE TEACHERS' COMPUTER SELF-EFFICACY, SOFTWARE INTEGRATION CONFIDENCE, AND LESSON PLANNING

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The purpose of this study was to demonstrate the effect of computer technology integration techniques on preservice teachers' feelings of computer self-efficacy and feelings of confidence in software integration. It was also the purpose of this study to interpret these preservice teachers' confidence in using computer technology integration techniques in their own planning and instruction during student teaching. The participants in this study were from two intact, non-randomly-formed classrooms. They were 27 preservice teachers enrolled in the College of Education at a university in north central Texas in two sections of a course entitled EDEE 4350, Mathematics in the Elementary School.

This study was quasi-experimental, with a nonequivalent pretest-posttest control group design. The independent variable was the type of instruction experienced in an elementary mathematics methods course: novel instruction with specialized computer technology integration techniques versus traditional instruction with no specialized technology integration techniques. The dependant variables were measured using the following instruments: the Demographic Data and Previous Context Use of the Computer Survey which described participants' demographics and their previous usage of the computer; the Self-Efficacy With Computer Technologies Scale; the Preservice

Teacher Software Integration Confidence Scale; and the Lesson Plan Infusion/Integration Scale.

The results of the data analysis revealed, through the inferential statistics run on the Self-Efficacy with Computer Technology Scale pretest and posttest, that there was no statistically significant difference between treatment groups ($p < .05$). The posttest-only Preservice Teachers Software Integration Confidence Scale revealed a statistically significant difference between treatment groups ($p < .05$). The posttest-only Lesson Plan Technology Infusion/Integration Scale revealed no statistical significance between treatment groups ($p < .05$). The study provides insight into the benefits of instruction in specific software integration techniques instruction. It suggests that when preservice teachers are given instruction in specific computer software integration techniques, they are more confident in the use of those techniques.

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CHAPTER 1

Introduction

Computers have been in place in the K-12 classroom for more than twenty years. Unfortunately, placing computers in classrooms does not mean that graduates from our school systems are equipped to use the computer as a tool. Morrison, Lowther, and DeMuelle (1999) warned that computers were not being used in school classrooms as they would be used in the workplace. In the early stages of computer placement in the classroom, teachers used them primarily as tutorial machines for students. Self-contained games, drill and practice software, word processing, and tutorial software certainly have a place, but if this is the primary use for the computer, then much is being missed in using it as a tool. Morrison et al. (1999) recommended teacher-designed lessons that use spreadsheets and databases to analyze data and develop relationships between concepts. These strategies are based on problem-based learning and are more closely related to workplace application.

According to the National Council of Teachers of Mathematics, technology has become an essential part of teaching, learning, and doing mathematics (Beaudrie, 2001). One study revealed that professors' proficiency with technology was limited to the use of the Internet, E-mail for communication, and word processing (Vannatta, 2000). This method of technology integration instruction leaves databases and spreadsheets largely unused. Not using these applications limits the assignments that would require problem-solving skills and higher order thinking skills.

Statement of the Problem

Colleges of Education must be very progressive in measuring themselves against the National Council for Accreditation of Teacher Education (NCATE) standards in order to maintain accreditation. The standards provide competency areas in technology and endorsement for educational computing (Brown, 2001). It has been asserted that teacher education institutions must close the teaching and learning gap between where they are and where they need to be (Gunter, 2001). For accreditation purposes, colleges of education must provide folios of evidence that coursework and field experiences are preparing teachers to effectively use computers in their classroom instruction (Lan, 1997). Unfortunately, faculty knowledge of the NCATE standards does not translate into an equal knowledge of the International Society for Technology in Education (ISTE) standards. Universities are doing a major disservice to their students if they fail to provide appropriate opportunities to develop information technology skills as part of their undergraduate program (Schrum and Dehoney, 1998).

The set of standards released by ISTE in 2000 specified technology standards for preservice teachers. The fifteen competencies that follow not only serve as guidelines for current preservice teachers but also as benchmarks for all teacher education programs:

1. Troubleshoot a computer system in order to solve routine hardware and software problems.
2. Evaluate and use computers and related technologies to support a coherent lesson.

3. Facilitate learning experiences using technology that affirm diversity and provide equity.
4. Implement a well-organized plan to manage available technology resources.
5. Facilitate learning experiences that use assistive technologies to meet the special needs of students.
6. Design and teach a coherent sequence of learning activities with appropriate use of technology by connecting district, state, and national standards.
7. Design, implement, and assess learner-centered lessons with technology that engage, motivate, and encourage self-directed student learning.
8. Guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area(s).
9. Develop and use criteria for ongoing assessment of technology-based student products.
10. Design an evaluation plan that will determine students' technology proficiency.
11. Analyze instructional practices that employ technology to improve planning, instruction, and management.
12. Apply technology productivity tools to collect, analyze, and interpret data and to report to parents.
13. Select and apply suitable productivity tools to complete tasks.

14. Model safe and responsible uses of technology and develop classroom procedures to implement school and district policy.
15. Participate in on-line professional collaboration with peers and experts as part of a personally designed plan, based on self-assessment, for professional growth in technology. (ISTE, 1991, p. 2)

Students in today's world are faced with an ever-increasing demand for the use of technology. Students need to develop a clear understanding of the role that technology can play in mathematics and the role that the computer can play in problem-solving (Cavey and Barnes, 2001). In order for this to become a reality, instructors in colleges of education must prepare preservice teachers to integrate technology into mathematics. Mathematics methods courses should prepare preservice teachers to implement technology integration practices in their teaching strategies.

Purpose of the Study

The purpose of this study was to assess the effect of technology integration techniques in an elementary mathematics methods course on preservice teachers' computer self-efficacy, software integration confidence, and lesson planning. More specifically, the purpose of this study was to demonstrate the effect of technology integration (through direct intervention, required assignments, and instructor demonstration) on preservice teachers' feelings of computer self-efficacy and feeling of confidence in software integration. It was also the purpose of this study to interpret these preservice teachers' confidence in using technology integration techniques in their own planning and instruction during student teaching.

In 2001, as a teaching fellow for a prominent university in Texas, the author became aware that the beginning structures for technology integration were in place in the College of Education. Professors in the Computer Education and Cognitive Systems Department of the College of Education instituted research and development of technology integration coursework for preservice teachers. The course CECS 4100, "Computers in the Classroom", was a requirement of all elementary preservice teachers in their degree plans. The course was designed to include motivational techniques and objectives in computer education. It included some programming language and instructional uses of the computer as well as topics of curriculum integration. Prerequisites to the CECS 4100 course included software and hardware applications courses. Equipment in each College of Education classroom had been upgraded and included a projector, a cabinet with a computer, VCR, and a remote device. This hardware allowed professors to utilize all the current software available to the university, including Internet access. Therefore, preservice teachers came to their required elementary methods courses with some background in the use of technology and some introduction to the concepts of technology integration. The significance of this study was to add to the research literature about computer integration requirements in an elementary mathematics methods course, and to explore the implications that this practice has in preservice teachers' practice during their student teaching. The important question was whether or not added instruction in computer integration techniques results in preservice teachers' attaining a high enough level of self-efficacy that, in turn, leads them to feel confident in utilizing the strategies in their assigned student teaching classroom.

Statement of the Hypotheses

It seems logical to assume that the addition of technology to instruction in a mathematics methods course can improve preservice teachers' abilities and attitudes toward using technology in their mathematics methods course as well as infusing technology in mathematics instruction during student teaching. Individuals weigh their capabilities and vulnerabilities, and then they generate self-appraisals of capability. Self-perception of efficacy is a driving force in, among other things, persistence and choice of activities (Ropp, 1999). A preservice teacher's performances based on authentic experiences are the most important source of information on efficacy. Authentic opportunities, such as hands-on computer experience, should be an important component in effective instruction for preservice teachers (Ropp, 1999). Therefore, the following directional research hypotheses were used for this study:

Hypothesis 1. Preservice elementary teachers who receive mathematics methods instruction with computer integration techniques will have higher scores on a Self-Efficacy with Computer Technologies Scale than preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

Hypothesis 2. Preservice elementary teachers who receive mathematics methods instruction with computer integration techniques will have higher scores on a Preservice Teacher Software Integration Confidence Scale than preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

Hypothesis 3. Preservice elementary teachers who receive mathematics methods instruction with computer integration techniques will generate lesson plans in their student teaching internship experience that score higher on a Lesson Plan Technology Infusion/Integration Scale than preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

In calculating the inferential statistics in this study, null hypotheses were assumed. The three null hypotheses for this study were as follows:

Null Hypothesis 1. There will be no statistically significant difference in scores on a Self-Efficacy with Computer Technologies Scale between preservice elementary teachers who receive mathematics methods instruction with computer integration techniques versus preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

Null Hypothesis 2. There will be no statistically significant difference in scores on a Preservice Teacher Software Integration Confidence Scale between preservice elementary teachers who receive mathematics methods instruction with computer integration techniques versus preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

Null Hypothesis 3. There will be no statistically significant difference in scores on a Lesson Plan Technology Infusion/Integration Scale between preservice elementary teachers who receive mathematics methods instruction with computer integration techniques versus preservice elementary teachers who receive traditional mathematics methods instruction without computer integration techniques.

Definition of Terms

The following definitions are provided, as these terms are pertinent to this study.

Computer self-efficacy. Computer self-efficacy was defined as not being concerned with the skill one possesses using the computer, but with the self-judgments of what one can do with these skills, especially as these skills are reflected in classroom use of the computer.

Elementary mathematics methods course. The elementary mathematics methods course was defined as a course in which instruction is given to preservice teachers in specific techniques describing how to teach mathematics concepts and skills to children in the elementary and middle school grades (EC-8).

Preservice teacher. Preservice teacher was defined as an intern and/or candidate studying for a degree and/or certification in education. The term preservice teacher, for the purposes of this study, refers to an individual who has completed the requirements for and has been admitted to the College of Education's teacher education program. This individual has also completed coursework requirements for the College of Education (i.e. field of study, academic major, technology, fine arts, and pedagogy coursework) and has been admitted into the Professional Development School program. The preservice teacher is in his/her year of internship (which includes methods courses) and student teaching.

Professional Development School (PDS). The Professional Development School was defined as a regular elementary or middle school that worked in affiliation with the university to develop thought provoking preparation for teacher candidates. The teacher candidates were placed in the schools by the school district sponsoring the

PDS and the university delivered methods coursework at a site in the school district. The teacher candidates spent two semesters in their PDS placement. The first semester included two days of classroom observation a week in the classrooms with their mentor teachers as well as two days of university instruction in their methods coursework. The second semester included their student teaching rotation as well as one class conducted by the university.

Self-efficacy. Self-efficacy was defined as individuals' judgments of their capabilities to execute courses of action required to attain designated types of performances. Self-efficacy is concerned not with the skills one has, but with the judgments of what one can do with the skills one possesses. (Bandura, 1986)

Software integration confidence. For the purposes of this study, software integration confidence was defined as one's confidence in integrating specific software applications, such as a spreadsheet or a database, into lessons taught in elementary mathematics classes.

Technology integration. For the purposes of this study, technology integration was limited to the application of computers and computer software. Technology integration was the infusion of the computer and it's software into the curriculum.

Assumptions

There were several underlying assumptions associated with this study. It was assumed that the participants in this study understood the importance of their eventual use of computer integration in their future elementary mathematics instruction. The participants needed to make this connection in order for the study to have relevance in their preparation for student teaching. It was assumed that the preservice teachers in the experimental group made the connection with the instructor's demonstration of computer integration techniques as a model for their future use as student teachers. There was also the assumption that a level of self-efficacy in computer technology and a confidence in software integration would actualize itself in the use of the computer as a tool in the planning and instruction of the preservice teacher in his/her mathematics classes when they did their student teaching.

Limitations

Ideally, the participants in the experimental group should have experienced the intervention by the Technology Leadership Institute in its entirety in a computer lab classroom. The limitation in this instance was available time. The time spent in the computer lab classroom was scheduled around other classes at the selected PDS campus, thus limiting the time for this group. Another limitation in this study was the length of time allowed for the preservice teacher to demonstrate computer integration techniques in the student teaching experience. This study was limited to elementary preservice teachers. It was also limited to preservice teachers at one university. Thus, results may or may not generalize to other preservice teachers and/or institutions.

Description of Design

This study was quasi-experimental. The design for this study was a nonequivalent pretest-posttest control group design. The experimental group and the control group each received a pretest, the Self-Efficacy with Computer Technologies Scale. The experimental group then received the novel treatment, and the control group received the traditional instruction. Both groups were then posttested at the end of the instructional treatment. This posttest included the original Self-Efficacy with

Computer Technologies Scale plus two other posttest-only instruments, which were the Preservice Teacher Software Integration Confidence Scale and the Lesson Plan Technology Infusion/Integration Scale.

CHAPTER 2

Related Literature

The review of literature found a large body of work dealing with technology integration in colleges of education. The literature revealed plans by colleges to improve technology integration in their coursework by including more specific courses for technology integration and by improving faculty demonstration of technology integration techniques. The following is a sample of the literature relevant to this study.

Technology Integration needs in Colleges of Education

Two examples of colleges of education that have examined themselves in relation to their perceived need for more technology integration training for their preservice teachers are the University of Georgia and the University of West Florida. The College of Education at the University of Georgia developed initiatives to address the lack of technology integration in their preservice teacher training (Hill and Somers, 1996). The outcome of this study was the recommendation to hire a technology coordinator, organize events and presentations to improve technology use, and to develop standards (Vannatta, 2000). The College of Education at the University of West Florida also initiated a technology planning process (Northrup and Little, 1996). They designed five benchmarks to facilitate a stronger program. These benchmarks included areas of equipment, technology needs, preservice teacher education, in-service, and outreach.

Technology Integration and Preservice Teachers

In a global study reflective of how teachers and preservice teachers develop their computer skills, Janice Stuhlmann (1998) of Louisiana State University commented that the estimated five to six years that teachers take to master the use of computers and include them in their daily lessons could be reduced. This time frame could be less if preservice teachers were well prepared in computer-assisted instruction.

One study looked at preservice teachers' attitudes and emotions in conjunction with computer use. Abbott and Farris (2000) reported that preservice teachers found using computers enjoyable, experienced little frustration, and believed that computers contributed to their learning as well as the production of products related to teaching.

For many preservice teachers, computing is stressful. Laffey and Musser (1998) found that student attitudes about the use of computers in the classroom and computer use in the real world were not the same. They report that students place a higher value on the future use of technology in the workplace than on the future use of technology in the schools. It comes as no surprise that they found preservice teachers to be anxious about their own use of technology as well as the expectations for them to use the computer as a tool in their future classrooms.

Technology Integration and College/University Professors

Deborah Eldridge (2001) of the City University of New York, Hunter College, claimed that not only was there an advantage to technology integration for her students, but there was also a side benefit of self-improvement for the professor. She found that she was more responsive to her students and more reflective of her teaching practice. Encouragement from her son gave Eldridge the courage to set up and maintain a website for her students. She developed a website that included a syllabus, lecture notes, grades and discussions, test materials, assignments, and Internet resources (Eldridge, 2001). She then surveyed her classes each semester for three semesters and made improvements to her website according to their comments and suggestions. The first implementation came in the spring of 1999. This semester was one of implementation and resulted in the highest degree of change and learning for both the students and the instructor. The students reported accessing the website to help them stay organized, keep up-to-date, and support their study. Each semester that Eldridge surveyed her students, she felt they had been impacted by the integration of the technology. She also reported a need to improve the site and her integration strategies. Eldridge reported, in conclusion, that she felt she had a clear vision of what she wanted to accomplish, but in her enthusiasm she may have underestimated the time and energy required to accomplish her goals.

Technology Infusion/Integration in Education Methods Courses

According to Marianne Handler (1993) of National-Louis University, although nearly 90% of all teacher education programs offer some opportunity for computer training, only 29% of students see themselves as prepared to integrate technology. Handler conducted her study by surveying one hundred and thirty three education graduates to collect data on the respondents' self-perceptions of their preparation to integrate technology. She divided the respondents into two categories: (1) teachers completing their first year in the classroom who felt their program prepared them to use computers in the classroom, and (2) those who did not perceive themselves as being prepared (Handler, 1993). The research that Handler conducted offered the following two insights: (1) the most commonly stated use of the computer in the respondents' methods courses was using the word processor for assignments, and (2) the most common answer given by respondents was having had at least one experience in software evaluation. Seeing technology used in methods classes is very important, according to this study. Handler concluded that a single course introducing technology in education is important, but that “hands-on” and “minds-on” opportunities in methods courses and in student teaching should be given equal importance.

A study conducted, not in mathematics methods courses but instead in social studies methods courses, provides some insight into the power of the instructor. Elizabeth Willis (1997) of New Mexico State University conducted research on the advent of technology integration in social studies methods coursework for preservice teachers. Although this study is not directly related to mathematics, it does reflect positively on technology integration. Willis provided background for her study by providing a historical context covering the past twenty years. She emphasized the debate between educators, parents, and the media on how to improve standardized test scores. She noted the many calls for reform, which have resulted in very little change in the low test scores. Willis emphasized the teacher as the agent of change and narrowed the area of needed change to that of technology integration. She also focused on the need for teacher education programs to provide more training for preservice teachers in computer use and computer integration. Willis discussed the modeling and instruction that she utilized in her classroom. She stated that changing from a static form of learning to a dynamic form of learning cannot come from the technology, but must come instead from the instructor. One of her basic assumptions was the tie between colleges of education and the National Council for Accreditation of Teacher Education (NCATE) standards and the International Society for Technology in Education (ISTE) foundation competencies for technology integration.

Willis offered three models for incorporating technology into teacher education programs illustrated in her review of related literature. One model for incorporating technology into preservice teacher programs was integrating it into the college curriculum. The second model was to require preservice teachers to take a computer integration course that would include applications such as word processing, database, and spreadsheet. The third model was to unite three program components to prepare preservice teachers to integrate technology. These components would include (a) a three-semester core course in computer applications, (b) professors who model computer integration in all courses, and (c) field experiences with mentor teachers who integrate technology into their lessons.

After this brief review of related literature, Willis introduced her alternative model for integrating technology into a teacher education program. In this, she described her experience as a teaching fellow and the computer course she taught to preservice teachers. In this reflection, she offered insight into demonstrative techniques by the instructor, expectations for student assignments, and the development of lesson plans that include technology integration. All of the goals and objectives for this course were carefully linked to NCATE and ISTE standards and competencies.

The next step in Willis's model was provided when she taught a secondary and elementary social studies methods course. She was then able to use computer integration strategies in her methods course. The applications that were used by the instructor for the social studies methods courses she taught were databases, hypertext/hypermedia, and simulation. The attempt was made to present preservice teachers with methods of use in these areas for their own classroom. Presentations were made in a motivational, professional manner. Database techniques were based on real-world usage, such as address books and phone books. Willis noted two specific applications. In both applications, she had each student create his/her own database in conjunction with any field that he/she desired. The preservice teachers then wrote a letter to a university official in a word processing software-using data from the fields they had created. A computer simulation was demonstrated by asking the preservice teachers to participate in a selected simulation. The simulation and its goals for use within a one-computer classroom were explained. The preservice teachers then formed groups and participated in the simulation activity. The outcome was an understanding that the dilemma presented by the simulation was the key to the activity and that the computer was only a tool of delivery. Willis concluded that technology integration had been successful in her social studies methods courses and would be beneficial not only in social studies methods courses, but in all methods courses.

Positive student responses are a side benefit for some instructors who integrate technology into their classes. Ken Jensen (2001) at the University of Nebraska stated that technology is an integral part of his mathematics methods course instruction. He also commented about the favor with which his students received this kind of instruction.

The study Jensen reported on was a case-study design. It included classroom observations, instructor interviews, and student-written feedback as sources of information for analysis. This information was augmented by data accumulated from student journals and observations augmented by other faculty members. Preservice teachers in his course were able to use laptop computers (with Internet connectivity), Mathematica®, Geometer's Sketch Pad®, E-mail, advanced calculators, and other technology devices.

Jensen reported that his findings were that the instructor had prepared the coursework and incorporated the technology appropriately. The students responded very favorably. He reported three specific responses from students in the class, all of which were very favorable. A female student commented, "I enjoy a … teacher who is trying innovative things in the classroom" (p. 66). A male student responded, "It is amazing what technology will allow you to do in the classroom" (p. 66). Another male student responded, "… I learned lots of neat features that would work beautifully in my Calc reci as well as the prealgebra we will be teaching" (p. 66).

There were negative aspects of the study. Jensen reported missed class time while checking out the laptops and the distraction of having a laptop in front of students during times he lectured.

All things considered, there were more positive points than negative points in the information related by Jensen (2001). The positive responses were coupled with his own admission of learning as well. Faculties are often divided about "how and to what extent" (p. 36) technology should be incorporated into coursework. Jensen reported that his strategies were one answer to college faculty members asking the question of how much technology should be used in a course of this nature.

Robert Quinn (1998), professor of mathematics education at the University of Nevada-Reno, commented that mathematics methods courses can affect preservice teacher's attitudes, knowledge, and assumptions about the role of teachers and technology in the classroom. One of the underlying assumptions of his study was that teachers teach the way they were taught. Information was gathered from 28 preservice elementary teachers and 19 preservice secondary math teachers. The median age of the elementary group was 28, and the median age of the secondary group was 29. Both the elementary and the secondary math methods courses provided numerous opportunities for participants to use technology.

The study was begun at the start of the semester using an eight-minute response to the question, “What are your beliefs concerning the use of technological aids in the teaching of mathematics?” (p. 375). Most participants held favorable views regarding technology at the beginning of the study. Quinn provided several specific responses from respondents. He quoted three preservice teachers who felt that technology could provide an important link to the mathematics curriculum. He offered thoughts from two students who expressed that technology could be a strong motivator for children. He then provided thoughts from three respondents who reacted negatively concerning the use of technology in mathematics. These three participants expressed negative views concerning the use of calculators in math and the need for basics to be delivered in a more traditional method.

The follow-up in his study was near the end of the semester in which the instructor asked each participant to answer four questions in a tape-recorded interview. The interview data revealed that preservice teachers received little exposure to technology in their elementary and secondary education. Three-fourths of the respondents recorded no use of technology, while the remaining respondents admitted sparing use during their formal education.

At the end of Quinn's study, most respondents indicated that their beliefs concerning the use of technology had remained unchanged. However, Quinn shared the thoughts of three preservice teachers who expressed changes in their beliefs about mathematics students using calculators. The three respondents originally felt that the students would use calculators as a crutch, but they changed their thoughts to reflect the positive use of calculators with basic mathematical principles. Four conclusions to his study were that (1) mathematics methods courses can provide preservice teachers with important knowledge and experience, (2) preservice teachers can learn mathematical content through experience involving technology, (3) preservice teachers are concerned about impending difficulties that might impede their ability to utilize technology in their classroom, and (4) preservice teachers leave mathematics methods courses feeling they need to know more about the use of technology.

Technology Integration and Preservice Teachers' Self-Efficacy

Finally, the basis for understanding the potential impact of technology integration on preservice teachers' self-efficacy was investigated by Margaret Ropp (1999). Ropp spent time in establishing the direction of her study by defining several key aspects of the research. Attitude toward computers was a key component in her study. If preservice teachers do not believe that technology has a use in the classroom, they will not use it no matter the degree of proficiency they may possess. Computer anxiety was another key element to Ropp's study. Ropp defined computer anxiety as a mixture of fear and apprehension felt by the user before interacting with the computer. She reported on the research literature investigating whether instruction and experience can reduce anxiety in students. Computer self-efficacy was the third important idea covered by Ropp. She defined self-efficacy and then related that concept to computer technology, stating that self-efficacy was concerned with the judgments of what one can do with whatever skill one possesses. She reported that the literature indicates a high correlation between self-efficacy and performance.

The technology proficiency portion of her study was directly linked to the Michigan State University College of Education Technology Proficiency checklist. The goal of this area of the study was to evaluate preservice teachers in four specific domains of proficiency. Those domains were (1) E-mail, (2) World Wide Web, (3) integrated applications, and (4) integrating technology into teaching. The items in the self-assessment were both simple and adaptive pedagogical uses of technology.

The last area of concern for this study was computer coping strategies. Ropp reported this as a less commonly researched area of technology study. She defined the use of this concept as strategies that individuals might use when they encounter difficulties getting the computer to do what they want.

The participants for this study included 53 preservice teachers from two sections of a teacher preparation course offered in the spring semester. There were 22 elementary preservice teachers and 28 secondary preservice teachers. Three preservice teachers declined to have their data used for research. The participants ranged in age from 21 years to 40-plus years; 34% were males and 64% were females.

Ropp (1999) used six instruments in her study. The Attitudes Toward Technology scale had 42 items that were constructed using positive and negative sentences. The Computer Anxiety Scale consisted of 20 items in sentence stem construction. The Computer Attitude Scale was a 23-item scale with positive and negative statement construction. The Computer Self-Efficacy Scale was a scale consisting of 29 statements that completed a sentence stem. This scale was used by permission from Murphy, Coover, and Owen (1989). The study also included the Computer Coping Strategies Scale. This scale was comprised of 17 strategies useful in problematic situations. The Technology Proficiency Self-Assessment had 20 items that asked participants to evaluate their pedagogical uses of technology.

Early in the semester, each participant was given a packet of surveys and instruments to complete as a homework assignment over a weekend. Data from these surveys were analyzed and the author reported the information gathered from the preservice teachers. At approximately the mid-term of the course, the preservice teachers in the study participated in two hands-on technology sessions. The two sessions totaled three hours in length. The preservice teachers worked in pairs, utilizing a web page designed specifically for the participants. This web page was designed with hyperlinks to encourage the participants to explore the Internet and discover teachers using the Internet in their classrooms to teach subject matter. At the end of the first session, the participants wrote responses to three open-ended statements on a fast-write instrument.

The surveys measuring the six sets of individual characteristics were administered in a pretest-posttest design. These six scales were the (1) Attitudes Toward Technology Scale, (2) Computer Anxiety Scale, (3) Computer Attitude Scale, (4) Computer Self-Efficacy Scale, (5) Technology Proficiency Self-Assessment, and (6) Computer Coping Strategies Scale. Pearson correlation coefficients were computed between these instruments as well as demographic variables at the pretest stage. At the posttest point of the study, Ropp did the correlational analysis again, and paired t-tests to assess significance of changes between administrations. Relationships among the background demographics and the six instruments given at the pretest were reported using nine different variables. These nine variables were age, gender, ease of computer access, computer ownership, weekly computer use, completed computer courses, method of most computer learning, and the number of teachers who used computers in the participants' education. Most variables showed only weak correlation. However, ease of computer access and hours of weekly computer use were significantly correlated as reported above.

Relationships among the six scales at pretest found significant correlations. Computer self-efficacy was positively correlated with the Computer Coping Strategies scale, indicating that students who felt more comfortable with general computer tasks tended to use more adaptive coping strategies. Computer Self-Efficacy was also highly correlated with the Technology Proficiency Scale. Computer anxiety was negatively correlated with the other four measures. These results provide some degree of support for the construct validity of the scales used in Ropp's study.

The comparison of scores from pretest to posttest indicates that the participants had mostly positive attitudes toward computers, relatively low computer anxiety, and fairly high computer self-efficacy. The results of the paired t-tests indicated significant growth on three of the six instruments: (1) Technology Proficiency Scale, with $t = 5.01$, $p < .001$, (2) Computer Self-Efficacy, with $t = 2.02$, $p < .05$, and (3) Computer Coping Strategies, with $t = 5.25$, $p < .001$. A repeated measures analysis of variance was conducted to investigate several differential gains from pretest to posttest. Significant main effects were found for the between-subjects Proficiency factor, with $F = 45.28$, $p < .001$ and for the two within-subjects factors of Time, with $F = 52.68$, $p < .001$, and Time, Time 1 vs. Time 2; with $F = 12.24$, $p < .001$.

Results reported by Ropp included two main points. At posttest, preservice teachers who were confident in their ability to perform computer tasks (computer self-efficacy) were less anxious about computers, had more positive attitudes toward computers, were more confident in their ability to teach using computers, and knew more computer coping strategies. More notably, while several items of demographic background information did not have any statistically significant relationship, the measures of computer access and amount of time spent weekly on a computer were statistically significantly correlated ($p < .05$) with almost all of the other measures used. She also reported that the most significant gains noted by participants from pretest to posttest were found for those preservice teachers who were least confident in their abilities at the beginning of the semester.

This review of related literature leads us to the current study on the effects of computer technology integration techniques in an elementary mathematics methods course on preservice teachers' computer self-efficacy, software integration confidence, and lesson planning. This research contributes to the current base of literature by focusing on mathematics methods course instruction. The intent of this study was to determine whether the use of specific computer integration techniques with preservice teachers in a mathematics methods course provides them with a level of self-efficacy or confidence that translates into usage of these techniques in the field. The experimental group participated in activities involving computer integration, experienced direct instruction on integration techniques, and completed required assignments with computer integration criteria. This study constituted a significant addition to the research literature on the impact or effectiveness of computer integration strategies used with preservice teachers. It has instructional implications for the design and implementation of effective, technology-infused mathematics methods courses and other methods courses.

CHAPTER 3

Design of the Study

Participants

The participants in this study were from two intact, non-randomly-formed classrooms. They were 27 preservice teachers enrolled in the College of Education at a university in north central Texas in two sections of a course entitled EDEE 4350, Mathematics in the Elementary School. The experimental group consisted of 17 female participants enrolled in EDEE 4350.002. The control group consisted of ten female participants enrolled in EDEE 4350.080. There were no males enrolled in either class. The ethnicity of the two groups was predominantly Caucasian. Each of the 27 participants was scheduled to student teach in the Spring 2003 semester.

Instruments

Four instruments were used to measure student characteristics and experiences. A demographic survey was used to collect information from the preservice teachers relating to personal information, experiences in their prior education relating to computer use, and their current computer use. This survey had 16 items and was entitled, "Demographic Data and Previous Context Use of the Computer Survey." It was used as a pretest instrument only. It described participants' demographics and their previous usage of the computer and was used to help establish the initial equivalence of groups. Participants were asked what year they first worked with a computer, how many college classes they had had in computer-related instruction, where their first experience with a computer took place, how many different teachers they had had who used technology in their instruction, and how they had learned the most about computers. The second section of the survey concentrated on current use of the computer. This section asked participants to indicate whether they owned a computer, how many hours a week they spend on the computer, which applications they use most frequently, and their Internet usage. This data is summarized later in this chapter and is detailed in table form. The survey is located in appendix a.

The second instrument was the Self-Efficacy With Computer Technologies Scale, consisting of 50 statements that complete a sentence stem asking for self-report of computer confidence (Murphy et al., 1989). It was used as a pretest and a posttest instrument. This scale was constructed using a five-point, Likert-type response scale, with the options of (1) Strongly Disagree, (2) Disagree, (3) Uncertain, (4) Agree, and (5) Strongly Agree. The first section was titled, “Computer Skills.” This section provided 24 statements to the sentence stem, “I feel confident…” Participants were asked to report on their physical skills in manipulating the computer. For example, one item was “I feel confident handling a floppy disk”. They were also asked to report on their skills working with software and hardware. They were asked about their confidence in copying files, explaining why a software program will/will not run on a computer, describing the function of the computer hardware, and troubleshooting computer problems. The second section was entitled, “Word Processing.” This section provided ten statements to the sentence stem “I feel confident…” In this section, participants were asked to report on their confidence in a word processing program with letter writing, accessing files, formatting text, printing and saving files, renaming a file, and moving blocks of text. The third section of the scale was entitled, “World Wide Web.” This section provided nine statements to the sentence stem, “I feel confident…” Participants were asked to report their abilities related to finding and using information, accessing information from a website, searching for information, and getting to a specific site on the World Wide Web. The fourth section of the scale was entitled, “Presentation Programs.” This section provided seven statements to the sentence stem “I feel confident…” Participants were asked to respond to creating a slide presentation, editing a slide presentation, adding pictures and sounds, working with colors and backgrounds, and rearranging and printing a presentation. This scale is located in appendix b.

The original 32-item Computer Self-Efficacy Scale was determined to be highly reliable and valid as reported by Murphy et. al. (1989). “Principal factor analysis with oblique (direct quartimin) rotation produced a three-factor solution that explained 92% of the systematic covariance among the 32 CSE items… . The alpha reliabilities for the three empirically derived factors were .97, .96, and .92, respectively” (p. 895). The alpha reliability estimates for each factor were very high, “indicating that the current form is suitable for research and evaluation purposes” (p. 898). The criticisms discussed in this article involve statements used in the section that dealt with mainframe computers. This concern, although refuted by Murphy et. al. (1989), was not a concern in this study because the Self-Efficacy with Computer Technologies Scale used here was an updated version that no longer addressed mainframe computer use. Dr. Steven V. Owen provided this updated version to the researcher. Dr. Owen was one of the original authors of the Computer Self-Efficacy Scale and has worked on many revisions since its original publication.

The third instrument was the Preservice Teacher Software Integration Confidence Scale. This instrument, designed by the researcher, consisted of ten statements constructed with a five-point, Likert-type response scale with the options of (1) Strongly Disagree, (2) Disagree, (3) Uncertain, (4) Agree, and (5) Strongly Agree. Participants were asked to define their levels of confidence in the utilization of computer integration techniques with students in a classroom. Specific items on the scale addressed participants' confidence with spreadsheet and database software as related to teaching students with these tools. The Preservice Teacher Software Integration Scale was designed to use as a posttest-only instrument. The Preservice Teacher Software Integration Scale is located in appendix c. Internal reliability data were collected on this instrument. The reliability analysis revealed an alpha of .9314 on section one, an alpha of .9347 on section two, and an alpha of .9500 on the total instrument. Content validity was established by having experts from the Technology Leadership Institute (TLI) review the ten items. These experts determined the instrument had content validity.

The fourth instrument, the Lesson Plan Infusion/Integration Scale, provided qualitative and quantitative data. This instrument was utilized as a posttest-only instrument. The author tracked a minimum of three preservice teachers from the experimental group and three preservice teachers from the control group into their student teaching experience. Grade level assignment and pretest scores matched these students. Lesson plans from each of these preservice teachers were collected. Attention was focused on lesson plans in the content area of mathematics. Researchers from the Technology Leadership Institute (TLI), a division of the Texas Center for Educational Technology, extrapolated and rated preservice teachers' use of computer integration strategies and shared this with the researcher. Analysis of this data was conducted by (a) identifying categories within the lesson plans using constant comparison methods as in Laney et al. (1996), and (b) scoring according to the rubric in the Lesson Plan Infusion/Integration Scale in the categories. These categories were developed *post facto* based on the actual wording in the participants' lesson plans. Two judges from TLI independently categorized and scored the participants lesson plans, and any discrepancies were discussed until a consensus was reached. The Lesson Plan Technology Infusion/Integration Scale is located in appendix d.

Design

This study was quasi-experimental. The design for this study was the nonequivalent pretest-posttest control group design. This design involved the random assignment of intact classes/groups to treatments (Gay and Airasian, 2000). The author made every attempt to utilize groups that were equivalent to combat threats to validity. The Demographic Data and Previous Use of the Computer Survey revealed several similarities in the demographic information between groups. All participants were in their senior year of school and all were female. The categories of age and elementary major (either EC-4 or 4-8) were similar between groups. The self-reported ethnicity across the two groups was 22 Caucasians (81.5%), three African-Americans (11.1%), one Hispanic (3.7%), and one Asian (3.7%). All participants were classified as seniors. Nineteen of the participants were early childhood through 4th grade certification majors, which represented 70.4% of the sample. Eight of the participants were fourth grade through eighth grade certification majors, which represented 29.6% of the sample. Table 1 demonstrates a breakdown of the demographic data.

Table 1

Participant Demographics

Category	Experimental Group	Control Group	Total	Total %
Senior Classification	17	10	27	100
Female Gender	17	10	27	100
Caucasian	15	7	22	81.5
African-American	1	2	3	11.1%
Hispanic	0	1	1	3.7%
Asian	1	0	1	3.7%

There were no participants screened out of the data analysis process. There were no participants who refused to participate in the study. Twenty-seven candidates were enrolled in the two classes, and all 27 agreed to participate in the study. Grade point averages were also similar between groups. The experimental group's mean grade point average was 3.306 and the control group's mean grade point average was 3.248. The use of a pretest and the two-way ANOVA design also helped establish the initial equivalence of groups.

Each group received a pretest. The experimental group got the novel treatment, and the control group got the traditional treatment. Both groups were posttested at the end of the instructional treatment.

The independent variable was the type of instruction experienced in an elementary mathematics methods course: novel instruction with specialized computer technology integration techniques versus traditional instruction with no specialized technology integration techniques. The dependant variables included the self-efficacy of preservice teachers with computer integration technologies as measured by the Self-Efficacy with Computer Technologies Scale, the confidence of preservice teachers with computer software integration as measured by the Preservice Teacher Software Integration Confidence Scale, and the use of computer technology integration techniques in their student teaching mathematics classes as measured by the Lesson Plan Technology Infusion/Integration Scale.

Procedure

During an early class period in the semester, each preservice teacher in EDEE 4350.002 (i.e. the experimental group, taught in a Professional Development School cadre located at an elementary school site), and EDEE 4350.080 (i.e. the control group, taught at a Professional Development School cadre located at a separate elementary school site), was given a packet of surveys. This packet included the Demographic Data Instrument and the Self-Efficacy with Computer Technologies Scale instrument. Students were asked to complete the instruments during class. The researcher's faculty sponsor proctored these instruments, and the results for individual participants were made known to the instructor after grades had been posted. Both groups were taught by the same instructor, the investigator of this study.

The instructor for the experimental technology integration group issued assignments that included an Internet search for mathematics lesson plans that used technology integration, the use of E-mail correspondence to turn in assignments to the instructor, plus several student assignments that required the use of computer software in the execution of the assignment and/or inclusion in the preservice teachers' plans as described below.

There were multiple opportunities for the instructor to demonstrate technology integration techniques with the preservice teachers in the experimental group. Techniques demonstrated by the instructor included the use of the World Wide Web and PowerPoint presentation software. These techniques were demonstrated throughout the course of study. The instructor demonstrated the use of the World Wide Web through the use of search tools, investigating school district web pages, and E-mail. The instructor utilized PowerPoint in weekly mini-lectures as coursework content was covered.

The preservice teachers in the experimental group constructed a notebook with ten prescribed sections. Each of these ten sections covered a mathematics instruction concept, and each section contained a minimum of one lesson plan for that section's topic that included technology integration. The first five sections were completed by mid-term and reviewed by the instructor. These five sections included: 1) Standards, 2) Problem-Solving, 3) Numbers and Place Value, 4) Addition/Subtraction, and 5) Multiplication/Division. The entire notebook (all ten sections) was completed by the end of the course and reviewed by the instructor. In addition to the first five sections described above, the completed notebook included the following sections: 6) Geometry, 7) Fractions, 8) Ration, Percentage, Proportion, 9) Measurement, and 10) Data Collection. All course requirements are in the course syllabus located in appendix e.

The preservice teachers in the experimental group were required to present in groups using PowerPoint and to demonstrate requiring their "class" to do the same. The PowerPoint presentation required each preservice teacher to analyze and evaluate a current mathematics textbook according to set criteria. These criteria included the following components: 1) compliance with National Council for Teachers of Mathematics principles and standards for mathematics, 2) identification of Texas Essential Knowledge and Skills, 3) activities formatted with the Texas Assessment of Knowledge and Skills, 4) use of problem-solving strategies, 5) non-dependence on rote learning and worksheets, 6) use of varied assessment instruments, 7) presence of interdisciplinary connections, 8) use of manipulatives, 9) employment of alternative approaches to instruction, 10) provision for hands-on learning opportunities, 11) presence of supplemental teaching materials, and 12) use of technology integration. Findings were reported by each group at the end of the course. Each group had ten minutes to present its findings and make recommendations for the chosen mathematics textbook.

In the middle of the semester, guest instructors from the Technology Leadership Institute (TLI), which demonstrates the integration of technology into the preservice teachers' future classrooms, made a presentation to the experimental group. This presentation included spreadsheet and database usage in the everyday mathematics classroom. Special emphasis was placed on the inclusion of technology TEKS. The TLI presenters focused on problem-solving activities in the middle-elementary grades (4^{th} through 6^{th}). Presentations were highly motivational, with humor, laughter, patience, perseverance, and professionalism demonstrated and encouraged. Hands-on activities were used to encourage preservice teachers to think and plan otherwise normal, routine mathematical exercises that included the use of spreadsheet and database software applications. Exciting presentations promoting knowledge of state expectations were provided in order to impact the preservice teachers' future experience with student teaching.

TLI presenters provided step-by-step instruction in a "how-to" format for transferring data in mathematical problem solving into a spreadsheet and working a solution. They also provided instruction on the practical application of database usage in a mathematical problem by demonstrating its ease of use in establishing a checkbook and also establishing a simple data arrangement.

This activity was followed by the TLI presenters escorting the preservice teachers to the computer lab located in the adjoining classroom and the preservice teachers executing a hands-on activity in which they manipulated the software in accordance to their previous training. Each activity included the construction of a spreadsheet utilizing information from the preservice teachers. Each preservice teacher provided his or her name, favorite color, favorite food, favorite number, and favorite holiday. They then took turns providing that data for the entire class. The data were then grouped by rows and columns to demonstrate the ease and functionality of this project and how it relates to the preservice teachers' classroom.

The TLI presenter then returned to the classroom with the cadre of preservice teachers and demonstrated another activity for a one-computer classroom. Using a spreadsheet on the only computer in the classroom, the preservice teachers were asked to categorize data from chocolate chip cookies. Each preservice teacher was given a cookie with four different kinds of chips baked in. They were then asked to break apart the cookies and determine how many of each kind of chip were present. The data were collected from the entire class and placed into the spreadsheet, and questions were asked to stimulate extended thought. This activity demonstrated the use of computer software as a tool and, more specifically, as a motivational and age-appropriate tool for children.

The database presentation consisted of introducing the software on the projection television in the classroom. Students were guided, step-by-step, through two of the sample databases provided with the software. Students were then given non-personal demographic information and told to assemble an address book for the class. The duration of this presentation was no more than four hours (or two class periods). The length was determined by the amount of time needed for the hands-on activity.

These activities and assignments addressed nearly half of the 15 standards for the student teaching and internship performance profile instituted by the International Society for Technology in Education. Included were; (1) apply troubleshooting strategies for solving routine hardware and software problems that occur in the classroom; (2) identify, evaluate, and select specific technology resources available at the school site to support a coherent lesson sequence; (3) design, manage, and facilitate learning experiences using technology that affirm diversity and provide equitable access to resources; (4) create and implement a well-organized plan to manage available technology resources, provide equitable access for all students, and enhance learning outcomes; (5) design, implement, and assess learner-centered lessons that are based on the current best practices on teaching and learning with technology and that engage, motivate, and encourage self-directed student learning; (6) guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject areas; and (7) apply technology productivity tools and resources to collect, analyze and interpret data and to report results to students and parents (ISTE, 1991).

The preservice teachers fulfilled most, if not all, of the National Council for Accreditation of Teacher Education standards for preservice teachers in relation to technology. Specifically, (1) for standard I.C.1, candidates completed a sequence of courses and/or experiences to develop an understanding of the structure, skills, core concepts, ideas, values, facts, methods of inquiry, and uses of technology for the content they plan to teach and; (2) for standard I.D.2 candidates completed a well-planned sequence of courses and/or experiences in pedagogical studies that helped develop understanding and use of: educational technology, including the use of computer and other technologies in instruction, assessment, and professional productivity (NCATE, 1995).

The control group was a class taught by the same instructor in a more traditional way, with no specialized technology integration strategies, experiences, or requirements. The students had no computer technology integration requirements, and they did not have the presentations or demonstrations of technology integration. The preservice teachers in the control group received the same mathematics methods content as the experimental group. The course syllabus is located in appendix f.

The experimental group and the control group had similar classroom experiences in several regards. They were both lectured to with the same mathematics methods content. They were both instructed in the use of mathematics manipulatives. They both participated in hands-on, manipulative training activities to model appropriate mathematics pedagogy for elementary and middle school classrooms. The main assignment for the course was the mathematics notebook, and both the experimental and control groups completed this assignment. The only difference in the two group's notebook assignment was that the experimental group was required to include technology integration in their ten lesson plans. The control group did not have technology included in their lesson plan requirement. The control group and the experimental group both had textbook analysis assignments. Students in the experimental group prepared their reports using a PowerPoint presentation. Each member of the control group presented her textbook analysis in the more traditional paper report format. To substitute for training in computer technology integration techniques, the control group had a more traditional assignment that consisted of tutoring sessions with students in the school to which they were assigned. This assignment was reported in a traditional paper format as well. The syllabi for the experimental and control groups may be found in the appendix.

The Self-Efficacy with Computer Technologies Scale and the Preservice Teacher Software Integration Confidence Scale was administered during class near the end of the semester. The author's faculty sponsor proctored these instruments, and the results for individual students were not made known to the instructor until after grades had been posted. Analyses of data from these instruments at pretest and posttest were shared with the class, in general terms, at the conclusion of the study.

The establishment of initial equivalence of the two groups was determined through descriptive and statistical means using the two pretest instruments. The two pretest instruments used were the Demographic Data and Previous Context Use of the Computer Survey and the Self-Efficacy with Computer Technologies Scale. The pretest results were very similar for the two groups. The pretest means were similar and the standard deviations for the two groups were very similar. Descriptive demographic information from the first pretest instrument demonstrated the comparability of the groups. All participants were in their senior year of school and all were female. The categories of age and elementary major (either EC-4 or 4-8) were similar between groups. Grade point averages were also similar between groups. Statistical analysis was done on the second instrument to determine reliability. Each of the four sections of the instrument was analyzed as well as a total item analysis of the instrument. The first section, "Computer Skills," had an alpha reliability of .8907. The second section, "Word Processing," had an alpha reliability of .6293. The third section, "World Wide Web," had an alpha reliability of .8346. The fourth section, "Presentation Programs," had an alpha reliability of .8632. All 50 items in the total instrument had an alpha reliability of .9308. These high alpha reliabilities allowed the analysis to be conducted using one variable; thus, a two-way ANOVA (repeated measures) was conducted to analyze the data.

The reliability analysis provided a reliability coefficient for the Self-Efficacy with Computer Technologies Scale pretest in each of its four categories and for the total scale comparing all 50 items. The analysis provided a reliability coefficient for the Self-Efficacy with Computer Technology Scale (SECTS) posttest in each of its four categories and for the total scale. The analysis also provided a reliability coefficient for the Preservice Teacher Software Integration Confidence Scale (PTSICS) posttest in each of its two parts and for the total scale comparing all ten items. Table 2 reports the alpha scale for the reliability analysis. The alpha coefficients were very high for all three instruments, with one minor exception. The alpha reliability coefficient for the SECTS pretest category "Word Processing" was only .6293, and the alpha reliability coefficient for the SECTS posttest category "Word Processing" was only .4258. Examination of these two categories revealed that the data from each participant were very similar, thus accounting for a lower number on the alpha rating. The total scale alpha reliability coefficients were extremely high for the SECTS pretest (.9308), the SECTS posttest (.9506), and the PTSICS posttest (.9500).

Table 2

Category and Total Reliability Analysis

Category	SECTS pretest	SECTS posttest	PTSICS posttest
Computer Skills	.8907	.9309	-
Word Processing	.6293	.4258	-
World Wide Web	.8346	.8577	-
Presentation Programs	.8632	.9115	-
Spreadsheet Integration	-	-	.9314
Database Integration	-	-	.9347
Total	.9308	.9506	.9500

The reliability analysis revealed a high degree of correlation in the data. This led to the decision to run a two-way ANOVA (repeated measures) on the SECTS pretest and the SECTS posttest. ANOVA was used to explore posttest differences between the two groups in terms of computer software integration confidence as measured by the PTSICS. An alpha level of .05 was used throughout the data analysis.

The author then collected the math lesson plans of three preservice teachers from the experimental group and three preservice teachers from the control group during their student teaching experience, which they pursued in the semester immediately following the study. The students were matched based on grade-level assignment and pretest scores. Review of lesson plans by technology integration experts from the Technology Leadership Institute ensured that researcher/teacher bias and effects were tightly controlled and that the qualitative portion of this study was valid. Researchers from the Technology Leadership Institute extrapolated preservice teachers' use of computer integration strategies and shared this with the author. The form used to collect this data was comprised of a rubric style point scale to identify integration strategies. A systematic method of categorizing and scoring was utilized to describe preservice teacher usage of computer software integration practices. Reliability was confirmed with researcher's agreement in scoring that was well over 90% of the scale judgments.

CHAPTER 4

Presentation of Data

The purpose of this chapter is to report the findings of the data based on the six stated hypotheses. This study was conducted to assess the effect of technology integration strategies in an elementary mathematics methods course on preservice teachers' computer self-efficacy, software integration confidence, and lesson planning in their student teaching semester. Reliability analysis was run on the Self-Efficacy with Computer Technologies Scale pretest and posttest. The same reliability analysis was run on the posttest-only Preservice Teacher Software Integration Confidence Scale and the Lesson Plan Technology Infusion/Integration Scale. The reliability analysis, described previously in chapter 3, was used to determine the number of constructs present in the data. The reliability scores were very high measuring one construct. Descriptive statistical analysis was used for data analysis of Hypotheses 1, 2 and 3. Null Hypotheses 1, 2, and 3 were then analyzed using inferential statistics.

The participants in the study were from two intact, non-randomly-formed classrooms. They were 27 preservice teachers enrolled in an elementary mathematics methods course in a college of education in a metropolitan state university. The two classrooms received different instructional treatments. The experimental group experienced novel instruction with specialized computer technology integration techniques, experiences, and requirements provided them by the regular course instructor and a guest instructor from the Technology Leadership Institute (TLI). The control group experienced the same content delivered in a more traditional instructional format without computer technology integration techniques, experiences, or requirements. Thus, use or non-use of computer technology integration techniques in an elementary mathematics methods course was the independent variable manipulated in this study. The dependent variables included the self-efficacy of preservice teachers with computer integration techniques as measured by the Self-Efficacy with Computer Technologies Scale, the confidence of preservice teachers with computer software integration as measured by the Preservice Teacher Software Integration Confidence Scale, and the use of computer technology integration techniques by preservice teachers during their student teaching experience in a mathematics class as measured by the Lesson Plan Technology Infusion/Integration Scale. The Windows SPSS 10.07™ statistical program was used to run the data analysis.

Descriptive and Inferential Statistics

The six hypotheses restated below were tested at the .05 level of statistical significance for all participants in the two groups. Hypothesis 1 stated that preservice elementary teachers who received mathematics methods instruction with computer integration techniques would have higher scores on a Self-Efficacy with Computer Technologies Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. Null Hypothesis 1 stated that there would be no statistically significant difference in scores on a Self-Efficacy with Computer Technologies Scale between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

Table 3 presents the descriptive statistics for the control group and the experimental group from the Self-Efficacy with Computer Technology Scale (SECTS) used in this study. It is interesting to note that the mean scores for the control group, the experimental group, and the total participants rose from pretest to posttest. Also note that the standard deviation of the scores grew smaller from pretest to posttest.

As described in Table 3 below, the pretest mean for the control group was 227.70 with a standard deviation of 14.39, and the posttest mean for the control group was 236.80 with a standard deviation of 8.74. The pretest mean for the experimental group was 233.06 with a standard deviation of 15.60, and the posttest mean for the experimental group was 240.06 with a standard deviation of 14.08. There was observable improvement in the means of both the experimental and control groups from pretest to posttest, and the standard deviations of both groups improved or narrowed. The control group's mean score improved 5.36 points, while the experimental group's mean score improved 3.26 points. The control group's standard deviation narrowed more than the experimental group's standard deviation.

Table 3

Group Means and Standard Deviations on the SECTS Pretest and Posttest

Group	Mean	Standard Deviation	N
Pretest Control	227.70	14.39	10
Pretest Experimental	233.06	15.60	17
Pretest Total	231.07	15.11	27
Posttest Control	236.80	8.74	10
Posttest Experimental	240.06	14.08	17

Posttest Total	238.85	12.29	27

Two-way repeated measures ANOVA was used to analyze the mean score difference between the control group and the experimental group from pretest to posttest. As shown in Table 4, the difference was not statistically significant ($p < .05$). There was a low effect (.029) , and power was also low (.132) as shown in Table 4.

Table 4

Two-Way Repeated Measures ANOVA Summary Table (SECTS)

Source	SS	df	Mean Square	F	p	Eta²	Power
Intercept	2767621.571	1	2767621.571	8792.652	.000	.997	1.000
Exp * Con	233.794	1	233.794	.743	.397	.029	.132
Error	7869.132	25	314.765				

Hypothesis 2 stated that preservice elementary teachers who received mathematics methods instruction with computer integration techniques would have higher scores on a Preservice Teacher Software Integration Confidence Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. Null Hypothesis 2 stated that there would be no statistically significant difference in scores on a Preservice Teacher Software Integration Confidence Scale (PTSICS) between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

Table 5 presents the descriptive statistics for the posttest–only Preservice Teacher Software Integration Confidence Scale (PTSICS). The data describe the performance of the control group, the experimental group, and the total population. As described below in Table 5 experimental group mean on the PTSICS was 39.65, and the control group mean on the PTSICS was 32.90. The standard deviation for the experimental group was 7.42, and the standard deviation for the control group was 6.37. The means were in the expected direction to support hypothesis 2 of this study, and the standard deviations were low enough for drawing conclusions with some confidence.

Table 5

Group Means and Standard Deviations on the PTSICS Posttest

Group	Mean	Standard Deviation	N
Control Group	32.90	6.37	10
Experimental Group	39.65	7.42	17
Total	37.15	7.68	27

One-way ANOVA for mean differences was used to analyze the difference in PTSICS posttest means between the control group and the experimental group. Table 6 demonstrates the difference was statistically significant ($p < .05$). It is notable that R squared was equal to .187, and the adjusted R squared was equal to .154. Thus, 15.4% of the variance between groups is explainable by the independent variable (i.e. use/non-use of computer technology integration techniques within an undergraduate elementary mathematics methods course).

Table 6

One-Way ANOVA Summary Table (PTSICS)

Source	SS	df	Mean Square	F	p	Eta^2	Power
Intercept	33137.884	1	33137.884	664.468	.000	.964	1.000

Exp * Con	286.625	1	286.625	5.747	.024	.187	.635
Error	1246.782	25	49.871				
Total	38793.000	27					

Hypothesis 3 stated that preservice elementary teachers who received mathematics methods instruction with computer integration techniques would generate lesson plans in their student teaching internship experience that scored higher on a Lesson Plan Technology Infusion/Integration Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. Null Hypothesis 3 stated that there would be no statistically significant difference in scores on a Lesson Plan Technology Infusion/Integration Scale between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

Table 7 presents the descriptive statistics for the posttest-only Lesson Plan Technology Infusion/Integration Scale (LPTIS). The data represent the control group, the experimental group, and the total population. As described below in Table 7 the experimental group mean on the LPTIS was 13.33, and the control group mean on the LPTIS was 1.67. The standard deviation for the experimental group was 10.41, and the standard deviation for the control group was 2.89. The mean score difference between the experimental group and the control group was certainly reflective of the direction that was expected.

Table 7

Group Means and Standard Deviations on the LPTIS Posttest

Group	Mean	Standard Deviation	N
Control Group	1.67	2.89	3
Experimental Group	13.33	10.41	3
Total	7.50	9.35	6

One-way ANOVA for mean differences was used to analyze the difference in LPTIS posttest means between the control group and the experimental group. Table 8 demonstrates that the difference was not statistically significant (p. < 05).

Table 8

One-Way ANOVA Summary Table (LPTIS)

Source	SS	df	Mean Square	F	p	Eta²	Power
Intercept	337.500	1	337.500	5.786	.074	.591	.450
Exp * Con	204.167	1	204.167	3.500	.135	.467	.302
Error	233.333	4	58.333				
Total	775.000	6					

Summary

There was no statistical significance ($p < .05$) between experimental and control groups on the Self-Efficacy with Computer Technology Scale at pretest and posttest. However, the results were in the expected direction that indicated growth by both groups and a higher mean score by the experimental group. There was statistical significance ($p = .024$) between groups on the posttest-only Preservice Teacher Software Integration Confidence Scale. There was no statistical significance ($p < .05$)

between groups on the Lesson Plan Technology Infusion/Integration Scale. However, the results were in the expected direction in that the mean score for the experimental group was much higher than the control group.

CHAPTER 5

Conclusions

The purpose of this study was to demonstrate the effect of computer technology integration (through direct intervention, required assignments, and instructor demonstration) on preservice teachers' feelings of computer self-efficacy and feelings of confidence in software integration. It was also the purpose of this study to interpret these preservice teachers' actual use of these computer technology integration techniques in their own planning and instruction during student teaching.

The participants in this study were from two intact, non-randomly-formed classrooms. They were 27 preservice teachers enrolled in a college of education at a university in north central Texas in two sections of a course entitled EDEE 4350, Mathematics in the Elementary School. The experimental group consisted of 17 female participants enrolled in EDEE 4350.002. The control group consisted of ten female participants enrolled in EDEE 4350.080. The ethnicity of the two groups was predominantly Caucasian. Each of the 27 participants was scheduled to student teach in the Spring 2003 semester.

The reliability analysis provided a reliability coefficient for the Self-Efficacy with Computer Technologies Scale (SECTS) pretest and posttest in each of its four categories and the total scale comparing all 50 items. The analysis also provided a reliability coefficient for the Preservice Teacher Software Integration Confidence Scale (PTSICS) posttest in each of its two parts and the total scale comparing all ten items. The reliability coefficients for the SECTS (pretest and posttest) and the PTSIC (posttest) were very high. The SECTS pretest alpha was .9308, and the SECTS posttest alpha was .9506. The PTSIC posttest alpha was .9500. These results provide a clear indication that the scales were very reliable. Margaret Ropp (1999) reported computer self-efficacy reliability coefficients of .96 in her study, which supports the findings of the current study.

The hypotheses were tested at the .05 level of statistical significance. In this study, the independent variable was the use or non-use of computer technology integration techniques in an undergraduate elementary mathematics methods course. Experimental group students experienced novel instruction with specialized technology strategies, experiences, and requirements provided to the experimental group by the regular course instructor and the guest instructor from the Technology Leadership Institute (TLI), while control group students experienced traditional instruction without computer technology integration techniques. The dependant variables included the self-efficacy of preservice teachers with computer integration technologies as measured by the Self-Efficacy with Computer Technologies Scale, the confidence of preservice teachers with computer software integration as measured by the Preservice Teacher Software Integration Confidence Scale, and the use of computer technology integration techniques by preservice teachers during their student teaching in a mathematics class as measured by the Lesson Plan Technology Infusion/Integration Scale.

The results of the data analysis revealed, through the inferential statistics run on the Self-Efficacy with Computer Technology Scale pretest and posttest, that there was no statistically significant difference between treatment groups ($p = .397$). Therefore, Hypothesis 1 was rejected, and Null Hypothesis 1 was sustained. Preservice elementary teachers who received mathematics methods instruction with computer integration techniques did not have higher scores on a Self-Efficacy with Computer Technologies Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. There was no statistically significant difference in scores on a Self-Efficacy with Computer Technologies Scale between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

The novel intervention had little measurable effect on the experimental participants in the study as pertaining to computer self-efficacy. The participants in the experimental group had higher mean scores at pretest and at the posttest as compared to the control group. The experimental group's pretest mean score was 5.36 more than the control group, and their posttest mean score was 3.26 more than the control group. There was also test wise occurrence improvement. However, this cannot be attributed to the intervention. Participants' mean scores, both pretest and posttest, were very high. The participants in both the experimental group and the control group appear to be very well prepared in the areas addressed by the SECTS instrument. These areas included basic computer skills, appropriate use of word processing skills, use of the World Wide Web, and presentation software skills.

The experimental group's pretest-posttest means of 233.06 and 240.06 and the control group's pretest-posttest means of 227.70 and 236.80 are relatively high when compared to the 250 total points attainable on the SECTS instrument. This reflects very well on the prior knowledge and skills attained by these preservice teachers. It also provides some basis to the thought that these participants are ready for more advanced, sophisticated software applications. These participants advanced through their secondary education with formal technology course requirements and completed university coursework in technology. This background is evident in their high pretest and posttest scores of self-efficacy.

Preservice teachers who are confident in their ability to perform computer tasks (i.e. who have high computer self-efficacy) also have more positive attitudes toward computers (Ropp, 1999). The preservice teachers in the present study had the background in technology use to support further preparation in computer integration strategies. Although students in her study only received three hours of hands-on computer technology instruction, Margaret Ropp (1999) reported that her results were statistically significant. In Ropp's study, the statistical analysis of computer self-efficacy yielded a $t = 2.02$, with $p < .05$. Although the current study did not match this statistical significance, the results were in the same, expected direction.

The results of the data analysis revealed, through the inferential statistics run on the posttest-only Preservice Teachers Software Integration Confidence Scale, that there was a statistically significant difference between treatment groups ($p = .024$). Therefore, Hypothesis 2 was sustained, and Null Hypothesis 2 was rejected. Preservice elementary teachers who received mathematics methods instruction with computer integration techniques had higher scores on a Preservice Teacher Software Integration Confidence Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. There was a statistically significant difference in scores on a Preservice Teacher

Software Integration Confidence Scale (PTSICS) between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

The statistical significance of the difference between treatment groups is important to this study. It reflects well on this portion of the study that the adjusted R squared value is equal to .154, permitting the inference that 15.4% of the observed effect is explainable by the independent variable. Preservice teachers who are exposed to computer technology integration techniques seem to be much more confident with the concepts of integrating spreadsheet and database software into their future lesson plans than preservice teachers who are not exposed to computer technology integration techniques.

The findings of this study, although limited to the student sample at one university, point to the possible benefits of introducing specific computer software integration techniques into mathematics methods courses at other teacher education institutions. In this study, demonstrating and utilizing specific computer integration techniques strengthened the experimental group's confidence in using computer hardware and software in their future classrooms. Schrum and Dehoney (1998) built a convincing argument for computer technology instruction in methods courses in their survey study. Methods course instructors used a variety of techniques that were applicable to their content area. The mathematics methods instructors used specific techniques that included spreadsheet software. Their results demonstrated that 90% or more of the survey respondents predicted that they would use spreadsheets and databases in their future classrooms.

Colleges of education often require preservice teachers to complete coursework in computer use and computer integration. The review of literature for this study demonstrates that some university professors do an adequate job of modeling computer integration in their classrooms. This study demonstrates the direct benefit of using specific computer software integration techniques on students' confidence in software integration. The preservice teachers in the experimental group internalized the novel treatment and thus felt prepared enough by that instruction to boost their confidence.

The results of the data analysis revealed, through the inferential statistics run on the Lesson Plan Technology Infusion/Integration Scale posttest, that there was no statistical significance between treatment groups ($p = .135$). Therefore, Hypothesis 3 was rejected, and Null Hypothesis 3 was sustained. Preservice elementary teachers who received mathematics methods instruction with computer integration techniques did not generate lesson plans in their student teaching internship experience that scored higher on a Lesson Plan Technology Infusion/Integration Scale than preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques. There was no statistically significant difference in scores on a Lesson Plan Technology Infusion/Integration Scale between preservice elementary teachers who received mathematics methods instruction with computer integration techniques versus preservice elementary teachers who received traditional mathematics methods instruction without computer integration techniques.

There were several uncontrollable variables at work that may help to explain the results on the Lesson Plan Technology Infusion/Integration Scale posttest. One factor was the availability of a minimal number of computers (i.e. one) in half of the classrooms in which the participants were teaching and the non-availability of computers in the other half of the classrooms occupied by participants. This factor certainly could have contributed to the student teachers' reluctance to plan for computer software integration. This reluctance was possibly enhanced further by their mentor teacher's inability to demonstrate computer integration techniques. This possibility could have existed easily. Most preservice teachers do not use technology in their field experience and do not work with teachers who can advise them on its use (Milken Exchange, 1999). Also, the collection of lesson plans was at random. This leaves the author with a question as to which lesson plans were sent (or not sent) that might (or might not) have indicated some form of software integration.

At first glance, the difference in the control group mean (1.67) and the experimental group mean (13.33) on the LPTIS posttest seemed to be a real difference, but it was not statistically significant. Without statistical significance, these apparent differences in group mean differences are impossible to interpret as a real difference. They may have arisen by chance. These data likely reflected no statistical difference because of the low number of participants. There were three participants from the control group and three participants from the experimental group. There was one remarkable statistic revealed in the analysis and that was Cohen's d, which was 4.035. This statistic records a greater than four standard deviation difference in the mean scores between the two groups. This suggests that even though there was no statistically significant difference between means, the mean score differences were very different in terms of standard deviation. The reality of the specific data is much more simplistic. The three students in the control group scored 0, 0, and 5 out of a possible 60 points on the LPTIS scale. The student teacher who scored 5 points recorded this in the category indicating teacher directed integration techniques. This category could record points for a wide variety of technology integration plans. The three students in the experimental group scored 5, 10, and 25 out of a possible 60 points on the LPTIS scale. These students scored all but 10 points in these three rubrics in the category scoring student lead usage of software. Even though this may not have recorded use of spreadsheet or database usage the student teachers were exhibiting some skill in technology integration techniques by allowing the students to constructively direct their own learning. Although the experimental group appears to have a much larger mean score, they also have a much larger standard deviation (10.41). The reason for this is that one experimental group student scored significantly higher than the other two experimental group students on the LPTIS scale, thus impacting the standard deviation. Whereas the control group students show virtually no evidence of lesson plan technology infusion/integration, the experimental group students at least show some evidence of lesson plan technology infusion/integration, with one experimental group student performing well above all other students – experimental or control. Again, this is an insufficient amount of data from which to draw a conclusion with any certainty.

The implications of these results may reach beyond the direct control of any college of education. Perhaps schools used in the professional development of preservice teachers should be supported in such a way as to provide the tools for mentor teachers and preservice teachers to use technology in a way that will insure success for students and teachers alike. But, is this level of support feasible? Let us assume that it could be achieved. If preservice teachers have a high level of self-efficacy, a high degree of confidence with the software, and a technology-rich environment (such as laptop computers in the hands of all children) in which to student teach, one wonders whether these preservice teachers would be more likely to plan and use the software.

If this is not feasible, then colleges of education should pay more attention to instructing preservice teachers on the use of computer integration techniques in a classroom with limited numbers of computers (i.e. 1-3) and/or the use of computer integration techniques in school computer labs. More time should be spent in methods classes on preparing preservice teachers to use computer labs as a viable resource. Typical computer lab time is spent with a computer lab instructor teaching a separate (or, at least, parallel) curriculum from the classroom teacher. Preservice teachers should be taught how to make better use of this time. They should be instructed in collaborative planning techniques so that they can engage in team planning with colleagues, including other teachers at their grade level and the school's computer lab instructor. If planned correctly, time in the computer lab could be utilized for hands-on integration of software with the day-to-day content and skills taught by the regular classroom teacher. In order to make this a reality, the preservice teacher must be prepared to take the initiative. Using guided discussion and other appropriate strategies, methods courses should instruct preservice teachers on how to cooperatively schedule and plan lessons with the computer lab instructor that successfully coordinate computer lab activities with classroom activities.

The preservice teachers in their semester of student teaching might also benefit from being closely monitored for their computer technology integration techniques. Intervention by a university supervisor that necessitated the use of the computer integration techniques they had previously studied might better insure their usage in the student teaching semester. The desired results may not happen automatically; there may need to be monitoring by the university and by knowledgeable on-site mentors in the classroom.

Conclusions

This study provides evidence that when preservice teachers are given instruction in specific computer software integration techniques, they are more confident. In this study, demonstrating and utilizing specific computer integration techniques strengthened the experimental group's confidence in using computer software in their future classrooms. The novel treatment with the experimental group had the desired effect, with significant results in terms of software integration confidence. The results of the data analysis also revealed, through the inferential statistics run on the Lesson Plan Technology Infusion/Integration Scale (LPTIS) posttest, that there was no statistical significance between treatment groups on their actual use of technology integration during student teaching. This lack of statistical significance may reflect the low number of participants/subjects in this data subset. The results of the study imply that the level to which software integration confidence is transformed into actual use may be variable and dependent on many factors. These factors may include the integration confidence level of the mentor teacher, the presence/absence of instruction on cooperative planning (between computer lab instructors and regular classroom teachers), the presence/absence of instruction on the efficient/integrative use of limited computer resources (e.g. a low number of computers in the regular classroom and limited access and/or time in a school computer lab), and other factors.

The intended purpose of this study was fulfilled. The study provides insight into the benefits of specific software integration techniques instruction. If we want preservice teachers to use computer integration strategies with their students, we must provide them with adequate preparation. In this study, some of the steps were in place to actualize this preparation, but more work is needed. Hopefully, the ultimate winners in this process will be the children in these teachers' classrooms. They will begin their journey of preparation to enter a technological world. Preservice teachers cannot be expected to have these abilities without the proper background and instruction in integration strategies.

Recommendations for Further Research

The data analysis in this study suggests several items in need of additional research, as follows:

1. Further research is recommended in computer integration techniques in mathematics, social studies, science, and reading methods courses.
2. Further research should consider ways to enlarge the sample of study and look at specific computer software integration strategies and confidence levels.
3. A meta-analysis of multiple studies related to the integration of software into methods coursework should be considered.

4. Further research should be considered to track preservice teachers into their career and assess the level of use that they demonstrate in their classrooms.
5. Research important to the global aspects of computer integration should also include studies on novel treatments involving in-service teacher staff development.
6. Future research should measure the willingness of preservice teachers to transfer their technology integration confidence into classroom use in their student teaching within field settings richly supported with computer technology

APPENDICES

APPENDIX A

Demographic Data and Previous Context Use of the Computer Survey

DEMOGRAPHIC DATA AND PREVIOUS CONTEXT USE OF THE COMPUTER

SURVEY

Please fill in the blank or circle the choice that best answers the following questions.

1. Year in school (i.e. 1 = freshman) 1 2 3 4 Grad

2. Female _______ Male ______

3. Age: __________

4. Ethnic origin: Caucasian ___________, African American _______, Hispanic ________

Native American ________, Asian ___________.

5. What is your major? ________________________________

6. How many college-level computer-related courses have you completed? __________

7. In what year did you first work with a computer? ________

8. Where did this first experience with a computer take place? (select only one)

______Elementary school
______Middle school
______High School
______College
______Your home
______Friends home
______Work
______Museum
______Library
______Other

9. How many different teachers have you had who used computer technology in their teaching?

K-12 _____________, College _______________

10. How have you learned the most about computers? (select only one)

______ K-12 schools
______ Courses in college

______ At work
______ Self-taught
______ Spouse and/or friend
______ Conferences
______ Courses offered over network
______ Computer support person

CURRENT CONTEXT OF COMPUTER USE

11. Do you own a computer? (circle one) Yes No

If yes, how old is it? ___________

12. How many hours a week, on average, do you use a computer in the following places?

Home _________

Work _________

Computer Lab _______

In a school __________

Other site (please list) ______ (Hours) _________

13. Rate the following applications by their frequency of use. (1 = most often, 2 = next most often, down to 5 = least often)

______e-mail ______Web browser ______word processing

______spreadsheet ______games

14. Are you currently subscribed to any E-mail discussion lists? Yes No

15. Do you have your own Web page? Yes No

16. How difficult is it for you to get access to computers or software for your coursework? (circle one)

Very Difficult				Very Easy
1	2	3	4	5

APPENDIX B

SELF-EFFICACY WITH COMPUTER TECHNOLOGIES

SELF-EFFICACY WITH COMPUTER TECHNOLOGIES

After reading each statement, please indicate the extent to which you agree or disagree, by circling the number to the right of each sentence. Please respond to all statements, even if you have not had a great amount of experience with a particular type of instructional computer technology.

Your responses should reflect your current level of appraisal with the activity described in each statement. For example:

I feel confident…	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
Ex. Formatting a computer diskette	1	2	3	4	5

By circling number 4 you indicate that you have some confidence in your ability to format a computer disk.

Computer skills

I feel confident

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. Working on a personal computer	1	2	3	4	5
2. Getting the software up and running	1	2	3	4	5
3. Using the user's guide when help is needed	1	2	3	4	5
4. Exiting a program	1	2	3	4	5
5. Understanding terms relating to the computer hardware	1	2	3	4	5
6. Understanding terms relating to the computer software	1	2	3	4	5
7. Handling a floppy disk properly	1	2	3	4	5
8. Learning to use a variety of programs	1	2	3	4	5
9. Learning advanced skills with software	1	2	3	4	5
10. Making selections from a menu	1	2	3	4	5
11. Using the computer to analyze number data	1	2	3	4	5
12. Using a printer to produce a hard copy	1	2	3	4	5
13. Copying a disk	1	2	3	4	5
14. Copying an individual file	1	2	3	4	5
15. Adding or deleting information from a file	1	2	3	4	5

	Strongly Strongly Disagree	Disagree	Uncertain	Agree	Agree
16. Moving the cursor around the screen	1	2	3	4	5
17. Describing the function of the computer hardware (keyboard, monitor, CPU)	1	2	3	4	5
18. Getting help for problems with the computer	1	2	3	4	5
19. Storing software disks properly	1	2	3	4	5
20. Explaining why a software program will/will not run on a computer	1	2	3	4	5
21. Using the computer to organize information	1	2	3	4	5
22. Deleting files no longer needed	1	2	3	4	5
23. Organizing and managing files	1	2	3	4	5
24. Troubleshooting computer problems	1	2	3	4	5

Word Processing
I feel confident…

25. Using a word processing program to write a letter or a report	1	2	3	4	5
26. Accessing saved files with a word processing program	1	2	3	4	5
27. Making corrections while word processing	1	2	3	4	5
28. Formatting text (bold, underline)	1	2	3	4	5
29. Moving blocks of text while word processing	1	2	3	4	5
30. Using spell check	1	2	3	4	5
31. Using the search/replace feature in word processing	1	2	3	4	5
32. Printing files I've written in word processing	1	2	3	4	5
33. Saving documents I've written in word processing	1	2	3	4	5
34. Renaming a word processing file	1	2	3	4	5

World Wide Web
I feel confident…

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
35. Finding information I need on the World Wide Web	1	2	3	4	5
36. Using the information I obtain on the world wide web	1	2	3	4	5
37. Accessing information within a website	1	2	3	4	5
38. Copying information from a website to another location	1	2	3	4	5
39. Saving information off a website	1	2	3	4	5
40. Moving the cursor around websites	1	2	3	4	5
41. Searching for information on a website	1	2	3	4	5
42. Getting to a specific site on the WWW	1	2	3	4	5
43. Using the World Wide Web as well as other sources of information	1	2	3	4	5

Presentation Programs
I feel confident…

44. Creating a slide presentation	1	2	3	4	5
45. Saving, closing, and opening presentations	1	2	3	4	5
46. Editing a presentation	1	2	3	4	5
47. Adding pictures, sounds, and video	1	2	3	4	5
48. Working with presentation colors and backgrounds	1	2	3	4	5
49. Rearranging a presentation	1	2	3	4	5
50. Printing a presentation	1	2	3	4	5

APPENDIX C

Preservice Teacher Software Integration Confidence Scale

PRESERVICE TEACHER SOFTWARE INTEGRATION CONFIDENCE SCALE

After reading each statement, please indicate the extent to which you agree or disagree by circling the number to the right of each sentence. Please respond to all statements. Your responses should reflect your current level of appraisal with the activity described in each statement. For example:

I feel confident instructing students with…	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
Ex. Student-generated PowerPoint presentations	1	2	3	4	5

By circling number 4 you indicate that you have some confidence in your ability to integrate this technology into your lessons with students.

Spreadsheet Integration Confidence

I feel confident integrating into my mathematics instruction…

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. Lessons that require students to use spreadsheet software to graph math problem solutions.	1	2	3	4	5
2. Lessons that ask students to use spreadsheet software as they problem-solve math problems.	1	2	3	4	5
3. Student-directed organization, construction, and merging of spreadsheet files.	1	2	3	4	5
4. Lessons that require students to use spreadsheet software to calculate formula math information.	1	2	3	4	5

Database Integration Confidence

I feel confident integrating into my mathematics instruction…

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
5. Lessons that require students to use database software to organize data.	1	2	3	4	5
6. Lessons that ask students to use database software to organize financial records.	1	2	3	4	5
7. Student use of database software to analyze data.	1	2	3	4	5
8. Student-directed use of database software to organize a directory of information.	1	2	3	4	5
9. Student-directed merging of data from a spreadsheet software file into a database software file.	1	2	3	4	5
10. Student-directed creating of database Fields	1	2	3	4	5

APPENDIX D

Lesson Plan Technology Infusion/Integration Scale

LESSON PLAN TECHNOLOGY INFUSION/INTEGRATION SCALE

Assign to each area a designation of the rubric to represent the absence or inclusion of the items described.

	Absent	Present
TEACHER DIRECTED INTEGRATION OF TECHNOLOGY		
STUDENT LEAD USAGE OF SOFTWARE IN THE LESSON PLAN		
SPREADSHEET SOFTWARE USE IN THE LESSON PLAN		
DATABASE SOFTWARE USE IN THE LESSON PLAN		
TOTAL		

Absent in plans shall be indicated with “0”

Present in plans shall be indicated with “5”

APPENDIX E

Experimental Group Course Syllabus

EXPERIMENTAL GROUP COURSE SYLLABUS

EDEE 4350
Mathematics For The Elementary School
Teacher Education and Administration

Bob Maninger

Class Meets NWISD – Thursdays 12:00 – 2:50

Texts
Kennedy, L. & Tipps, S. (2000). *Guiding children's learning of mathematics.* 9th Edition. Boston: Wadsworth Publishing.

www.sbec.state.tx.us
http://www.tea.state.tx.us

Course Description
The purpose of this course is to provide knowledge and skills in elementary mathematics instructional methodology and to provide a context for understanding, through an examination of the national standards in mathematics and TEKS.

Course Requirements and the Final Course Grade
The instructor reserves the right to change course assignments, projects, and examinations throughout the semester. Each assignment/project must be completed and turned in by the due date given. If you are absent on a due date, the assignment/project must be turned in on the day you return to class. Late assignments will be subject to a point reduction or non-acceptance at the instructor's discretion. Class attendance and participation will be considered in assigning the final course grade (3 absences = drop 1 letter grade, 4 or more = F for the course). It is expected that all assignments, projects, and examinations will be completed at the mastery level (as designated by the instructor). If in the opinion of the instructor an assignment/project is not satisfactory it may be returned to the student and the student may be required to re-do the work until it is an acceptable level of mastery. If any work is not completed at the mastery level by the end of the course the instructor reserves the right to give the student an "I" or and "F" at his discretion.

ADA Policy on Auxiliary Aids and Reasonable Accommodation
The College of Education does not discriminate on the basis of disability in the recruitment and employment of faculty and staff, and the operation of any of its programs and activities, as specified by federal laws and regulations. Copies of the College of Education ADA Compliance Document are available from Dr. XXX the ADA liaison for TE.

Policy on Cheating and Plagiarism
The Code of Student Conduct and Discipline provides penalties for misconduct by students, including academic dishonesty. Academic dishonesty includes cheating and plagiarism. The term “cheating” includes, but is not limited to, (1) use of any unauthorized assistance in taking quizzes, tests, or examinations; (2) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; or (3) the acquisition without permission, of tests, or other academic material belonging to a faculty or staff member of the university. The term “plagiarism” includes, but is not limited to the use by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. If you engage in academic dishonesty related to this class you will receive a failing grade on the test or assignment and a failing grade in the course. In addition, the case will be referred to the Dean of Students for appropriate disciplinary action.

Course Requirements

1. Carefully read the required text and any required supplementary materials. Be prepared prior to class for in-class discussion of readings.

2. Mathematics Notebook – 60% of final grade. Half presented October 10. Final and total project presented the week before finals (Dec 5). Instructor will provide further instructions.

3. Internet Lesson Plan / e-mail – 10% of final grade. Using a designed step-by-step guide you will search out math lesson plans on the Internet and email results to me. (Sept 5)

4. PowerPoint Presentation of Textbook Analysis – 30% of final grade. Small group project to present to the class your combined evaluation of a current math textbook. More specifics from the instructor. (Nov 21/Dec 5)

The course grade will be based on class attendance and participation, and assigned activities. The course grade is based on your percentage of the total possible points. To receive maximum points on assignments, please consider maximum to be the equivalent of the grade of A+, which means exceptional work. Simply meeting minimal requirements will equate to a B or C grade.

Grading scale: 90-100%= A, 80-89%= B, 70-79%= C.

Attendance Policy
Students are expected to be in attendance for all class meetings and practicum days. Late papers will be accepted only under extreme circumstances. Each late assignment will receive a reduction in points of 20% per each class day late. Exams may be taken late only in extreme circumstances. Please consider yourselves professionals and act accordingly. Absence and tardiness will be considered in the final calculation of the

course grade. This course syllabus is not a contract and may be altered at the discretion of the instructor. Students will be given reasonable notice of any changes.

SCHEDULE OF EVENTS

This schedule is a framework and will likely change

WEEK	CLASS ACTIVITIES	ITEMS DUE
Aug 29	Course Overview	
Sep 5	Standards (Ch1)	Internet Plan
Sep 12	Problem Solving (Ch2)	
Sep 19	Numbers, Place Value (Ch6)	
Sep 26	Addition / Subtraction (Ch7)	
Oct 3	Multiplication / Division (Ch8)	
Oct 10	Geometry (Ch9)	First ½ Notebook
Oct 17	Fractions !!! (Ch10)	
Oct 24	TCET PRESENTATIONS	
Oct 31	TCET PRESENTATIONS	
Nov 7	Ratio, Percentage, and proportion (Ch11)	
Nov 14	Measurements (Ch12)	
Nov 21	Data Collection (Ch13)	PPT Presentations
Nov 28	NO CLASS – THANKSGIVING BREAK	
Dec 5		PPT Presentations
Dec 12	Notebooks Presented During Class	

MATHEMATICS NOTEBOOK

The notebook serves as a comprehensive demonstration of your progress in teaching mathematics. It will contain a variety of evidence and examples of your knowledge and implementation of mathematics strategies tied to TEKS and NCTM. The first five sections will be due ***October 10.*** The completed notebook, all ten sections will be due ***December 5.***

The notebook should be organized in the following sections:

I. Standards
II. Problem Solving
III. Numbers, Place Value
IV. Addition / Subtraction
V. Multiplication / Subtraction
VI. Geometry
VII. Fractions
VIII. Ratio, Percentage, Proportion
IX. Measurement
X. Data Collection

Each of the TEN SECTIONS should include:

I. Chapter Summary
II. Class notes, activities, and any handouts
III. Article critique
IV. Planned Lesson with technology integration of some kind
V. Reflection of the week of class

Explanations

Chapter Summary – summarize each textbook chapter as follows:

- Identify five (5) new ideas unfamiliar to yourself – complete sentences
- Identify three (3) key concepts covered – complete sentences
- Align ten (10) activities in the chapter (blue boxes) with TEKS (activity #, grade level, TEKS identification)

Article Critique

Research an article about the subject matter in the chapter. No more than two (2) pages, one page of explanation of the article including the author's main ideas and one page of personal reflection. Use APA style to document references. Include a copy of the article.

Lesson Plans

Must include: Objectives, activities (including a brief description of the entire lesson), list of materials, and TEKS.

PowerPoint Presentation of Textbook Analysis

A mathematics textbook teacher edition will be studied, analyzed, assessed, and reported for recommendation or non-recommendation using the guidelines below. There will be some group work allowed to discuss and bounce around ideas, but EACH STUDENT WILL prepare a 5 – 7 minute PowerPoint presentation to report the final analysis.

The analysis must include all of the items listed below, obviously in your PPT presentation you will need to combine appropriate topics on single slides. The PPT should be about 5 – 10 slides. Does the selected text comply with current NCTM standards? Why or why not? Make a recommendation for or against the textbook based on the criteria. The final report is a "pretend" report to a school district committee that is making textbook recommendations to the local school board. These reports will be done beginning November 21 unless otherwise decided by the instructor. You need to provide the instructor with a "handouts (6 slides per page)" copy of the PowerPoint and any other pertinent information.

COMPONENTS

Find the following components and determine the level of inclusion of each component.

- NCTM Principles and Standards for School Mathematics
- TEKS
- TAAS / Standardized testing formatted activities
- Problem Solving Strategies
- Rote Learning / Worksheets
- Assessment Instruments
- Interdisciplinary Connections
- Use of manipulatives – which ones and how often
- Alternative approaches to instruction (ESL, GT, SPED)
- Hands-on learning opportunities for learners
- Teacher supplemental materials
- Technology Integration

APPENDIX F

Control Group Course Syllabus

CONTROL GROUP COURSE SYLLABUS

EDEE 4350
Mathematics For The Elementary School
Teacher Education and Administration

Bob Maninger

Class Meets CES – Wednesdays 12:30 – 3:20

Texts
Kennedy, L. & Tipps, S. (2000). *Guiding children's learning of mathematics.* 9th Edition. Boston: Wadsworth Publishing.

www.sbec.state.tx.us
http://www.tea.state.tx.us

Course Description
The purpose of this course is to provide knowledge and skills in elementary mathematics instructional methodology and to provide a context for understanding, through an examination of the national standards in mathematics and TEKS.

Course Requirements and the Final Course Grade
The instructor reserves the right to change course assignments, projects, and examinations throughout the semester. Each assignment/project must be completed and turned in by the due date given. If you are absent on a due date, the assignment/project must be turned in on the day you return to class. Late assignments will be subject to a point reduction or non-acceptance at the instructor's discretion. Class attendance and participation will be considered in assigning the final course grade (3 absences = drop 1 letter grade, 4 or more = F for the course). It is expected that all assignments, projects, and examinations will be completed at the mastery level (as designated by the instructor). If in the opinion of the instructor an assignment/project is not satisfactory it may be returned to the student and the student may be required to re-do the work until it is an acceptable level of mastery. If any work is not completed at the mastery level by the end of the course the instructor reserves the right to give the student an "I" or and "F" at his discretion.

ADA Policy on Auxiliary Aids and Reasonable Accommodation
The College of Education does not discriminate on the basis of disability in the recruitment and employment of faculty and staff, and the operation of any of its programs and activities, as specified by federal laws and regulations. Copies of the College of Education ADA Compliance Document are available from Dr. XXXX the ADA liaison for TE.

Policy on Cheating and Plagiarism
The Code of Student Conduct and Discipline provides penalties for misconduct by students, including academic dishonesty. Academic dishonesty includes cheating and plagiarism. The term "cheating" includes, but is not limited to, (1) use of any unauthorized assistance in taking quizzes, tests, or examinations; (2) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; or (3) the acquisition without permission, of tests, or other academic material belonging to a faculty or staff member of the university. The term "plagiarism" includes, but is not limited to the use by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. If you engage in academic dishonesty related to this class you will receive a failing grade on the test or assignment and a failing grade in the course. In addition, the case will be referred to the Dean of Students for appropriate disciplinary action.

Course Requirements

5. Carefully read the required text and any required supplementary materials. Be prepared prior to class for in-class discussion of readings.

6. Mathematics Notebook – 60% of final grade. Half presented October 10. Final and total project presented the week before finals (Dec 5). Instructor will provide further instructions.

7. Tutoring Project – 15% of final grade. Requirements submitted by instructor. Due Nov 21.

8. Textbook Analysis – 25% of final grade. Small group project to qualify a final individual report. Specifics from the instructor. (Due Nov 21/Dec 5)

The course grade will be based on class attendance and participation, and assigned activities. The course grade is based on your percentage of the total possible points. To receive maximum points on assignments, please consider maximum to be the equivalent of the grade of A+, which means exceptional work. Simply meeting minimal requirements will equate to a B or C grade.

Grading scale: 90-100%= A, 80-89%= B, 70-79%= C.

Attendance Policy
Students are expected to be in attendance for all class meetings and practicum days. Late papers will be accepted only under extreme circumstances. Each late assignment will receive a reduction in points of 20% per each class day late. Exams may be taken late only in extreme circumstances. Please consider yourselves professionals and act accordingly. Absence and tardiness will be considered in the final calculation of the course grade.

This course syllabus is not a contract and may be altered at the discretion of the instructor. Students will be given reasonable notice of any changes.

SCHEDULE OF EVENTS

This schedule is a framework and will likely change

WEEK	CLASS ACTIVITIES	ITEMS DUE
Aug 28	Course Overview	
Sep 4	Standards (Ch1)	
Sep 11	Problem Solving (Ch2)	
Sep 18	Numbers, Place Value (Ch6)	
Sep 25	Addition / Subtraction (Ch7)	
Oct 2	Multiplication / Division (Ch8)	
Oct 9	Geometry (Ch9)	First ½ Notebook
Oct 16	Fractions !!! (Ch10)	
Oct 23	Teaching and Learning Mathematics (if time)	
Oct 30	NO CLASS (Individual time to work on projects)	
Nov 6	Ratio, Percentage, and proportion (Ch11)	
Nov 13	Measurements (Ch12)	
Nov 20	Data Collection (Ch13)	Tutoring Project
Nov 27	NO CLASS – THANKSGIVING BREAK	
Dec 4	Notebooks Presented During Class…	Textbook Analysis
Dec 11	Notebooks Presented During Class…	

MATHEMATICS NOTEBOOK

The notebook serves as a comprehensive demonstration of your progress in teaching mathematics. It will contain a variety of evidence and examples of your knowledge and implementation of mathematics strategies tied to TEKS and NCTM. The first five sections will be due ***October 10.*** The completed notebook, all ten sections will be due ***December 5.***

The notebook should be organized in the following sections:

XI. Standards
XII. Problem Solving
XIII. Numbers, Place Value
XIV. Addition / Subtraction
XV. Multiplication / Subtraction
XVI. Geometry
XVII. Fractions
XVIII. Ratio, Percentage, Proportion
XIX. Measurement
XX. Data Collection

Each of the TEN SECTIONS should include:

VI. Chapter Summary
VII. Class notes, activities, and any handouts
VIII. Article critique
IX. Planned Lesson with activities
X. Reflection of the week of class

Explanations

Chapter Summary – summarize each textbook chapter as follows:

- Identify five (5) new ideas unfamiliar to yourself – complete sentences
- Identify three (3) key concepts covered – complete sentences
- Align ten (10) activities in the chapter (blue boxes) with TEKS (activity #, grade level, TEKS identification)

Article Critique

Research an article about the subject matter in the chapter. No more than two (2) pages, one page of explanation of the article including the author's main ideas and one page of personal reflection. Use APA style to document references. Include a copy of the article.

Lesson Plans

Must include: Objectives, activities (including a brief description of the entire lesson), list of materials, and TEKS.

Textbook Analysis

A mathematics textbook teacher edition will be studied, analyzed, assessed, and reported for recommendation or non-recommendation using the guidelines below. There will be some group work allowed to discuss and bounce around ideas, but EACH STUDENT WILL prepare a single report on a single textbook.

The analysis must include all of the items listed below. Does the selected text comply with current NCTM standards? Why or why not? Make a recommendation for or against the textbook based on the criteria. The final report is a “pretend” report to a school district committee that is making textbook recommendations to the local school board. These reports will be due December 5 unless otherwise decided by the instructor.

COMPONENTS

Find the following components and determine the level of inclusion of each component.

- NCTM Principles and Standards for School Mathematics
- TEKS
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- Alternative approaches to instruction (ESL, GT, SPED)
- Hands-on learning opportunities for learners
- Teacher supplemental materials
- Technology Integration

TUTORING PROJECT

You will need to find a student in need of mathematics support. This project will require you to spend at least 10+ hours with at least 1+ student(s). Tutoring may take place in an official school setting, or may take place informally elsewhere. You will report on what you do to improve the student's mathematical knowledge, skill, and attitude. The reporting document should include a time log, reflection on experiences (limit 2 pages), planning, assessment, student work samples, and anything else pertinent to the time you spend together. This is not a time for drill and skill, but a time to improve a students overall performance and attitude towards mathematics. This project will be due November 20**.**

Criteria for Success

	Not spresent			Excellent
Project demonstrates development of effective teaching and assessment techniques representing TEKS and NCTM and program goals.	1	2	3	4
Demonstration of organization / management techniques and attention to individualism and specific student needs.	1	2	3	4
Project reflections demonstrate student growth in learning	1	2	3	4
Project reflections demonstrates understanding ways to motivate and challenges the student	1	2	3	4
Demonstration of a variety of instructional activities	1	2	3	4

APPENDIX G

Technology Leadership Institute Agenda

TECHNOLOGY LEADERSHIP INSTITUTE

SPREADSHEET AND DATABASE AGENDA

October 24 and 31, 2001

Linda Hodges, Ed. D.

October 24

- Introductions
- Demonstration of key functions of spreadsheet software
- Preservice teachers to the computer lab for hands-on activities
- Demonstration of one-computer classroom activity in regular classroom
- Wrap up discussion and questions on spreadsheet software

October 31

- Demonstration of key functions of database software
- Demonstrate model database
- Preservice teachers to the computer lab for hands-on activities
- Wrap up discussion and questions on database software

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