PERCEPTIONS OF PRESERVICE EDUCATORS, INSERVICE EDUCATORS, AND PROFESSIONAL DEVELOPMENT PERSONNEL REGARDING EFFECTIVE METHODS FOR LEARNING TECHNOLOGY INTEGRATION SKILLS

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INTRODUCTION

Background

The demands of our technological society have drastically changed the focus of the kindergarten through 12^{th}-grade (K-12) curriculum. Schools must prepare students for the technology-abundant jobs in the 21^{st} century. According to Collis et al. (1996), students need to be technology literate in order to excel in future jobs and to be productive citizens. In addition, educators should use technology to boost instruction and thus enhance learning by students.

In the new millennium, the increase of the importance of learning technology is evident in public schools. Never before have students had access to so many different types of technological tools. In 1997, the Educational Testing Service (ETS) reported that 98% of United States schools had computers, and 64% were connected to the Internet. In addition, local area networks, satellite technology, videodiscs, and cable TV access were listed. By 2001, the National Center for Education Statistics (2002) reported that 99% of United States schools had computers, and 99% were connected to the Internet. The increase from 1997 to 2001 of computer hardware and Internet connections demonstrates the continued support for providing technology for students.

Recent federal and state legislation make it clear that the government feels strongly about integrating technology into the public schools. The Goals 2000: Educate America Act issued funds for technology planning on both the federal and state levels

(US Congress, 1994). In 1996, the government announced a goal to provide educators with training and support so that students would be properly prepared for a technological world (ETS, 1997). The most recent government proposal involves using technology-literate educators to train other educators in how to use technology. This project is coined the 21st Century Teacher Program. Other programs providing assistance in the utilization of technology include America's Technology Literacy Challenge and "Tech Corps" (ETS, 1997). Recently, the International Society for Technology in Education (ISTE) published the first National Educational Technology Standards for Teachers. This publication was funded partly by the United States Department of Education as part of the Preparing Tomorrow's Teachers to Use Technology (PT3) grant program (ISTE, 2000). The PT3 initiative provides grants to help teacher education departments prepare technology-proficient educators (Department of Education [DOE], 1999). Specifically, in Texas, the Technology Applications Texas Essential Knowledge and Skills (TA-TEKS) were adopted in 1998 (Texas Education Association [TEA], 2001). The TA-TEKS provide a comprehensive curriculum for the training and utilization of technology in Texas schools. In addition, educators are required to confirm technology competency on the Texas Examinations of Educator Standards exam (TEA, 2001).

Rationale for the Study

In 1999, educators reported that technology integration training, follow-up training, and advanced courses were the least available district-offered workshops (National Center for Education Statistics [NCES], 2001). The greatest number of courses included those in basic computer operation and use. Additional or more advanced training is often sought outside of the school district, but often at an educator's time and expense. In 1995, the Office of Technology Assessment (OTA) reported a 15% expenditure on educator technology training after a recommendation to spend 30%. In addition, the technology training that was being offered included topics regarding hardware and software, and was not specific to the integration process. Several researchers cite lack of valuable training as the main reason educators do not integrate technology into the curriculum (Kearsley & Lynch, 1992; OTA, 1995; Shermis, 1990; Stoddart & Neiderhauser, 1993). In fact, only 20% of United States' educators in 1999 felt "prepared" to use technology with classroom instruction (NCES, 2001). In addition, those 20% indicated the greatest amount of time spent in training workshops and were more likely to use technology in the classroom. Training educators to integrate technology is vital for the future success of students in a technologically driven society. Workshops need to move beyond basic computer skills courses and provide educators with actual curriculum integration training. More research is needed to understand how to successfully accomplish this task.

Significance of the Study

This study adds to the limited research regarding methods for training educators to use technology in the curriculum. Results indicate educator's perceived effectiveness of different methods for learning technology integration skills. The goal of this study was to provide data that may be used to create new alternatives for training current and future educators. Educator preparation programs, as well as school districts, will be able to use the data to reorganize and add valuable training resources to their current staff development design. This reorganization is needed so that educators are properly prepared to educate millennium students in a new-age classroom.

Theoretical Framework

The concept of self-directed learning was used as the underlying framework to analyze what preservice educators, inservice educators, and professional development personnel perceive to be the most effective method for learning technology integration skills. Self-directed learning is derived from Malcolm Knowles, who included the model in his world-renowned theory of Andragogy (Knowles, Holton, & Swanson, 1998). Knowles proposed that all adults eventually have the desire to be self-directed learners; thus, adults strive to be more involved with managing the learning process. In addition, the self-directed learning model states that the need for this independence increases with age and a person's experience. Experience refers to an interaction between a learner and the environment. In addition, according to Knowles et al., the personality variable of "locus of control" provides insight into a learner's preference for training environments. J. B. Rotter developed the most widely used instrument for measuring locus of control. Rotter (1966) measured locus of control on a continuum where an individual tends to be either internal (credits learning outcomes to oneself) or external (credits learning outcomes to the environment).

This study examined educators' preferences for learning technology integration skills. A survey was distributed to compare effective training methods while utilizing the concept of self-directed learning and the locus of control personality variable.

Purpose of Study

The purpose of this study was to determine the perceptions of preservice educators, inservice educators, and professional development personnel regarding effective methods for learning technology integration skills in order to provide the education community with justifiable data concerning the need for educator training alternatives.

Research Questions

This study focused on the following research questions:

1. Are there significant differences among preservice educators, inservice educators, and professional development personnel in the perceived effectiveness of different methods for learning technology integration skills?
2. Are there significant differences among preservice educators, inservice educators, and professional development personnel in how they rate the effectiveness of different methods for learning technology integration skills when categorized by age?
3. Are there significant differences among preservice educators, inservice educators, and professional development personnel in how they rate the effectiveness of different methods for learning technology integration skills when categorized by total hours of instruction?
4. Are there significant differences among preservice educators, inservice educators, and professional development personnel in how they rate the effectiveness of different methods for learning technology integration skills when categorized by locus of control?

Hypotheses to be Tested

The following null hypotheses were tested:

1. There is no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills. (Ratings

of 1-5, with 1 equal to *Not Effective* and 5 equal to *Very Effective* for each of the eight training methods).

2. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by age. (A fill-in prompt for the number of years since birth).
3. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction. (Number ranges of 0, 1-8, 9-20, 21-40 from the 1998 California Assessment Profile [$CTAP^2$], and the following number ranges extended; 41-80, 81-160, 161-300, and more than 300).
4. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external). (Rating of 1-23 as specified in the instrumentation section [Rotter, 1966]).

Limitations of the Study

This study focused on preservice educators at the University of North Texas, inservice educators currently working in the school districts of Allen, Coppell, and Frisco in the state of Texas, and former Allen Independent School District professional development personnel. Because all subjects were not randomly selected, the findings may not be generalized to the entire preservice, inservice, and professional development personnel population. In addition, given that all of the groups are in the northern region of the state of Texas, the results may not be generalized to other Texas regions or other states of different size and/or educational technology emphasis.

Definition of Terms

Inservice Educators

Currently practicing K-12 educators.

Locus of Control

An individual's belief about what causes certain outcomes.

Preservice Educators

Students enrolled in a higher education educator preparation program.

Professional Development Personnel

For this study, professionals formerly employed by the Allen Independent School District to help educators with curriculum, instruction, and integration of technology.

School Districts

A collection of institutions, marked out by law, for the purpose of instruction and learning.

Self-directed Learning

Self-governing one's own learning experience.

Staff Development

Periodic days of instruction/training for currently practicing educators.

Teacher Training

Various types of training for currently practicing educators.

Technology Integration

Using technologies within various subject areas.

Technology Integration Skills

The act of using technology to further enhance the current curriculum.

Technology Integration Training

Instruction on how to implement technology use within subject areas.

CHAPTER 2

LITERATURE REVIEW

Introduction

As technology becomes more abundant in schools, many authors feel it is imperative that educators are properly prepared to use this valuable resource. A reoccurring theme in the literature is the lack of valuable training for both current and future educators. Preparing preservice educators is in the hands of colleges and universities. Certification programs have the task of instilling technology competencies into undergraduate degree plans. This entails teaching not only the basics of computer operation, but also how to effectively integrate technology into the curriculum. School districts need to provide the introductory training for current educators, in addition to flexible and continuous training to keep employees abreast of technological change. Brand (1998) provided the following rationale: "If students are going to be prepared for a technological society, they must be taught by confident and skilled teachers. This can only be done by adequate training and development of teachers" (p.13). Everyone defines adequate training differently. One educator who learns well from a colleague may not feel as confident learning from printed documentation. Therefore, the purpose of this study is to determine what preservice educators, inservice educators, and professional development personnel perceive to be the optimal method(s) for learning technology integration skills. This chapter contains the following main sections: technology integration, training, age and training, training hours, locus of control and training, preservice practices, inservice innovations, professional development personnel, validity critique, and summary.

Technology Integration

The use of technology in education has many benefits for students. According to Roblyer and Edwards (2000), five reasons to use technology in education are:

1. Motivation
2. Unique instructional capabilities
3. Support for new instructional techniques
4. Increased teacher productivity
5. Required skills for an information age

Technology has long attracted the attention of students. Technology assists students with retaining attention and thus more time is spent in the classroom on learning (Summers, 1990). Through technology, teachers are offered a wealth of tools for expanding instructional strategies and increasing productivity. Thus, successful integration of technology improves both teaching and learning.

The integration of technology into the curriculum is defined for this study as "using technology effectively and efficiently in the general content areas to allow students to learn how to apply technical skills in meaningful ways" (Dockstader, 1999, p.73). Technology integration is not solely teaching about computers or teaching how to use a software program. True technology integration involves a connection with the subject matter and relevance to the curriculum. To reach this goal, the curriculum and educational objectives are examined first, and then the technology is added to enrich the lessons (Guhlin, 1996). In order to prepare students to be life-long learners in an informational and technological society, learning should take place through the use of technology. To accomplish this goal, educators need specific training in the integration of technology. “Helping teachers use technology may be the most important task for helping students use technology effectively for learning” (OTA, 1995).

Technology Training

The National Education Association (1997-1998) reported that 50% of teachers in 1997 were not properly trained to use technology in the classroom. Still today, training is minimal due to money allotments. Less than 15% of a school district's budget is spent on technology, and most of this percentage is for purchasing hardware (OTA, 1995). In addition, most training provided for today’s educators highlights the basic operation of computers, not the integration of technology resources into the curriculum. If educators are expected to transfer their learning to the classroom, technology training should not be treated as a separate component (Roblyer & Edwards, 2000; Shelton & Jones, 1996). Basic computer operation may be needed with some educators at the beginning, but mostly, courses are needed on technology integration into the current curriculum. Educators need to see first-hand how technology can be used in various subject areas.

Learner preferences need to be considered for educators, as is done daily with students. Each educator should be treated as an individual when it comes to the format of training. All individuals differ in how they learn best. However, education typically does not offer a variety of personal options for teachers (Marczely, 1996). Few teachers are consulted on the types of training opportunities that are offered. Teachers should be involved in the planning of technology training to assure that needs are being met (Guhlin, 1996; Marczely, 1996).

Many school districts provide technology training that is convenient or money-conscience, not necessarily what the teachers want or need. Many authors have stated the need for training to be flexible in content and delivery (Browne & Ritchie, 1991; Harvey & Purnell, 1995; Stager, 1995). Providing a workshop may be the most popular training method, but these traditional one-shot workshops have proven ineffective in transferring skills to the classroom (Benson, 1997; Poole & Moran, 1998). Training needs to be long-term (e.g., follow-up training, yearly plans) and continuous to ensure educator accountability of technological change (Harvey & Purnell, 1995; Roblyer & Edwards, 2000; Shelton & Jones, 1996).

Age and Training

Many older adults are referred to as technophobes, who are afraid of anything that is high-tech in current society. However, older adults are the largest growing age group that is purchasing computers and acquiring Internet accounts. In 1998, an estimated 7.6 million Internet users were age 50 or older (Hansen, 1998). A study sponsored by SeniorNet documented that older adults spent an average of 12 hours a week using computers, compared to 9 and 7 hours used by college students and teenagers (Hansen, 1998).

A national study on older adults and computers in 1996 reported that 39% taught themselves how to use computers and 21% learned on the job (Adler, 1996). In addition, those who categorized themselves as beginners were more likely to have learned by taking a class. The experienced adults tended to educate themselves or learned at work (Adler, 1996).

Recent studies have also been conducted in the field of distance education and age. This new delivery method for administering courses has prompted many studies in order to establish baseline data on effectiveness. Instructors have collected data on several variables, including course format choice, dropout rates, and success in the course by different ages.

Cook (1997) compared choice of delivery mode and age for a communications course at Ontario Community College. Her findings indicated that the older students were more likely to choose the online version of the course. Students who chose the traditional classroom format tended to be between the ages of 20 and 22. After age 22, the choice in delivery for the face-to-face format decreased by 10% every 2 years.

Dille and Mezack (1991) surveyed 188 students enrolled in a one-way video course. These findings showed that the older students not only tended to choose the online format, but also performed better than the younger students.

A study by Czaja and Sharit (1993) studied performance of 65 women on computer-related tasks. The results showed an increase in errors directly related to age. However, the adults with computer experience (more hours of use) performed better.

Zandri and Charness (1989) performed training sessions to determine effective design for adult learners. Specifically, methods were studied on how to effectively train adults on various software packages. Findings yielded a need for a self-paced environment and for having learners complete course requirements with a partner. This current study adds to the existing literature by determining which types of training are preferred for varying ages of today's teachers.

Training Hours

Does the amount of technology integration hours have an impact on the preferred training method of educators? This study sought to answer this question.

The National Center for Education Statistics (1999) reported that 78% of teachers participated in at least 1 hour of technology integration training in 1998. This is a 27% increase since the 1993 survey. However, only 12% of these teachers felt that the training improved their classroom teaching “a lot” (NCES, 1999). Contradictorily, those teachers with more than 8 hours of technology integration training indicated a 38% belief that the activities were helpful. Thus, those teachers with more training hours indicated a more beneficial outcome. The report also stated that teachers with more hours of training felt better “prepared” to use computers and the Internet in the classroom (NCES, 1999). In addition, these teachers were more likely to assign students work involving the use of a computer. For example, teachers with more than 32 hours of training assigned problem-solving activities more than those teachers with no hours of training.

A study of four middle schools in Massachusetts showed that using technology takes hours of training to see results. Twenty-three case studies revealed a significant change in the teachers' use of technology in the classroom after 3 years of training (Persky, 1990). A 10-year study on technology integration, the Apple Computer Classrooms of Tomorrow (ACOT) project, provided training and continuous support to teachers. The study showed a significant change toward a technology-integrated classroom after 4 years of initial and follow-up training (Dwyer, 1994). Training is the reason for both “success and failure of integration” (Roblyer & Edwards, 2000, p. 33).

Locus of Control and Training

The concept of locus of control was derived from Julian Rotter's Social Learning Theory in the 1950s. Rotter developed this theory after extensive research on the success and failure of reinforcement (Spector, 1982). According to Rotter's theory (1966), an individual either credits learning outcomes to oneself (internals) or to the environment (externals). Internals have the belief that success or failure is due to personal efforts. Similarly, externals blame luck, chance, and the power of others (Mearns, 2000). People are classified along a continuum from very internal to very external. According to Mearns, classification is usually constant, but in certain situations people may act differently due to past experiences.

Research on Web-based instruction as well as distance learning reveals a successful student to have an internal locus of control. The Web-based classroom is traditionally more active and requires the student to be more self-directed (McCormack & Jones, 1998).

A study at Ontario Community College surveyed incoming freshman on course delivery preferences and compared the results with locus of control scores. Data revealed that internals tended to choose the online course design over the traditional face-to-face format (Cook, 1997). Dille and Mezack (1991) conducted a similar study with community college students, but compared locus of control with online course success. Results yielded not only that internals more successful at self-directed courses, but also that the more internal the student, the higher the letter grade in the class.

Parker (1999) studied dropout rates for distance education students for the Maricopa Community College District in Phoenix, Arizona. The locus of control score predicted the dropout rate of students with 80% accuracy. However, the internals completed the course whether it was delivered through audio, correspondence, or online media.

Preservice Practices

In 1997, the National Council for Accreditation of Teacher Education (NCATE) and the ISTE joined to revise the current standards for preservice teacher education. The new standards expect teachers to possess up-to-date technology skills, as well as be able to create lesson plans that incorporate technology into the curriculum (ISTE, 2000). In 1998 the Milken Exchange on Education Technology (1999) solicited ISTE to determine how colleges were training new teachers to use technology in the classroom. The results from over 90,000 graduates revealed that more training was needed, and modeled by faculty, on the actual integration of technology. In addition, future research was recommended on how students learn technology skills. These reports prompted increased attention and change in teacher education departments across the United States.

In 1998, thirty-eight states reported a technology requirement for preservice educators before graduation (Zehr, 1998). Specifically, North Carolina and Vermont insisted that all student teachers submit a technology portfolio during the last semester of classes. Zehr noted that an actual assessment on technology skills was and still is required in Idaho. The Virginia General Assembly (1999) passed House Bill 2263 which requires teachers as of July 1, 2003 to "demonstrate proficiency in the use of educational technology for instruction" in order to receive a license or renewal. Similar requirements already exist for current practicing teachers in Connecticut, New Hampshire, and North Carolina (Zehr, 1998). Many states demand that the preparation of teachers includes the use of technology. However, what is the best method for providing this much-needed skill?

In 1992, undergraduate agriculture students at Cornell University were surveyed regarding the best methods for learning technology skills. The top three methods selected were trial and error, credit classes, and peer support. Computer lab assistance received the lowest rating (Davis, 1999).

Meredith College surveyed undergraduate students in 1999. The freshmen indicated faculty assistance as the best method to acquire computer integration skills. On the other hand, sophomores, juniors, and seniors ranked trial and error and peer support as most effective. A follow-up study revealed consistent findings (S. Tiu, personal communication, December 6, 2000).

This study aids in determining the effective methods for training future educators on how to integrate technology into the curriculum.

Inservice Innovations

Several national initiatives target technology integration training for current educators. In 1998, The Intel Applying Computers in Education (ACE) Project trained over 3,300 inservice educators in technology integration. Over 95% of the participants reported learning new skills that would directly benefit students. Inservice educators who participated in the first year of training were surveyed nine months later. Eighty-four percent reported that using computers improved an educator's instruction, and 80% conveyed an enhancement in student learning (Intel Corporation, 1999).

Microsoft and Intel collaborated in 2000 to provide the Intel Teach to the Future program. This worldwide program provides integration training into existing curricula for inservice educators. It is estimated that over 400,000 inservice educators will be trained by the year 2003 (Intel Corporation, 2000). Intel's President, Craig Barrett, recently observed, "The scope of this program represents the industry's recognition that all the educational technology in classrooms today is worth nothing if teachers don't know how to use it effectively" (Intel Corporation, 2000).

Many innovative school districts are effectively training teachers to use technology in the curriculum. In 1998, the Maryland Technology Academy was established in order to provide technology training for inservice educators. The training involves three weeks of technology lesson plan development and follow-up activities. (McCullen, 2002). North Carolina, sponsored by ExplorNet, has a statewide initiative that is providing a 5-day, technology integration training program for inservice educators in underserved areas in the state. The goal of this program is to have teams work on school improvement projects at the training session that can be taken back to prospective schools (McCullen, 2002). The Lubbock Independent School District in Texas views inservice educators as individuals because it allows for selective training methods. Specifically, the educators of Lubbock Independent School District, have choices concerning how to learn technology integration skills. Training alternatives include taking a course or an online tutorial, or reading a manual (McCullen, 2002).

The 1999 Fast Response Survey System (FRSS), surveyed current educators regarding technology training methods. Ninety-three percent indicated a preference for independent learning as the medium for learning classroom technology integration. The next two training methods were staff development sessions (88%) and learning via colleagues (87%). In addition, educators with three or fewer years of experience were more likely than the more experienced educators to cite college courses as preparing them successfully for using technology in the classroom (NCES, 1999).

Results of this study assist in providing valuable training for inservice educators on the integration of technology.

Professional Development Personnel

Several school districts employ individuals to assist inservice educators with technology integration. The titles may not be the same, but the goal is consistent in helping educators use technology in the classroom. The Allen Independent School District (AISD) in Allen, Texas, is the only school district thus far in Texas that has implemented a paid position for a person to assist educators with technology integration district-wide (G. Williford, personal communication, August 4, 2000). Professional Development Personnel (PDP) refers to the individuals in Allen who are responsible for assisting educators with curriculum needs and technology integration into the classroom. In addition, the PDP provide training for educators and assist with lesson planning (AISD, 1999). The PDP were surveyed in this study to determine whether their preferences for learning technology integration skills are congruent with current and future educators.

Validity Critique

The studies mentioned in this chapter vary in strength regarding the validity of the outcomes. Davis (1999) surveyed only agriculture students and had a 38% return rate on the questionnaire. The outcomes may not be the same for all students at the university. Parker's study (1999) had only 94 subjects and Cook (1997) only surveyed 60 students.

A larger sample may yield different or more promising results. Future research is recommended with a larger sample size and a higher return rate.

Summary

It is apparent in the literature that many authors feel that adequate training is needed for successful technology integration. Without the training, it will be difficult for educators to effectively prepare students to be technology-literate citizens. Training should be flexible in delivery, and it should be continuous. Everyone learns differently, and thus providing a variety of training opportunities may be the best alternative.

Older adults prefer the more self-directed learning environments, whereas younger students are enrolling in the traditional face-to-face courses. Internals also tend to choose alternative training methods such as online courses or video and seem to perform better than externals. Frequent and continuous training is needed to keep educators abreast of technological change. Currently practicing educators with more training hours are utilizing technology in the classroom more than those with less training.

Many states, colleges, and school districts are showing increased concern for technology-trained educators by issuing mandates and providing innovative training opportunities. In addition, professional development personnel are being hired to assist educators in this endeavor. This study attempted to determine consistent patterns for learning technology integration skills of preservice, inservice, and professional development personnel, in order to provide valuable training opportunities.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

This study examined preferences for learning technology integration skills among preservice educators at the University of North Texas; inservice educators at Allen ISD, Coppell ISD, and Frisco ISD; and professional development personnel at Allen ISD. The preservice educators answered the online survey during class time. The same online survey was administered to the inservice educators and the professional development personnel via an electronic request from the superintendent. All groups were measured for similarities and differences in training preferences. In addition, those training preferences were cross-referenced with age, training hours, and the locus of control personality factor. This chapter covers the following topics: identified population, identified sample, research hypotheses, research design, pilot study, instrumentation, data collection procedures, data analysis procedures, and summary.

Identified Population

The population for this study was public school educators and professional development personnel in the K-12 environment of the United States, including university students enrolled in preservice courses required for teacher certification.

Identified Sample

A convenience sample of current preservice educators, inservice educators, and professional development personnel was used for this study. A total of 2,227 subjects (preservice, inservice, professional development personnel) were solicited to complete the survey. According to Gall, Borg, & Gall (1996), a convenience sample is justifiable as long as the researcher describes in detail the sample used and the reasons for selection. The current preservice educators were students at the University of North Texas. Specifically, these subjects were enrolled in either Computer Education and Cognitive Systems (CECS 3440; *n*=41) or Introduction to Instructional Technology and Computers in the Classroom (CECS 4100; *n*=122). There were two sections of CECS 3440 and six sections of CECS 4100, totaling 163 subjects. The CECS 3440 course is a teaching with technology course while CECS 4100 is a required course on classroom technology integration techniques.

The inservice educators solicited were both elementary and secondary educators from Allen ISD (*n*=724), Coppell ISD (*n*=654), and Frisco ISD (*n*=659). In addition, there were 27 professional development personnel from Allen ISD. The school districts were selected for convenience and accessibility reasons.

Hypotheses to Be Tested

The following null hypotheses were tested:

1. There is no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills. (Ratings of 1-5, with 1 equal to *Not Effective* and 5 equal to *Very Effective* for each of the eight training methods).
2. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of

different methods for learning technology integration skills when categorized by age. (A fill-in prompt for the number of years since birth).

3. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction. (Number ranges of 0, 1-8, 9-20, 21-40 from the 1998 California Assessment Profile [CTAP[2]], and the following number ranges extended; 41-80, 81-160, 161-300, and more than 300).
4. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external). (Rating of 1-23 as specified in the instrumentation section [Rotter, 1966]).

Research Design

This study utilized a factorial design using a multivariate analysis of variance (MANOVA) for each major research question. The researcher determined the effect of the independent variables solely and jointly on the dependent variables (Gall et al., 1996). The independent variables were: educator type (preservice, inservice, professional development personnel), age, training hours, and locus of control. The dependent variables were the training methods for learning technology integration skills. The training methods included: credit classes, workshops, open computer labs, technology personnel support, peer support, online help, printed documentation, and trial and error.

Pilot Study

A pilot study was conducted with 8 University of North Texas preservice educators and 46 inservice educators at Coppell ISD. These subjects were given the eight-item survey from the Computer Competency Skills questionnaire (© Cornell University, Computer Competency Skills questionnaire, Ithaca, NY, www.cornell.edu) developed by Philip Davis at Cornell University in 1997.

This survey was one section from the university program review questionnaire. The reliability reported for Davis' instrument and the estimate for the pilot study were .85 and .65 respectively. A copy of the pilot study instrument is located in Appendix A, and Davis' computer competency questions can be found in Appendix B.

Although the sample size was small, data analysis showed interesting results. For example, both the preservice and inservice educators chose "peer support" as the preferred method for learning technology integration skills out of a total of eight choices. In addition, drop-in open labs were rated eighth and seventh by preservice and inservice, respectively. Furthermore, preservice educators rated credit classes as one of the least helpful methods, and inservice educators scored workshops third from the bottom. These results tend to illustrate that the methods, which universities and school districts are currently employing, may not be the preferences of the attendees.

Instrumentation

This study investigated perceptions of preservice educators, inservice educators, and professional development personnel regarding effective methods for learning technology integration skills. Technology training methods, along with demographic information and locus of control indicators, were used to gather data for this study. The technology training methods questions were derived from the Computer Competency Skills questionnaire that was developed by Philip Davis at Cornell University in 1997. This questionnaire consisted of eight Likert scale items that addressed training method preferences. The reliability for the scale designed by Davis was .85. The locus of control score was assessed by using the instrument developed by Rotter in 1966. Rotter's Internal-External Locus of Control Scale (© J.B. Rotter, Interal-External Locus of Control Scale, Storrs, CT, www.psych.uconn.edu) was developed and refined through a series of validation procedures spanning 1957-1966.

One hundred forced-choice items were reduced to 60 through factor analysis. This 60-item instrument was further cross-validated by two separate studies and now consists of 29 items. Internal consistency for Rotter's scale ranged from .65 to .79 on various samples tested at the University of Ohio. Each item on the scale contains two statements requiring subjects to choose agreement with one. Six items on the scale are filler items and do not count towards final scoring. Rotter's scale measures subjects on a range from 1 *(very internal*) to 23 (*very external*). A score from 1-11 signifies an internal locus of control. Participants scoring 13-23 have an external locus of control and those with a score of 12 possess characteristics of both. A copy of Rotter's Internal-External Locus of Control Scale is located in Appendix C.

A new survey combining the aforementioned two questionnaires, with the addition of demographic questions, was constructed and administered online. The demographic items included in Part I were gender, age, highest degree received, years of teaching experience, current level of teaching, training background, student technology use, and school affiliation. Although all of the demographic information was not analyzed for this study, future research and publication might deem the data useful. Davis' eight computer competency questions comprised Part II of the new survey with a reliability coefficient of .65. The last section of the survey contained Rotter's Internal-External Locus of Control Scale with a comparable reliability coefficient of .70. A summary of the reliabilities obtained for this study is presented in Table 1. A copy of the informed consent and the survey titled Technology Training Survey are located in Appendix D and E, respectively. In addition, a copy of the California Technology Assessment Profile (CTAP[2]), which was used to categorize hours of instruction in the Technology Training Survey, is located in Appendix F.

Table 1

Comparisons of Reliability Estimates for the Davis and Rotter Instruments and the Technology Training Survey

Instrument	Davis	Rotter
Reliabilities	.85 [a]	.65-.79 [b]
Technology Training Survey Reliabilities	.65	.70

[a]From Dean Sutphin, Cornell University (personal communication, August 30, 2002).
[b]From "Generalized expectations for internal versus external control of reinforcement" by J. Rotter, 1966, Psychological Monographs, 80, p. 1-28.

Data Collection Procedures

This study was conducted using online data collection via a survey developed with Microsoft FrontPage® web site creation and management tool (© Microsoft Corp., Redmond, WA, www.microsoft.com). The online administration of the survey was estimated to take 20 minutes. The last four digits of each subject's social security number were used as identification to prevent duplicates. Data were collected from three different Texas school districts and the University of North Texas (Allen ISD, Coppell ISD, and Frisco ISD) from April 15, 2002, to June 15, 2002.

The preservice educators were administered the survey in class after permission was granted from the instructors of each section during the week of April 29, 2002. The incoming data was monitored during the class hour and the total number of surveys submitted was emailed to each instructor. Another email was sent the following week requesting survey completion by those with low student totals.

Inservice educators and professional development personnel took the survey online as well. The researcher met with each school district's superintendent to obtain consent to administer the survey. Copies of the permission letters are located in Appendixes G through I. Each superintendent in the three school districts sent a request through electronic mail to complete the online survey to all currently employed elementary and secondary teachers. Survey requests were sent out to Frisco ISD and the professional development personnel during the week of May 3, 2002. During the week of May 13, 2002 and May 20, 2002, data were collected from Coppell ISD and Allen ISD respectively. The incoming data were monitored frequently and a follow-up email with the total amount of surveys submitted by each campus was sent to each superintendent at the end of each week. The survey was available online until June 15, 2002. The data were analyzed during the months of July and August.

An application for the Approval of Investigation Involving Human Subjects was submitted to the University of North Texas Institutional Review Board (IRB), and approval was granted. A copy of the approval letter is located in Appendix J. Data collection did not occur until approval was granted from the IRB.

Data Analysis Procedures

Descriptive statistics were collected and analyzed for the following demographic items: age, training (total hours of instruction), locus of control (internal vs. external), and preferred method for learning technology integration. Hypothesis testing was carried out through a multivariate analysis of variance (MANOVA) for each major research question.

1. Research question 1; 8x3 (training methods by educator type)
2. Research question 2; two 8x3s (training methods by educator type by age [low vs. high])
3. Research question 3; two 8x3s (training methods by educator type by training hours [low vs. high])
4. Research question 4; two 8x3s (training methods by group by locus of control score [internal. vs. external])

These MANOVAs are graphically displayed in Figures 1-4. The results were analyzed using the Statistical Program for the Social Sciences® (SPSS) data analysis software (©SPSS, Chicago, IL, www.spss.com)

	Preservice	Inservice	PDP
1. Credit Courses			
2. Workshops			
3. Open Labs			
4. Tech Support			
5. Peer Support			
6. Online Help			
7. Printed Doc.			
8. Trial/Error			

Figure 1. Research question 1: training methods by educator type.

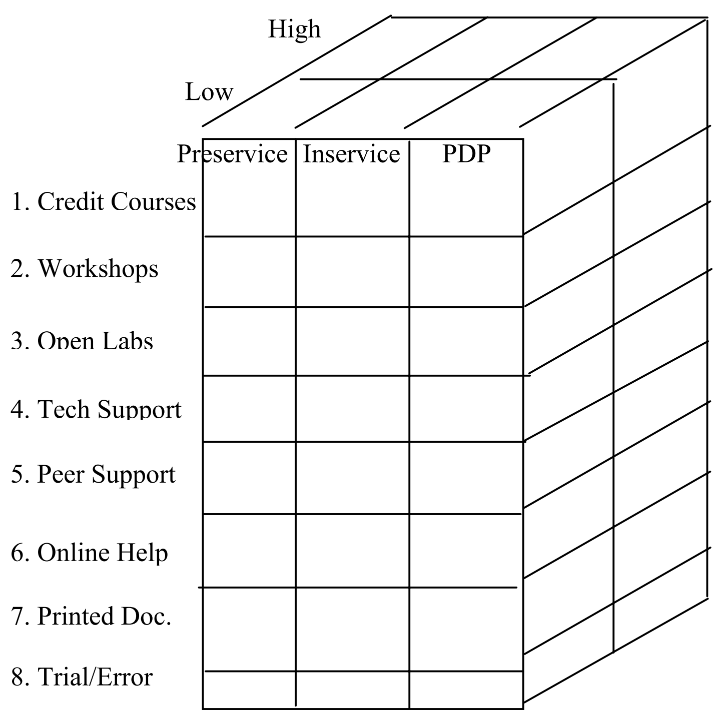

Figure 2. Research question 2: training methods by educator type for low and high age.

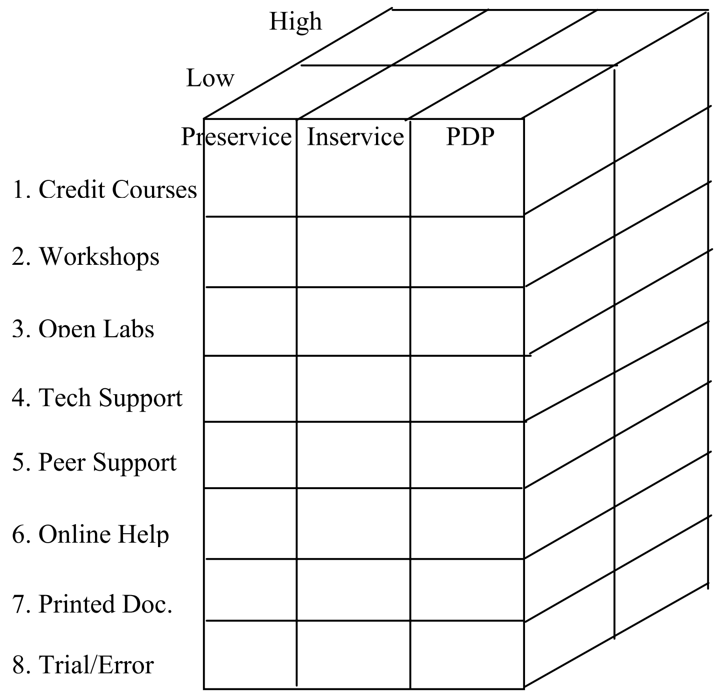

Figure 3. Research question 3: training methods by educator type for low and high training hours.

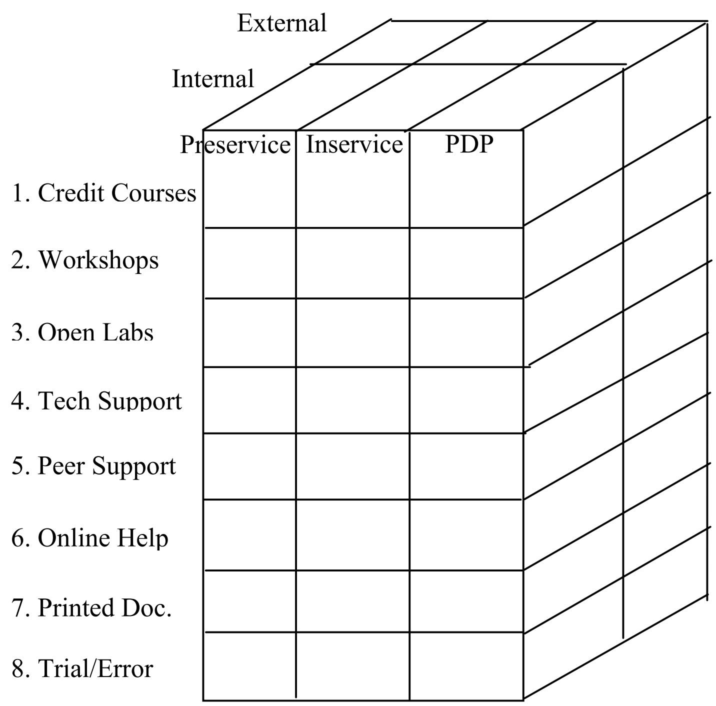

Figure 4. Research question 4: training methods by educator type for low and high locus of control score.

Summary

Preservice educators, inservice educators, and professional development personnel were surveyed regarding their perceived effectiveness of certain technology training methods. These training method preferences were then compared to age, training hours, and locus of control score for this study. The data were analyzed using a multivariate analysis of variance (MANOVA) for each major research question. The results of this research study are intended to assist decision makers in the field of education in providing adequate training resources for teachers to effectively integrate technology into the curriculum. All participating entities received a copy of the results.

CHAPTER 4

FINDINGS

Introduction

This study examined educators' perceived effectiveness of different methods for learning technology integration skills. Demographic information, as well as the findings and analyses of each research question, are presented in this chapter. The following null hypotheses were tested:

1. There is no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills. (Ratings of 1-5, with 1 equal to *Not Effective* and 5 equal to *Very Effective* for each of the eight training methods).
2. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by age. (A fill-in prompt for the number of years since birth).
3. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction. (Number ranges of 0, 1-8, 9-20, 21-40 from the 1998 California

Assessment Profile [CTAP^2], and the following number ranges extended; 41-80, 81-160, 161-300, and more than 300).

4. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external). (Rating of 1-23 as specified in the instrumentation section [Rotter, 1966]).

Description of Subjects

A total of 2,234 educators (preservice, inservice, and professional development personnel) were solicited to complete the survey. The preservice educators took the online survey during class time, with 96 of the 163 surveys returned. The inservice educators and professional development personnel were asked to complete the survey via an email from each school district's superintendent. Out of a total of 2037 total inservice educators and 27 professional personnel, 663 surveys were submitted. Thus, the total number of subjects for this study was 759. Table 2 illustrates the total number of requests and the actual number of surveys submitted (*N*=759) for each educator type.

Table 2

Return Rates of Technology Training Survey for Each Educator Type and All Educators Combined

Educator type	Requested	Submitted	Return rate
Preservice educators	163	97	60%
Inservice educators	2037	641	31%
Allen	724	127	18%
Coppell	654	265	41%
Frisco	659	248	38%
PDPs	27	22	81%
Total	2227	759	34%

Selective background information is presented in Tables 3-5 to provide more in-depth description about the educators in this study. The demographic items presented include: gender, highest degree received, and years of teaching experience. Further demographic information is discussed with each research question. Out of a total of 759 educators, 87.2% were female. A summary of the gender data (categorized by educator type) is presented in Table 3.

Table 3

Gender for Each Educator Type and All Educators Combined

Group	Male	Male %	Female	Female %
Preservice educators	13	13.4	84	86.6
Inservice educators	82	12.8	559	87.2
Allen	19	15.0	108	85.0
Coppell	41	15.5	224	84.5
Frisco	22	8.9	226	91.1
PDPs	2	9.1	20	90.9
Total	97	12.8	662	87.2

Out of 759 educators, 86.7% have received either a bachelor's or a master's degree. The majority of preservice educators have completed a high school general degree (70.1%). The majority of inservice educators (67.5%) have completed a bachelor's degree, whereas the majority of PDPs have completed a master's degree (63.6%). A summary of the highest degree received data (categorized by educator type) is presented in Table 4.

Table 4

Highest Degree Received for Each Educator Type and All Educators Combined

Group	High school	BA/BS	MA/MEd	EdD/PhD	Other
Preservice educators	68 (70.1%)	8 (8.2%)	2 (2.1%)	0	19 (19.6%)
Inservice educators	0	432 (67.5%)	195 (30.5%)	2 (0.3%)	10 (1.6%)
[a]Allen	0	81 (63.8%)	44 (34.6%)	1 (0.8%)	0
Coppell	0	175 (66.0%)	83 (31.3%)	1 (0.4%)	6 (2.3%)
Frisco	0	176 (71.0%)	68 (27.4%)	0	4 (1.6%)
PDPs	0	7 (31.8%)	14 (63.6%)	0	1 (4.5%)
Total	68 (9.0%)	447 (58.9%)	211 (27.8%)	2 (.3%)	30 (4.0%)

Note. *N*=758.

[a] One educator did not answer the question from Allen ISD.

The average years of teaching experience are 9.98. A summary of the total years of teaching experience for all educator types combined is presented in Table 5. A graphical representation is displayed in Figure 5.

Table 5

Total Years of Teaching Experience for Each Educator Type and All Educators Combined

Group	*n*	Mean	Minimum	Maximum	Std. dev.
Preservice educators	97	.84	0	18	2.31
Inservice educators	640	11.25	0	39	8.79
Allen	127	11.85	0	39	9.302
Coppell	265	12.19	0	39	9.177
Frisco	248	9.95	0	35	7.934
PDPs	22	13.14	2	35	7.83
Total	759	9.98	0	39	8.94

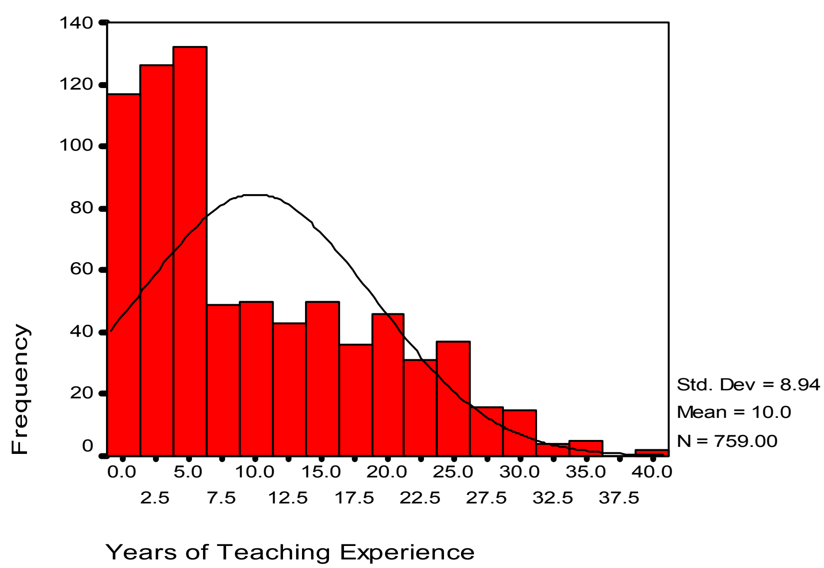

Figure 5. Histogram showing years of teaching experience for all educator types.

The preservice educators perceived credit courses as the most effective method for learning technology integration skills. The inservice educators and the professional development personnel both selected technical support. A summary of the demographic information for the training methods for each educator type is presented in Table 6.

Table 6

Comparison of Training Method Perceived Effectiveness of Preservice and Inservice, Inservice and PDP, and PDP and Preservice

Preservice (n=97) versus Inservice (n=640)

	Preservice		Inservice		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Tech support	4.00	1.13	4.24	1.04	-.11
Peer support	4.03	1.02	4.18	.89	-.08
Credit courses	4.22	.93	3.86	1.00	.18
Trial/Error	3.97	1.00	3.77	1.18	.09
Workshops	3.57	.98	3.47	1.18	.05
Comp. Labs	3.70	1.15	3.30	1.25	.16
Online help	3.54	1.10	3.00	1.20	.23
Printed docs	3.28	1.27	2.88	1.34	.15

Inservice (n=640) versus PDP (n=22)

	Inservice		PDP		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Tech support	4.24	1.04	4.59	.80	-.19
Peer support	4.18	.89	4.50	.80	-.19
Credit courses	3.86	1.00	4.41	.73	-.30
Trial/Error	3.77	1.18	4.09	1.15	-.14
Workshops	3.47	1.18	3.82	1.14	-.15
Comp. Labs	3.30	1.25	3.91	1.11	-.25
Online help	3.00	1.20	3.50	1.06	-.22
Printed docs	2.88	1.34	3.18	1.22	-.12

(table continues)

Table 6 *(continued)*

PDP (*n*=22) versus Preservice (*n*=97)

	PDP		Preservice		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Tech support	4.59	.80	4.00	1.13	.29
Peer support	4.50	.80	4.03	1.02	.25
Credit courses	4.41	.73	4.22	.93	.11
Trial/Error	4.09	1.15	3.97	1.00	.06
Workshops	3.82	1.14	3.57	.98	.09
Comp. Labs	3.91	1.11	3.70	1.15	.12
Online help	3.50	1.06	3.54	1.10	-.02
Printed docs	3.18	1.22	3.28	1.27	-.04

Analysis of Hypothesis 1

> Hypothesis 1: There will be no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills.

Hypothesis 1 was tested by performing a multivariate analysis of variance (MANOVA) with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. The mean and standard deviation for the perceived effectiveness of the eight training methods for all educator types combined are presented in descending order in Table 7.

Table 7

Perceived Effectiveness of Training Methods for All Educator Types Combined

Variable	Mean	Standard dev.
Tech support	4.22	1.050
Peer support	4.17	.033
Credit Courses	3.92	.994
Trial/Error	3.80	1.158
Workshops	3.49	1.153
Computer Labs	3.37	1.244
Online help	3.08	1.198
Printed documentation	2.94	1.336

Note. *N*=759.

As shown in Table 8, the preservice, inservice, and professional development personnel differed at the .05 level ($p < .0005$) in their ratings of perceived effectiveness across the eight training methods.

Table 8

Comparison of Effective Training Methods and Educator Type

Between-subjects factors

Group	Value label	*n*
3.00	Inservice	640
4.00	Preservice	97
5.00	PDP	22

(table continues)

Table 8 *(continued)*

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's trace	.910	950.543	8.000	749.000	.000
	Wilks' lambda	.090	950.543	8.000	749.000	.000
	Hotelling's trace	10.153	950.543	8.000	749.000	.000
	Roy's largest root	10.153	950.543	8.000	749.000	.000
Group	Pillai's trace	.074	3.600	16.000	1500.000	.000
	Wilks' lambda	.927	3.633	16.000	1498.000	.000
	Hotelling's trace	.078	3.666	16.000	1496.000	.000
	Roy's largest root	.068	6.384	8.000	750.000	.000

*$p < .0005$.

Therefore, the null hypothesis of no differences among the educator types is rejected, and the alternative hypothesis is accepted. Preservice educators, inservice educators, and professional development personnel differed in their collective perceptions of training method effectiveness for learning technology integration skills.

Additional Findings

Post hoc tests revealed that the differences were found in the areas of credit courses, computer labs, technical support, online help, and printed documentation. There was no difference in perceptions of workshops, peer support, and trial and error across all educator types. This information is presented in Table 9.

Table 9

ANOVA Showing the Comparison of Effective Training Methods and Educator Type

Training method		Sum of Squares	*df*	Mean Square	F	Significance of *F*
Credit courses	Between groups	16.616	2	8.308	8.569	.000
	Within groups	732.952	756	.970		
	Total	749.568	758			
Workshops	Between groups	3.621	2	1.811	1.363	.256
	Within groups	1004.089	756	1.328		
	Total	1007.710	758			
Computer labs	Between groups	19.883	2	9.942	6.517	.002
	Within groups	1153.342	756	1.526		
	Total	1173.225	758			
Tech support	Between groups	7.524	2	3.762	3.432	.033
	Within groups	828.731	756	1.096		
	Total	836.256	758			
Peer support	Between groups	4.097	2	2.049	2.519	.081
	Within groups	614.946	756	.813		
	Total	619.043	758			
Online help	Between groups	27.981	2	13.991	9.972	.000
	Within groups	1060.622	756	1.403		
	Total	1088.603	758			
Printed documentation	Between groups	15.898	2	7.949	4.492	.012
	Within groups	1337.939	756	1.770		
	Total	1353.837	758			
Trial/Error	Between groups	5.662	2	2.831	2.119	.121
	Within groups	1010.088	756	1.336		
	Total	1015.750	758			

*$p < .05$.

Table 10 shows the means for each training method further broken down by educator type. The training methods that were significantly different for the three types of educators are marked with an asterisk.

Table 10

Mean Scores for Each Training Method and for Each Educator Type

Method	Type	*n*	Mean
*Credit courses	Preservice	97	4.22
	Inservice	641	3.86
	PDP	22	4.41
	Total	759	3.92
Workshops	Preservice	97	3.57
	Inservice	641	3.47
	PDP	22	3.82
	Total	759	3.49
*Computer labs	Preservice	97	3.70
	Inservice	641	3.30
	PDP	22	3.91
	Total	759	3.37
*Tech support	Preservice	97	4.00
	Inservice	641	4.24
	PDP	22	4.59
	Total	759	4.22
Peer support	Preservice	97	4.03
	Inservice	641	4.18
	PDP	22	4.50
	Total	759	4.17
*Online help	Preservice	97	3.54
	Inservice	641	3.00
	PDP	22	3.50
	Total	759	3.08
*Printed documentation	Preservice	97	3.28
	Inservice	641	2.88
	PDP	22	3.18
	Total	759	2.94
Trial/Error	Preservice	97	3.97
	Inservice	641	3.77
	PDP	22	4.09
	Total	759	3.80

Note. *=significant difference at $p < .05$.

Technical support and peer support were the highest rated training methods among educators as a whole.

Analysis of Hypothesis 2

> Hypothesis 2: There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by age.

Hypothesis 2 was tested by carrying out two MANOVA procedures, one for the younger educators and one for the older educators. Age was dichotomized into low and high based on the median age of 36 (35=49.5%; 36=51.9%). As shown in Figure 6, the distribution of ages for the respondents approaches bimodality at approximately 36 years of age. This also corresponds to the author's experience that teachers are typically considered veteran status at the age of 36. Therefore, the dichotomization point of 36 was accepted as reasonable. Educators less than 36 years of age were placed in the low category, and those 36 years of age and higher represented the high category. The frequency distribution for age of all educator types combined is provided in Table 11. The mean, standard deviation, and effect size for each training method categorized by educator type and low and high age are presented in Table 12.

Table 11

Age Frequency Distribution for All Educator Types Combined

Age	Frequency	Percent	Cumulative percent
19	1	.1	.1
20	10	1.3	1.5
21	19	2.5	4.0
22	9	1.2	5.2
23	24	3.2	8.3
24	31	4.1	12.4
25	38	5.0	17.4
26	30	4.0	21.4
27	48	6.3	27.7
28	32	4.2	32.0
29	22	2.9	34.9
30	19	2.5	37.4
31	23	3.0	40.4
32	17	2.2	42.7
33	14	1.8	44.5
34	20	2.6	47.2
35	17	2.2	49.4
36	18	2.4	51.8
37	26	3.4	55.2
38	14	1.8	57.1
39	19	2.5	59.6
40	17	2.2	61.8
41	14	1.8	63.7
42	15	2.0	65.7
43	26	3.4	69.1
44	18	2.4	71.5
45	16	2.1	73.6
46	25	3.3	76.9
47	18	2.4	79.3
48	26	3.4	82.7
49	18	2.4	85.1
50	20	2.6	87.7
51	12	1.6	89.3
52	21	2.8	92.1

(table continues)

Table 11 *(continued)*

Age	Frequency	Percent	Cumulative percent
53	15	2.0	94.1
54	9	1.2	95.2
55	8	1.1	96.3
56	4	.5	96.8
57	10	1.3	98.2
58	3	.4	98.5
59	3	.4	98.9
60	3	.4	99.3
61	2	.3	99.6
62	1	.1	99.7
64	2	.3	100.0
	Mean	36.70	
	Standard deviation	10.84	

Note. *N*=757, two missing variables.

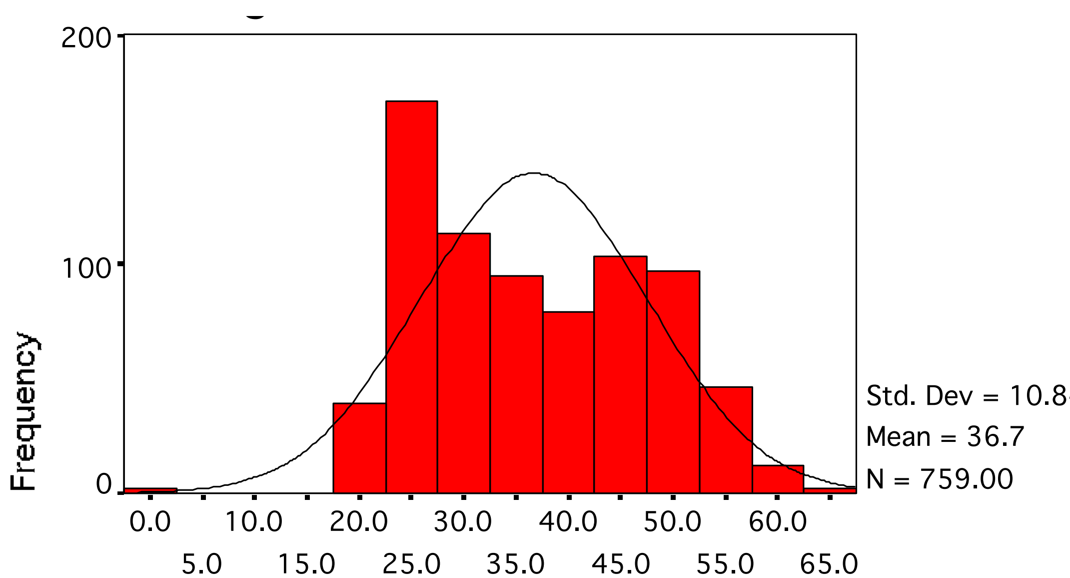

Figure 6. Histogram showing age frequency distribution for all educator types.

Table 12

Training Method Perceived Effectiveness for the Young Educator Group and the Older Educator Group

Preservice Young (*n*=86) versus Preservice Old (*n*=11)

	Preservice Young		Preservice Old		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Credit courses	4.21	.96	4.36	.37	-.09
Peer support	4.06	1.03	3.91	.94	.08
Tech support	4.05	1.09	3.73	1.42	.13
Trial/Error	4.00	.99	3.82	1.08	.09
Comp. Labs	3.83	1.11	2.73	1.01	.46
Workshops	3.64	.99	3.18	.75	.25
Online help	3.56	1.08	3.36	1.29	.08
Printed docs	3.28	1.23	3.36	1.27	-.03

Inservice Young (*n*=279) versus Inservice Old (*n*=359)

	Inservice Young		Inservice Old		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Tech support	4.20	1.06	4.26	1.03	-.03
Peer support	4.06	.92	4.28	.85	.12
Credit courses	3.86	.96	3.87	1.03	-.01
Trial/Error	3.95	1.08	3.64	1.23	.13
Workshops	3.28	1.15	3.61	1.18	-.14
Comp. Labs	3.25	1.18	3.35	1.31	-.04
Online help	2.94	1.18	3.05	1.22	-.05
Printed docs	2.82	1.33	2.92	1.35	-.04

(table continues)

Table 12 *(continued)*

PDP Young (n=9) versus PDP Old (n=13)

Methods	PDP Young Mean	PDP Young St. Dev.	PDP Old Mean	PDP Old St. Dev.	ES
Tech support	4.22	1.09	4.85	.38	-.36
Peer support	4.11	1.05	4.77	.44	-.38
Credit courses	4.00	.87	4.69	.48	-.44
Trial/Error	4.22	.83	4.00	1.35	.10
Workshops	3.67	1.41	4.08	.86	-.17
Comp. Labs	3.33	1.41	4.15	.80	-.34
Online help	3.11	1.17	3.77	.93	-.30
Printed docs	3.11	1.27	3.23	1.24	-.05

The first MANOVA procedure, for educators less than or equal to 36 years of age, was performed with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As shown in Table 13, the preservice, inservice, and professional development personnel (those younger than age 36) differed at the .05 level (p <. 0005) in their ratings of perceived effectiveness across the eight training methods.

Table 13

Comparison of Effective Training Methods and Educator Type and Age < 36

Between-subjects factors

Group	Value label	n
3.00	Inservice	279
4.00	Preservice	86
5.00	PDP	9

(table continues)

Table 13 *(continued)*

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's trace	.890	367.151	8.000	364.000	.000
	Wilks' lambda	.110	367.151	8.000	364.000	.000
	Hotelling's trace	8.069	367.151	8.000	364.000	.000
	Roy's largest root	8.069	367.151	8.000	364.000	.000
Group	Pillai's trace	.117	2.827	16.000	730.000	.000
	Wilks' lambda	.884	2.903	16.000	728.000	.000
	Hotelling's trace	.131	2.978	16.000	726.000	.000
	Roy's largest root	.128	5.849	8.000	365.000	.000

*$p < .0005$.

The second MANOVA procedure, for educators older than 36 years of age, was performed with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As displayed in Table 14, the preservice, inservice, and professional development personnel (those equal to or older than age 36) differed at the .05 level (p=.025) in their ratings of perceived effectiveness across the eight training methods. Thus, both the younger and older educators yielded significant results.

Table 14

Comparison of Effective Training Methods and Educator Type and Age ≥ 36

Between-subjects factors

Group	Value label	*n*
3.00	Inservice	359
4.00	Preservice	11
5.00	PDP	13

(table continues)

Table 14 *(continued)*

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's Trace	.891	379.182	8.000	373.000	.000
	Wilks' Lambda	.109	379.182	8.000	373.000	.000
	Hotelling's Trace	8.133	379.182	8.000	373.000	.000
	Roy's Largest Root	8.133	379.182	8.000	373.000	.000
Group	Pillai's Trace	.075	1.831	16.000	748.000	.024
	Wilks' Lambda	.926	1.828	16.000	746.000	.024
	Hotelling's Trace	.078	1.824	16.000	744.000	.025
	Roy's Largest Root	.047	2.206	8.000	374.000	.026

*$p < .05$.

Therefore, the null hypothesis of no differences among the educator types when categorized by age is rejected, and the alternative hypothesis is accepted. Both young and old preservice educators, inservice educators, and professional development personnel differed in their perceived effectiveness of training methods for learning technology integration skills.

Additional Findings

Post hoc analysis revealed that the areas in which the differences occurred were not identical for the two groups. The preservice, inservice, and professional development personnel differed significantly in technical support and peer support if they were older, but if they were younger they did not. Specifically, technical support and peer support were rated highest by the older professional development personnel followed by the inservice and then preservice educators. There was no significant difference between technical support and peer support within the younger educators. These methods averaged 4.17 and 4.06 on a scale of 1 to 5, respectively. The younger preservice, inservice, and professional development personnel differed significantly on their perceived effectiveness of workshops, online help, and printed documentation whereas the older group did not. In particular, the preservice educators ranked the workshops, online help, and printed documentation the highest. No obvious pattern emerged that would distinguish the younger educators from the older educators.

Analysis of Hypothesis 3

> Hypothesis 3: There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction.

Hypothesis 3 was examined by carrying out two MANOVA procedures, one including the educators with minimal amount of training hours (in the past 12 months) and one for educators with training hours greater than the median category choice of 2. (2=50.9%; 3=71.0%). Educators with training hours equal or below eight represent the low category (equal or less than category 2). The high category (greater than category choice 2) represents the educators with more than nine hours of training in technology integration. The frequency distribution for training hours of all educator types is provided in Table 15 and graphically displayed in Figure 7. A summary of the means, standard deviations, and effect size for each educator type is presented in Table 16.

Table 15

Hours of Training in Technology Integration in the Past 12 Months

Training hours	Frequency	Percent	Cumulative percent
0 hours	56	7.4	7.4
1-8 hours	330	43.5	50.9
9-20 hours	153	20.2	71.0
21-40 hours	107	14.1	85.1
41-80 hours	65	8.6	93.7
81-160 hours	18	2.4	96.0
161-300 hours	11	1.4	97.5
More than 300 hours	19	2.5	100.0

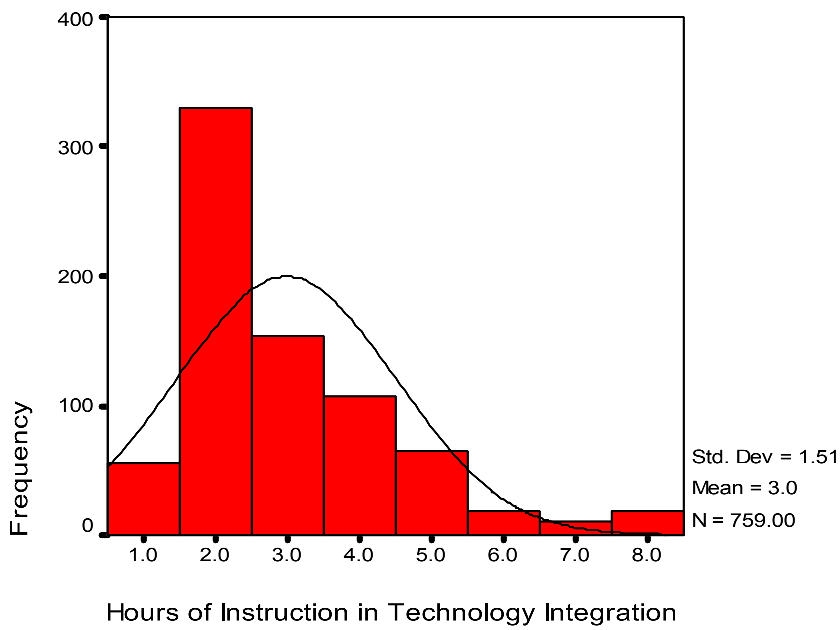

Figure 7. Hours of instruction in technology integration in the past 12 months.

Table 16

Training Method Perceived Effectiveness for the Low Training Hour Educator Group and the High Training Hour Educator Group

Preservice Low TIhours (*n*=36) versus Preservice High TIhours (*n*=61)

	Low TIhours		High TIhours		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Credit courses	4.19	.92	4.25	.94	-.03
Peer support	3.86	1.13	4.15	.95	-.14
Tech support	4.03	1.11	4.00	1.15	.01
Trial/Error	4.11	.98	3.90	1.01	.10
Comp. Labs	3.64	1.33	3.74	1.03	-.04
Workshops	3.56	.94	3.61	1.00	-.03
Online help	3.67	1.12	3.46	1.09	.09
Printed docs	3.53	1.25	3.15	1.26	.15

Inservice Low TIhours (*n*=338) versus Inservice High TIhours (*n*=302)

	Low TIhours		High TIhours		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Tech support	4.27	.99	4.21	1.09	.03
Peer support	4.15	.88	4.22	.89	-.04
Credit courses	3.80	1.03	3.93	.96	-.07
Trial/Error	3.70	1.17	3.85	1.19	-.06
Comp. Labs	3.22	1.23	3.40	1.27	-.07
Work-shops	3.45	1.15	3.49	1.21	-.02
Online help	3.00	1.20	3.01	1.20	00
Printed docs	2.80	1.34	2.96	1.34	-.06

(table continues)

Table 16 *(continued)*

PDP Low TIhours (*n*=12) versus PDP High TIhours (*n*=10)

Methods	Low TIhours Mean	Low TIhours St. Dev.	High TIhours Mean	High TIhours St. Dev.	ES
Tech support	4.25	.97	5.00	.00	-.48
Peer support	4.50	.67	4.50	.97	0
Credit courses	4.33	.89	4.50	.53	-.12
Trial/Error	4.08	.90	4.10	1.45	0
Comp. Labs	4.00	.95	3.80	1.32	.09
Work-shops	3.67	1.23	4.00	1.05	-.14
Online help	3.58	1.08	3.40	1.07	.08
Printed docs	3.08	1.24	3.30	1.25	-.09

The first MANOVA procedure, for educators with training hours less than or equal to category 2, was performed with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As presented in Table 17, the preservice, inservice, and professional development personnel (who completed eight or fewer training hours) differed at the .05 level ($p <. 0005$) in their ratings of perceived effectiveness across the eight training methods.

Table 17

Comparison of Effective Training Methods and Educator Type and Training Hours ≤ Category 2

Between-subjects factors

Group	Value label	*n*
3.00	Inservice	338
4.00	Preservice	36
5.00	PDP	12

(table continues)

Table 17 *(continued)*

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's trace	.910	474.407	8.000	376.000	.000
	Wilks' lambda	.090	474.407	8.000	376.000	.000
	Hotelling's trace	10.094	474.407	8.000	376.000	.000
	Roy's largest root	10.094	474.407	8.000	376.000	.000
Group	Pillai's trace	.105	2.618	16.000	754.000	.001
	Wilks' lambda	.896	2.648	16.000	752.000	.000
	Hotelling's trace	.114	2.677	16.000	750.000	.000
	Roy's largest root	.098	4.600	8.000	377.000	.000

*$p < .0005$.

The second MANOVA procedure, for educators with training hours greater than category 2 (high), was performed with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As shown in Table 18, the preservice, inservice, and professional development personnel (who completed more than 8 training hours) differed at the .05 level (p=.042) in their ratings of perceived effectiveness across the eight training methods.

Table 18

Comparison of Effective Training Methods and Educator Type and Training Hours > Category 2

Between-subjects factors

Group	Value label	*n*
3.00	Inservice	302
4.00	Preservice	61
5.00	PDP	10

(table continues)

Table 18 *(continued)*

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's trace	.910	458.811	8.000	363.000	.000
	Wilks' lambda	.900	458.811	8.000	363.000	.000
	Hotelling's trace	10.112	458.811	8.000	363.000	.000
	Roy's largest root	10.112	458.811	8.000	363.000	.000
Group	Pillai's trace	.072	1.698	16.000	728.000	.042
	Wilks' lambda	.929	1.698	16.000	726.000	.042
	Hotelling's trace	.075	1.697	16.000	724.000	.042
	Roy's largest root	.052	2.359	8.000	364.000	.017

*$p < .05$.

Additional Findings

Post hoc analysis revealed that the areas in which the differences emerged were not identical for the two groups. The preservice educators, inservice educators, and professional development personnel in both groups differed significantly in credit courses and online help. The educators with a high number of training hours differed significantly on technical support but the educators with a low number of training hours did not. The educators with low training hours differed significantly on printed documentation, whereas the educators with high training hours did not. Figure 8 shows the difference among the low and high training hour groups on printed documentation.

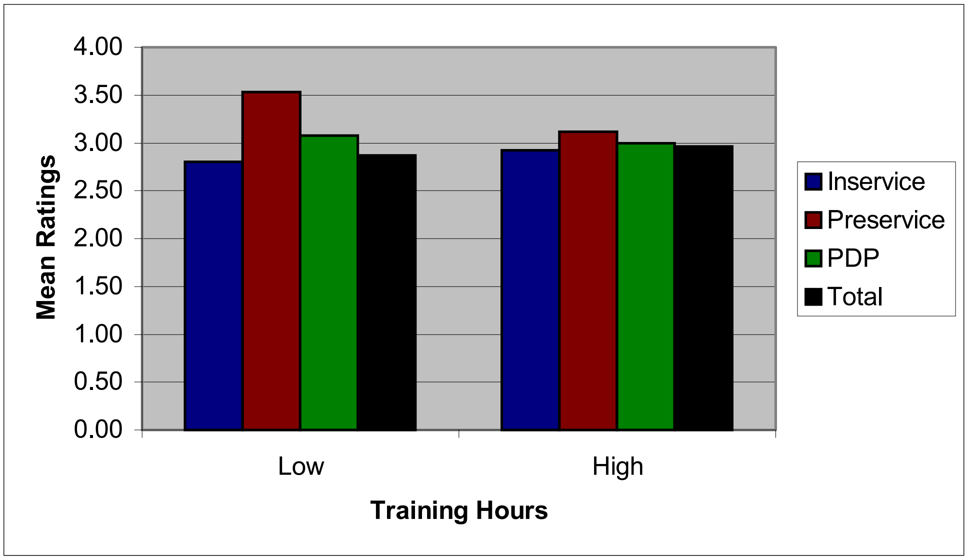

Figure 9. Effectiveness of printed documentation categorized by number of training hours for all educator types.

Analysis of Hypothesis 4

> Hypothesis 4: There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external).

Hypothesis 4 was tested by carrying out two MANOVA procedures, one including the educators with a low locus of control score and one with educators with a high locus of control score. The locus of control variable was dichotomized into low and high based on Rotter's median of 12. According to Rotter, a person with a locus of control score of 12 has characteristics of both an internal and an external. A score from 1-11 indicates an internal locus of control, and 13-23 exhibits characteristics of an external.

For this study, educators with a locus of control score below 12 represent the low category. The high category represents those educators with a locus of control score greater than 12. The frequency distribution for locus of control for all educator types is provided in Table 19 and graphically displayed in Figure 9. A summary of the means, standard deviations, and effect size for each educator type is presented in Table 20.

Table 19

Locus of Control Scores for All Educator Types Combined

Locus of control score	Frequency	Percent	Cumulative percent
2	8	1.1	1.1
3	21	2.8	3.8
4	29	3.8	7.6
5	57	7.5	15.2
6	53	7.0	22.1
7	57	7.5	29.6
8	85	11.2	40.8
9	79	10.4	51.3
10	97	12.8	64.0
11	51	6.7	70.8
12	70	9.2	80.0
13	40	5.3	85.2
14	43	5.7	90.9
15	32	4.2	95.1
16	18	2.4	97.5
17	8	1.1	98.6
18	5	.7	99.2
19	1	.1	99.3
20	5	.7	100.0
	Mean	9.48	
	Standard deviation	3.58	

Note. *N*=759. 1=*very internal* to 23=*very external*.

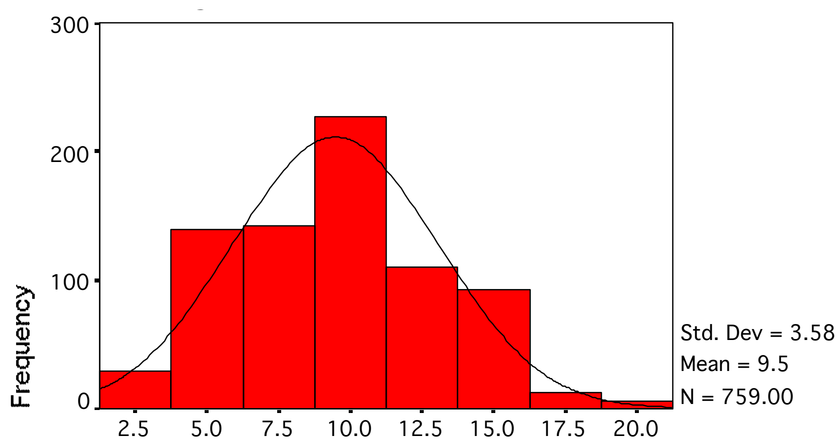

Figure 9. Histogram showing the locus of control scores for all educator types.

Table 20

Training Method Perceived Effectiveness for the Low Locus of Control Educator Group and the High Locus of Control Educator Group

Preservice Internals (*n*=51) versus Preservice Externals (*n*=25)

	Internals		Externals		ES
Methods	Mean	St. Dev.	Mean	St. Dev.	
Credit courses	4.37	.82	4.16	1.07	.11
Peer support	4.16	.86	4.16	1.07	0
Tech support	4.14	.98	3.96	1.31	.08
Comp. Labs	3.69	1.12	3.96	1.17	.10
Trial/Error	4.10	.88	3.92	1.00	-.12
Workshops	3.63	.98	3.68	1.07	.12
Online help	3.63	.89	3.36	1.25	-.03
Printed docs	3.29	1.27	3.16	1.34	.05

(table continues)

Table 20 *(continued)*

Inservice Internals (*n*=471) versus Inservice Externals (*n*=122)

Methods	Internals Mean	Internals St. Dev.	Externals Mean	Externals St. Dev.	ES
Tech support	4.28	1.00	4.02	1.16	.12
Peer support	4.28	.87	3.95	.99	.15
Credit courses	3.86	.99	3.84	1.04	.01
Trial/Error	3.73	1.20	3.82	1.14	-.04
Workshops	3.59	1.14	3.05	1.21	.22
Comp. Labs	3.36	1.26	3.14	1.17	.09
Online help	3.03	1.21	2.89	1.17	.06
Printed docs	2.85	1.33	2.93	1.42	-.03

PDP Internals (*n*=15) versus PDP Externals (*n*=5)

Methods	Internals Mean	Internals St. Dev.	Externals Mean	Externals St. Dev.	ES
Tech support	4.87	.35	4.20	1.30	.33
Peer support	4.53	.83	4.80	.45	-.20
Credit courses	4.47	.83	4.40	.55	.05
Trial/Error	4.27	1.16	3.80	1.30	.19
Comp. Labs	4.07	1.22	4.00	.00	.04
Workshops	4.00	1.07	4.00	.71	0
Online help	3.33	1.18	4.20	.45	-.44
Printed docs	3.60	1.12	2.60	.89	.44

The first MANOVA procedure was performed, for educators with a locus of control score less than 12 (low), with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As shown in Table 14, the preservice, inservice, and professional development personnel (in the low locus of control category) differed at the .05 level ($p<.0005$) in their ratings of perceived effectiveness across the eight training methods.

Table 21

Comparison of Effective Training Methods and Educator Type and Locus of Control Score < 12

Between-subjects factors

Group	Value label	*n*
3.00	Inservice	471
4.00	Preservice	51
5.00	PDP	15

Multivariate tests

Effect		Value	*F*	Hypothesis *df*	Error *df*	Significance of *F*
Intercept	Pillai's trace	.917	731.786	8.000	527.000	.000
	Wilks' lambda	.083	731.786	8.000	527.000	.000
	Hotelling's trace	11.109	731.786	8.000	527.000	.000
	Roy's largest root	11.109	731.786	8.000	527.000	.000
GROUP	Pillai's trace	.085	2.919	16.000	1056.000	.000
	Wilks' lambda	.917	2.932	16.000	1054.000	.000
	Hotelling's trace	.090	2.945	16.000	1052.000	.000
	Roy's largest root	.069	4.573	8.000	528.000	.000

*$p < .0005$.

The second MANOVA procedure was performed, for educators with a locus of control score greater than 12 (high), with the eight training methods as dependent variables and educator type (preservice, inservice, professional development personnel) as the independent variable. As displayed in Table 22, the preservice, inservice, and professional development personnel (in the high locus of control category) differed at the

.05 level (p=.036) in their ratings of perceived effectiveness across the eight training methods.

Table 23

Comparison of Effective Training Methods and Educator Type and Locus of Control Score > 12

Between-subjects factors

Group	Value label	n
3.00	Inservice	122
4.00	Preservice	25
5.00	PDP	5

Multivariate tests

Effect		Value	F	Hypothesis df	Error df	Significance of F
Intercept	Pillai's trace	.907	173.364	8.000	142.000	.000
	Wilks' lambda	.093	173.364	8.000	142.000	.000
	Hotelling's trace	9.767	173.364	8.000	142.000	.000
	Roy's largest root	9.767	173.364	8.000	142.000	.000
Group	Pillai's trace	.173	1.692	16.000	286.000	.047
	Wilks' lambda	.830	1.728	16.000	284.000	.041
	Hotelling's trace	.200	1.763	16.000	282.000	.036
	Roy's largest root	.177	3.158	8.000	143.000	.003

*$p < .05$.

Thus, educators scoring both low and high on the locus of control scale yielded significant results. Therefore, the null hypothesis of no differences among the educator types when categorized by locus of control is rejected, and the alternative hypothesis is accepted. Both low and high scoring preservice educators, inservice educators, and professional development personnel on the locus of control scale differed in their perceived effectiveness of training methods for learning technology integration skills. However, the areas in which the differences existed were not identical for the two groups. Both the internal and external (locus of control score) preservice, inservice, and professional development personnel differed significantly on computer labs, and online help, and did not differ on technical support and peer support. The internal educators did differ significantly on credit courses, printed documentation and trial and error, whereas the externals did not. Figures 10-12 show the means for credit courses, printed documentation, and trial and error for educators with both an internal and external locus of control.

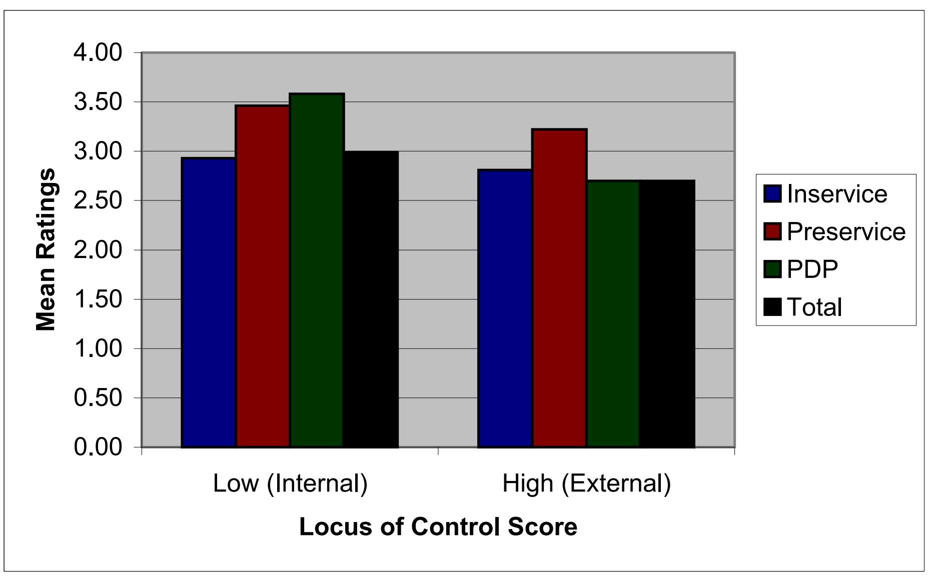

Figure 10. Effectiveness of credit courses categorized by locus of control score hours for all educator types.

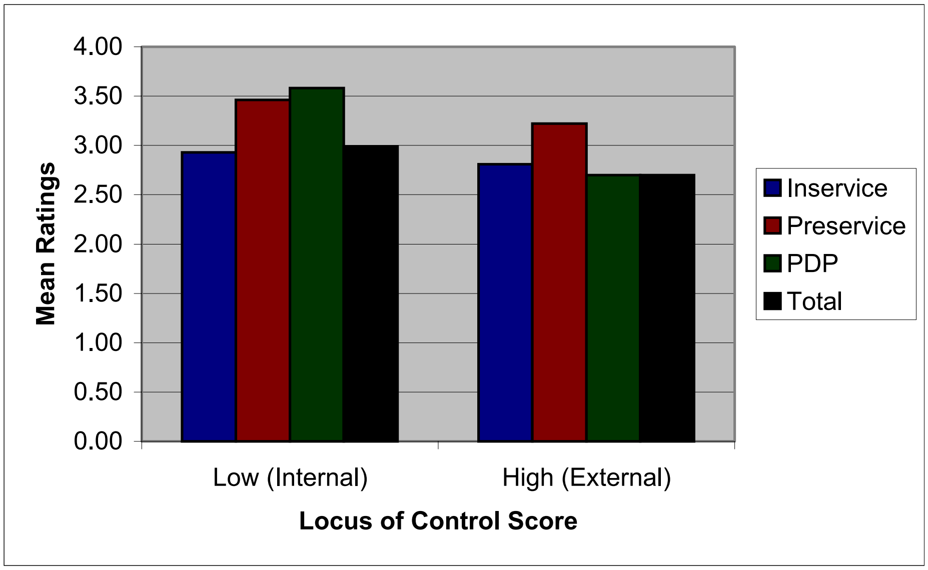

Figure 11. Effectiveness of printed documentation categorized by locus of control score hours for all educator types.

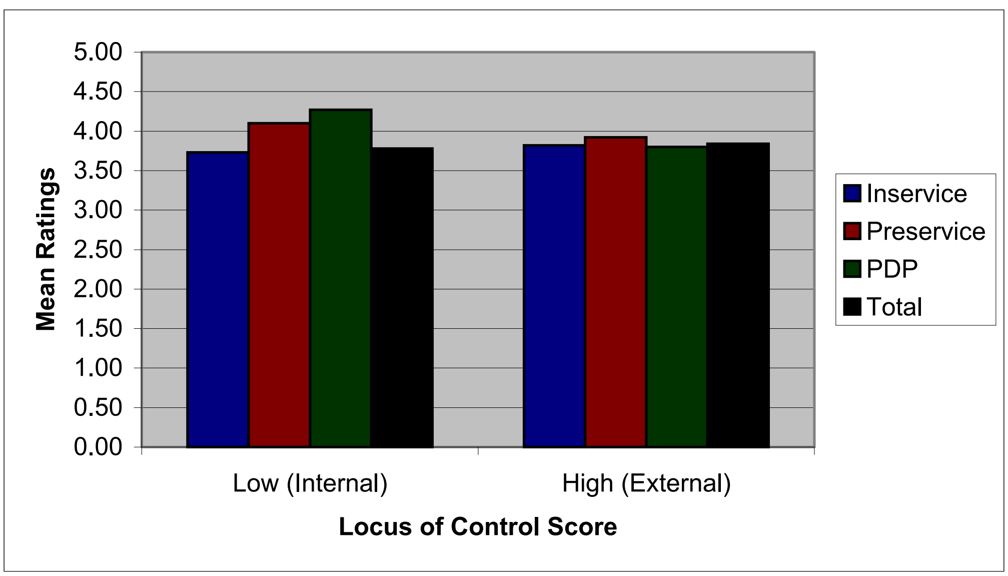

Figure 12. Effectiveness of trial and error categorized by locus of control score hours for all educator types.

Summary

This study examined preferences for learning technology integration skills among preservice educators at the University of North Texas, inservice educators at Allen ISD, Coppell ISD, and Frisco ISD, and professional development personnel from Allen ISD. The following null hypotheses were tested:

1. There will be no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills.
2. There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by age.
3. There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction.
4. There will be no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external).

The demographic data presented in Tables 2-5 included: return rate, gender, highest degree received, and years of teaching experience. Sixty percent of the preservice educators, 31% inservice educators, and 81% of the professional development personnel completed the surveys. Of the completed surveys, 87.2% were from female educators and 12.8% were from male educators. Eighty-seven percent of the educators indicated possessing a bachelor's or a master's degree. Teaching experience ranged from zero years to 39 total years, with a mean of 9.98.

The preservice, inservice, and professional development personnel, combined as one entity, differed at the .05 level ($p < .0005$) in their ratings of perceived effectiveness across the eight training methods. Furthermore, when categorized by age, training hours, and locus of control score, the preservice, inservice, and professional development personnel differed significantly ($p<.05$) in how they perceived the effectiveness of the eight training methods. Thus, the testing of Hypotheses 1-4 all revealed significant results at the .05 level. All null hypotheses were rejected. All groups differed on their perceived effectiveness of training methods as a whole and when categorized by age, training hours, and locus of control.

Further analysis of the trends of the data showed a similar pattern for preservice educators and inservice educators with respect to credit courses and workshops–both educator types perceived these avenues as less useful then professional development personnel. By contrast, preservice and professional development personnel have similar views in the areas of online help, printed documentation, and trial and error–both educator types perceived these as more effective than inservice educators perceived them.

CHAPTER 5

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This study adds to the body of research regarding methods for training educators to use technology in the curriculum. Educators using a technology-integrated curriculum will adequately prepare students to function in a technological society. It is evident by the increase in technology hardware that the education arena believes in the importance of utilizing technology; however, the training of educators to use these resources in the curriculum is lacking. The National Education Agency (1998) reported that 50% of teachers were not properly trained in integrating technology. In addition, the majority of the training covered basic computer operation, not how to integrate technology into the curriculum. In 2001, the National Center for Educational Statistics (2001) stated that only 20% of the teachers surveyed felt “prepared” to use technology in the classroom. Training educators to integrate technology is a necessity, but how to effectively and efficiently accomplish this task is in question.

Summary of Findings

This study attempted to determine which training methods educators perceived as most effective for learning technology integration skills in order to provide insight into designing optimal educator training programs. The following null hypotheses were analyzed:

1. There is no overall significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel the regarding effectiveness of different methods for learning technology integration skills.
2. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by age.
3. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by hours of instruction.
4. There is no significant difference in the perceptions of preservice educators, inservice educators, and professional development personnel regarding the effectiveness of different methods for learning technology integration skills when categorized by locus of control (internal vs. external).

A multivariance of analysis (MANOVA) was performed for each research question using alpha=.05 as the criterion for rejection of the null hypotheses. Research question 1 examined whether there were significant differences among preservice, inservice, and professional development personnel in their perceived effectiveness of certain types of training methods for learning technology integration skills. A significant difference was found, and post hoc tests revealed that the differences were found in the areas of credit courses, computer labs, technical support, online help, and printed documentation. There was no difference in perceptions of workshops, peer support, and trial and error across all educator types.

Research question 2 asked whether there were significant differences among preservice, inservice, and professional development personnel in their perceived effectiveness of certain types of training methods for learning technology integration skills when categorized by age. As described in the discussion of Hypothesis 2, independent MANOVAs for both younger educators (< 36) and older educators ($\geq$ 36) confirmed significant differences across all training methods for both groups. However, the areas in which the differences occurred were not identical for the two groups. The preservice, inservice, and professional development personnel differed significantly in technical support and peer support if they were older, but if they were younger they did not. Specifically, technical support and peer support were rated highest by the older professional development personnel followed by the inservice and then preservice educators. There was no significant difference between technical support and peer support within the younger educators. These methods averaged 4.17 and 4.06 on a scale of 1 to 5, respectively. The younger preservice, inservice, and professional development personnel differed significantly on their perceived effectiveness of workshops, online help, and printed documentation whereas the older group did not. In particular, the preservice educators ranked the workshops, online help, and printed documentation the highest. No obvious pattern emerged that would distinguish the younger educators from the older educators.

Research question 3 examined whether there were significant differences between preservice, inservice, and professional development personnel in their perceived effectiveness of certain types of training methods for learning technology integration skills when categorized by training hours. As described in the discussion of Hypothesis 3, independent MANOVAs for educators with low training hours and educators with high training hours confirmed significant differences across all training methods for both groups. However, the areas in which the differences emerged were not identical for the two groups. The preservice educators, inservice educators, and professional development personnel in both groups differed significantly in credit courses and online help. The educators with a high number of training hours differed significantly on technical support but the educators with a low number of training hours did not. The educators with low training hours differed significantly on printed documentation, whereas the educators with high training hours did not.

Research question 4 asked whether there were significant differences among preservice, inservice, and professional development personnel in their perceived effectiveness of certain types of training methods for learning technology integration skills when categorized by locus of control score. As described in the discussion of Hypothesis 4, independent MANOVAs for educators with a low (internal) locus of control score and educators with a high (external) locus of control score confirmed significant differences. However, the areas in which the differences existed were not identical for the two groups. Both the internal and external (locus of control score) preservice, inservice, and professional development personnel differed significantly on credit courses, computer labs, and online help, and did not differ on workshops, technical support, and peer support.

Trends Across Preservice, Inservice, and PDP Types of Educators

Although the educators in this study were not significantly different for all types of training methods, examining trends in the data provided additional insight. The inservice educators ranked all but three training methods the lowest. The preservice educators rated all training methods higher than the inservice educators except for technical support and peer support, and classified credit courses basically the same. However, technical support and peer support were the two highest ratings among the educators as a whole. It is conjectured that the educators ranked technical support and peer support the highest because this kind of training is the quickest and most immediate for educators with limited time. In addition, one-on-one assistance from a technical personnel or a colleague is comforting when utilizing something new. Credit courses received the third highest ranking as a whole, but were the top choice for preservice educators. Credit courses offer more than just a one-shot training opportunity, in addition to, educator networking and one-on-one help. It is enlightening to see that preservice educators ranked the current main avenue for providing them training as the most effective method. The bottom two training methods selected by all educator types were printed documentation and online help. Thus, searching and reading training materials is not perceived as being effective by educators regardless of whether they are preservice, inservice, or professional development personnel. Interestingly, the inservice educators ranked the effectiveness of computer labs and workshops as fifth and sixth out of eight choices. These training methods are frequently employed in schools, and thus alternate training methods for inservice educators are suggested. The professional development personnel selected every training method as being effective, by rating all of the methods high with the lowest being printed documentation (mean=3.18). Perhaps the professional development personnel are so well versed in training that they perceive all of the methods to be effective at certain times or in particular situations. Graphical representations of trends among educator types are displayed in Figures 13 and 14.

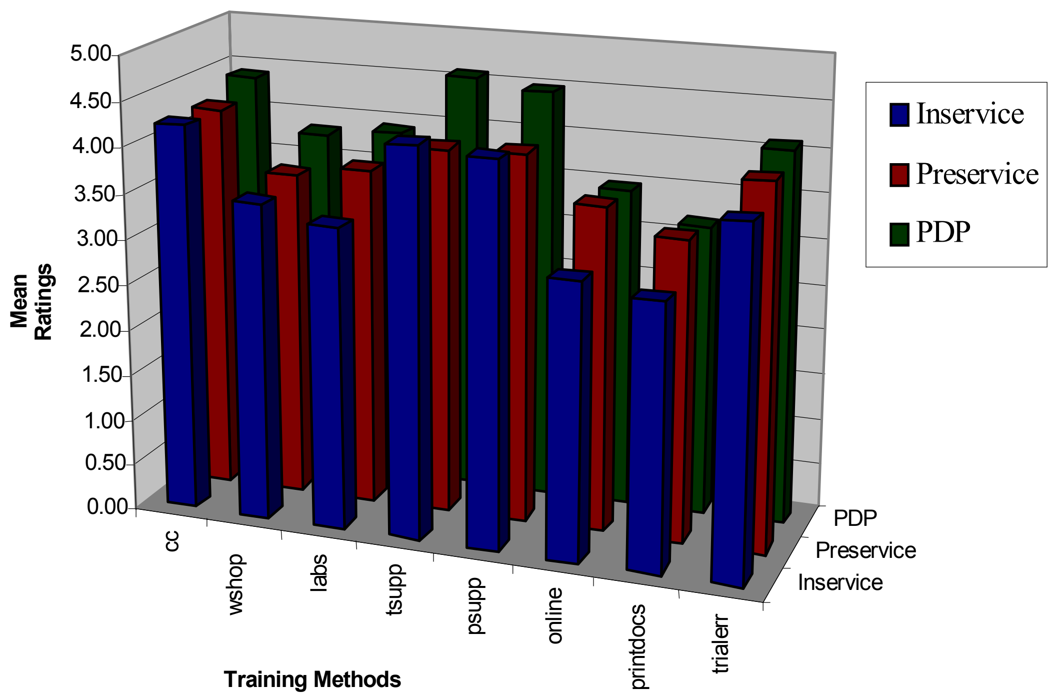

Figure 13. Bar graph showing training methods trends for three educator types.

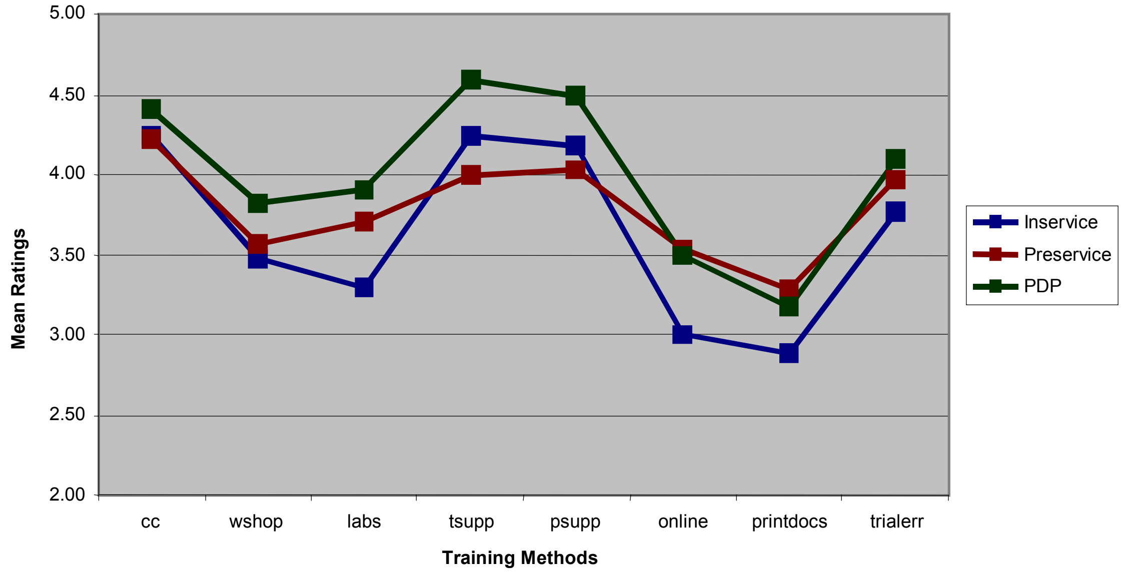

Figure 14. Line graph showing training methods trends for three educator types.

As shown in Figure 14, the patterns of preferences appear to be similar for preservice educators and inservice educators with respect to credit courses and workshops–both educator types perceived these avenues as less useful then professional development personnel. By contrast, preservice and professional development personnel have similar views in the areas of online help, printed documentation, and trial and error–both educator types perceived these as more effective than inservice educators perceived them.

<u>Training Hours</u>

Printed documentation ranked the highest by preservice educators, followed by professional development personnel, and then inservice educators in the low training hour group. Perhaps preservice educators rate this method high since a time-consuming job is not prohibiting them from using this resource. In addition, having low training hours might require these preservice educators to read printed documentation to complete assignments.

For the higher training hours group, the professional development personnel rated technical support significantly higher than did the preservice educators. Specifically, all of the professional development personnel with high training hours rated technical support as very effective (mean=5.00). This resource is a quick fix for a majority of technology issues in the K-12 environment. Perhaps professional development personnel with many training hours are already skilled in basic computer operation and integration and thus consulting with technical support personnel would yield more effective results for higher-level technology issues. More research is needed in this area.

The means for the effectiveness of technical support by preservice educators and professional development personnel, categorized by low and high training hours, are presented in Figure 15. In general, trends that emerged when distinguishing the educators with low and high numbers of training hours appeared with printed documentation and technical support. For all other training methods, differences across preservice, inservice, and professional development personnel were consistent for the educators with low and high training hours.

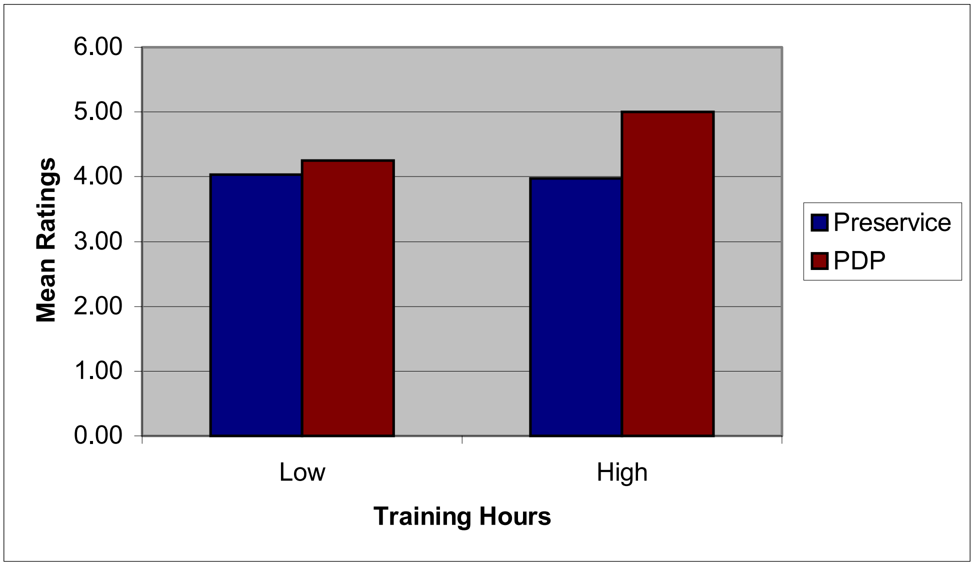

Figure 15. Effectiveness of technical support categorized by number of training hours for preservice educators and professional development personnel.

Locus of Control

In printed documentation and trial and error, the inservice educators with an internal locus of control scored these methods the lowest, followed by the preservice educators and professional development personnel (Figures 11 and 12, p. 64). Perhaps the time constraints in a K-12 educator's schedule does not allow for this method to be effective. An internal locus of control person takes responsibility for learning, and thus, these self-directed methods would seem effective for these types of educators. However, the inservice educators scored them significantly lower.

Congruence of Findings with Previous Studies

Guhlin and Marczely (1996) stressed the importance of learner preferences in designing training. They reported the need for a variety of personal options for educators and the involvement of educators in the planning of technology training to assure needs were being met. In addition, many authors stated the need for training to be flexible in content and delivery (Browne & Ritchie, 1991; Harvey & Purnell 1995; Stager 1995). The results of this study demonstrated that learner preferences are indeed different and thus considering this before implementing training is important. There were significant differences in the perceived effectiveness across the eight training methods among preservice educators, inservice educators, and professional development personnel. Thus, the all of the educator types perceived certain methods over others as effective for learning technology integration skills.

Benson (1997) and Poole & Moran (1998) reported on the ineffectiveness of workshops in transferring skills to the classroom. Several authors stated the need for training to be long-term (e.g., follow-up training, yearly plans) and continuous (Harvey & Purnell, 1995; Roblyer & Edwards, 2000; Shelton & Jones, 1996). In this study, credit courses (long-term) and workshops (short-term) differed significantly ($p<.05$) in their perceived effectiveness by preservice educators, inservice educators, and professional development personnel. Specifically, credit courses were ranked significantly higher in perceived effectiveness over workshops.

Adler (1996) found that 39% of older adults taught themselves how to use computers and 21% learned on the job. The remainder (40%) learned from a class or a friend. In addition, those who categorized themselves as "beginners" were more likely to have learned by taking a class. The “experienced” adults tended to educate themselves or learned at work. In this study, looking at the age 55 and older educators, the top 4 choices were peer support, technical support, credit courses, and workshops. These methods corresponded with Adler's study in that the majority of older educators preferred to learn from a friend or in a classroom setting. The fifth preferred method of learning technology integration skills by older educators was trial and error. This also relates with Adler's study in that 39% or the second highest grouping, taught themselves how to use a computer. However, when dividing the older educators into beginner (< eight hours of training) and experienced (> eight hours of training), there was not a difference in perceived effectiveness of training methods. Both the beginners and experienced older educators perceived peer support and technical support, followed by credit courses, as being the most effective methods for learning technology integration skills.

Cook (1997) and Dille and Mezack (1991) reported that older students were more likely to choose an online version of a course compared to the traditional classroom setting. Students who chose the traditional classroom format tended to be between the ages of 20 and 22. After age 20, the choice in delivery for the face-to-face format decreased by 10% every 2 years. For this study, looking at the educators who were between the ages of 20 and 22, the top preferred method for learning technology integration skills was credit courses. Similarly, at age 23, the top preferred method switched to technical support and credit courses dropped to the fourth choice. Credit courses stayed at this position until age 46 where it moved up to third. Because online course delivery was not an option on the survey for this current study, further comparisons were not possible.

According to the U.S. Equal Employment Opportunity Commission, the Age Discrimination Act of 1967 places a person in an older-aged category at age 40. Thus, a follow-up analysis for Hypothesis 2 using age 40, instead of age 36 as the dichotomization point for high versus low age, was carried out. As with Hypothesis 2, a MANOVA performed on the younger group yielded significant differences between preservice, inservice, and professional development personnel.

A corresponding MANOVA was performed for the educators older than age 40. No significant difference was found, however, the number of educators was so small in this group, that the procedure is not deemed an accurate measure for the hypothesis. The means for the older than 40 group, however, did show the same pattern as categorizing the groups by age 36. Thus, when categorizing the educators using age 40, there still was a significant difference among the younger educators, while the older educator group did not have a high enough *n* for all three educator types to justify the non-significant result.

Zandri and Charness (1989) found that the best training method for older adults was in a self-paced environment with a partner. In this current study, older adults perceived peer support as the most effective method for learning technology integration skills. Thus, having a partner (e.g., peer support) is a preferred method by older adults in this study as well.

NCES (1999) stated teachers with more than eight hours of technology integration training were more likely to assign students work involving the use of a computer. Persky (1990) showed that using technology takes hours of training to see change in the classroom. Twenty-three case studies revealed a significant change in the teachers' use of technology in the classroom after three years of training. A 10-year study on technology integration, the ACOT project, showed a significant change toward a technology-integrated classroom after four years of initial and follow-up training (Dwyer, 1994). This study found similar results. When looking solely at the inservice educators, there was a significant difference (*p*<.0005) between low and high number of training hours and the amount of time that students used the computer for assignments in the classroom. Specifically, those inservice educators with more than eight hours of training gave significantly more work to their students using a computer.

Cook (1997) revealed that students with an internal locus of control tended to choose the online course design over the traditional face-to-face format. For this current study, credit courses ranked equally by both internal and external locus of control educators. Thus, both groups felt that credit courses were equally effective for learning technology integration skills. Interestingly, the only significant difference between internal and external locus of control educators was in the workshop method. Internals felt that workshops were significantly (p<.0005) more effective for learning technology integration skills. This finding was not congruent with the research that stated an individual with an internal locus of control tended to favor self-directed learning methods over the traditional classroom format. Further comparisons were not possible since online course delivery was not a training method option on the survey for this current study. Davis (1997) reported that undergraduate agriculture students at Cornell University selected trial and error, credit classes, and peer support as the most effective methods for learning computer skills. Computer lab assistance received the lowest rating. S. Tiu (personal communication, December 6, 2000) found that freshman students at Meredith College preferred “faculty assistance” as the best method to acquire computer skills. On the other hand, sophomores, juniors, and seniors ranked “trial and error” and “peer support” as most effective. Of the 97 preservice educators in this current study, credit courses and peer support were in the top 3; however, trial and error was not. Faculty assistance was not an option on this current survey, however, technical support was and it ranked third. In addition, computer lab assistance ranked fifth out of eight choices and printed documentation received the lowest rating.

McCullen (2002) revealed that Lubbock Independent School District allowed for selective training methods. Training alternatives included taking a course, or an online tutorial, or reading a manual. These methods were congruent with findings from this study. There were significant differences in the perceived effectiveness of different training methods by preservice educators, inservice educators, and professional development personnel. Thus, providing educators with a variety of training options will yields the best results.

The 1999 FRSS revealed that 93% of currently practicing educators preferred independent learning as the medium for learning classroom technology integration. The next two training methods were staff development sessions (88%) and learning via colleagues (87%). For this current study, inservice educators rated technical support as the most effective method for learning technology integration skills. The first independent learning method, trial and error, ranked forth out of eight choices. This was not consistent with the results from the FRSS. Possibly, the educators surveyed by FRSS preferred independent learning to other methods in the interest of time, but may not necessarily deem it as effective. Peer support was congruent with the research as it ranked second in this current study as well as with FRSS.

NCES (2000) reported that educators with three or fewer years of experience were more likely than the more experienced educators to cite college courses as preparing them successfully for using technology in the classroom. For this study, the educators with three or fewer years of experiences also perceived credit courses as more effective than the educators with more than three years of experiences. However, the differences between the two groups were not significant.

Conclusions

The integration of technology into the K-12 curriculum is a necessity in the classroom in order to provide a rich environment for the continued success of students. In order to achieve this goal, educators need adequate training with follow-up and continuous support. Whether training preservice educators, inservice educators, or professional development personnel, examining their perceived effectiveness of training methods is important. A needs assessment would provide a blueprint for the training methods that educators desire, and would also provide the best means for effective transfer to the classroom. Examining the educator types as one entity as well as individually indicates that technical support, peer support, and credit courses are top choices for effectively learning technology integration skills. This supports the belief in continuous and follow-up and/or mentor training. Credit courses should continue to be required for preservice educator programs and provided for inservice and PDP as well. Technical support personnel should be available for all educator types, whether in the university setting or in a school district. In addition, implementing a mentoring program would foster peer collaboration and support and ultimately the use of technology in the classroom. These methods are more effective ways to spend funds for training educators in using technology in the curriculum. According to this study, educators do not perceive current, widely used methods such as workshops, computer labs, and printed documentation as being effective. Thus, educator training should be revamped to include the methods that the educators themselves have affirmed as effective for learning technology integration skills. This will assure an integrated curriculum that prepares students for a technological society.

Categorizing the educator types into age, training hours, and locus of control provides further insight into the great diversity of the methods that are deemed effective by the groups. However, in this study, an educator's age, amount of training hours, and locus of control score does not appear to provide the best insight into training preference. It is the type of educator that is important when designing technology integration training.

Recommendations

Based on the process and results of this study, several recommendations are offered for individuals involved with training educators to use technology.

1. After considering type of educator, conduct a needs assessment to determine preferred training method or methods. Offer a variety of training formats in order to benefit all educators.
2. Provide technical personnel for educators as a means for providing just-in-time training and arrange peer collaboration through a mentor program because peer support and technical support were the top two training methods chosen. In addition, provide and require follow-up and continuous training sessions because the research reflects this need and credit courses were ranked as a top choice.
3. Limit workshops training methods in the inservice arena, because inservice educators do not deem them as effective.
4. Solicit evaluation feedback on every training session in order to continue to improve the training.

Based on the process and results of this study, several recommendations are offered for future studies involving technology integration training.

1. Conduct the same study using a larger preservice population extending beyond the University of North Texas in order to validate the findings of this study with a larger sample size and acquire comparable data with preservice educators outside Texas universities.
2. Conduct the same study using a larger professional development personnel (or other similar personnel job title) population extending beyond the Allen Independent School District since the sample size in this study was small (n=22) and to validate the findings of this study and to study trends more closely.
3. Provide a follow-up study that utilizing a pre-post design. This study will provide training to educators based on a needs assessment. After the training, the survey would be given again to determine if the training methods were still rated as the first time.