TEACHER PERCEIVED IMPACT OF TECHNOLOGY ON ELEMENTARY CLASSROOMS AND TEACHING

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CONNIE M. CRANE

Dr. Dan Cockrell, Dissertation Supervisor
Dr. Jerry Valentine, Dissertation Supervisor

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The undersigned, appointed by the Dean of the Graduate Faculty, have examined a dissertation entitled:

TEACHER PERCEIVED IMPACT OF TECHNOLOGY ON ELEMENTARY CLASSROOMS AND TEACHING

presented by CONNIE MARIE CRANE a candidate for the degree of DOCTOR OF EDUCATION and hereby certify that in their opinion it is worthy of acceptance.

Dr. Jerry Valentine, Co-Advisor
Educational Leadership & Policy Analysis

Dr. Dan Cockrell, Co-Advisor
Educational Leadership & Policy Analysis

Dr. Jay Scribner
Educational Leadership & Policy Analysis

Dr. Karen Cockrell
Educational Leadership & Policy Analysis

Dr. George Petersen
Educational Leadership & Policy Analysis

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Connie M. Crane

Dr. Dan Cockrell — Dissertation Supervisor
Dr. Jerry Valentine — Dissertation Supervisor

ABSTRACT

Issues surrounding technology integration are varied. Over the last decade, the presence of technology in elementary classrooms has increased; however, research indicates that many teachers are not utilizing these resources effectively. Although research supports the notion that technology in the classroom has an influence on student learning, research also points to the teacher as an important lynch pin in technology integration in the curriculum (Mandell, Sorge, & Russell, 2002).

The purpose of this study was to investigate how technology is used and integrated into the elementary curriculum and to explore the influence of technology on student success. The study focused primarily on the teachers' knowledge and skill levels in using and integrating technology into the curriculum and on professional development opportunities in the area of technology use and integration provided to teachers. Using a mixed method comparative design, data were generated from teacher surveys and focus group and individual interviews.

Data from the survey questionnaire were analyzed using descriptive statistics. A t-test was used to determine if there was a significant difference between the groups of teachers, including those from a non-technology school and those from a technology school who teach in non-technology and technology classrooms. Focus group and

individual interview data were analyzed in order to identify patterns and topics of belief, values, and practices related to the teachers' classroom technology use.

The two schools in this study were an elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program. The following subgroups of teachers from the schools were included in the study:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

The findings revealed significant differences between teachers' perceptions of their roles and responsibilities for integrating technology, the influence of technology on student success, and the type of professional development activities conducted. With the eMINTS grades 3-6 versus Non-eMINTS grades K-6 analysis at the technology school, there was a significant difference in beliefs and reality of the teachers. Non-eMINTS teachers perceived greater external pressure to use and integrate technology in the classroom; whereas, the eMINTS teachers in grades 3-6 identified a greater ideology about, competence level in, and resources available for technology. Differences in perceptions about professional development were also found.

Qualitative findings for this study revealed three primary themes that appear to be essential to understanding the use and integration of technology in elementary classrooms and the influence of technology on student success. Those primary themes include: (1) barriers to technology integration; (2) importance of technology training; and (3) learning environment.

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CHAPTER 1

Introduction to the Study

Nearly 50 years ago, with the Soviet's launch of Sputnik, the United States was suddenly scrambling to reclaim its place as a leader. One stride towards this revitalization was a strong commitment and investment in public education (Berends, 2004). During the 1960s and 1970s decade, school research revealed the lack of equal opportunities for individuals; this lack of opportunities resulted in the Civil Rights Act of 1964. Students' test scores had declined and compared poorly with students in other countries. Recognizing the frustrations caused by academic deficiencies, the National Commission on Excellence in Education (1983) published A Nation at Risk, and recommend that state governments increase high school graduation requirements, adopt higher measurable achievement standards, increase the time students engaged in learning, and develop higher standards for teacher preparation and professional growth. This report noted that the United States was falling behind other competitors and called for school reform (Nystrand, 1992).

During the 1980s and 1990s, restructuring schools research became a focus of reform and emphasized more rigorous and measurable standards (Berends, 2004). The aim was to provide clear academic expectations for all students and the entire educational system. As a result, individual states endorsed the standards movement, and Missouri created the Missouri Assessment Program (MAP) and Show-Me Standards (Missouri Department of Elementary and Secondary Education, 2000).

With more than two decades of educational reform efforts since the release of A Nation At Risk, students and schools remained deficient in reaching higher standards, and this deficiency prompted the passage of Goals 2000. Goals 2000 established a framework for identifying standards and measuring student progress to improve student academic achievement (Goals 2000, 1994). Then in 2002 the No Child Left Behind Act (NCLB) containing the most sweeping changes in federal law effecting education was signed into law. One aspect of NCLB, a government mandate establishing significant accountability measures for public schools by the year 2014, focused on the integration of technology into classrooms to improve teaching and learning.

Technology is revolutionizing much of the way the world operates (Falba, et al., 2001). Workplaces are changing, employment skills are shifting, and new knowledge is required to accommodate this rapid infusion of technology. People are required to learn new ways to relate to different information sources and to communicate globally, as well as locally (U.S. Congress, Office of Technology Assessment, 1995).

In the school setting technology, electric educational tools such as computers, laptops, audiovisual equipment, digital cameras, graphing calculators, scanners, projectors, and printers, is a rapidly increasing education resource that has the potential to transform learning by creating an optimum teaching and learning environment. The availability of technology and the Internet has increased significantly in the nation's schools and classrooms (Williams, 2000). Technology is available in almost every classroom in the United States, with 98% of schools and 77% of classrooms connected to the Internet (NCES, 2001). With all this connectivity in schools, teachers must be trained to create technology rich learning environments for students (Anderson & Becker, 2001).

A 1998 survey found that while students, teachers, and parents agree on technology's potential to make substantial improvements in education, technology has not been fully integrated into the learning process (Schroeder, 1999). Thirty percent of teachers in grades four through twelve use technology for administrative tasks or do not use technology at all (Becker, 1999).

National, state, and local initiatives have provided schools with computer hardware and software, allowed schools and classrooms to connect to the Internet, and supported technology-focused professional opportunities for teachers (Coley, et. al., 1997; U.S. Department of Education, 1996). These initiatives are aimed toward understanding how best to use technology to improve teaching and learning as well as training educators to effectively use technology (Williams, 2000).

Conceptual Framework

Technology is not a panacea; it is a means used by teachers to improve and enhance instruction (Mandell, Sorge, & Russell, 2002). A significant responsibility of education is the preparation of students for the future; therefore, educators must teach students to use technology to succeed in today's world (Morrow, et al., 2002).

Teaching with technology requires a shift from the traditional teaching practice. In order for technology to transform teaching and learning, the teacher's role must be redefined, and existing teaching practice must change (Wiburg, 1997). "To make real changes in classrooms, so that technology is truly used each day as a thinking, creative, and research tool, requires significant work in changing instructional approaches, assessments, and management strategies" (Wiburg, 1997, p. 181).

According to the Office of Educational Technology (OET), technology enables accountability and leadership to transform education, improves equality and increases student access to learning (MO DESE, 2002; MO DESE, 2003; OET, 2003). As noted in the Technology Policy Brief of WestEd (2002), the use of technology can have a transformative effect on education by redefining teacher and student roles. Teachers become coaches and collaborators rather than dispensers of knowledge. Students take charge of their learning and construct knowledge.

Mandell, Sorge, and Russell (2002) also supported the notion that technology can provide students with opportunities to discover and create knowledge thereby permitting teachers to take on the role of facilitators. Educators using technology help students learn how to learn and provide them with a valuable skill more important than the imparting of factual information.

Mann and Shafer (1997) found that when technology was introduced in the classroom, profound effects on achievement were observed. In conducting an extensive study of 55 New York state school districts Mann and Shafer compiled and analyzed data from 4,041 teachers, 1,722 students, 159 principals, and 41 superintendents to find out how the investment in technology affected student achievement. Results indicated that schools with more instructional technology and teacher training experienced increased student achievement. At the elementary level significant gains were made on the state's Comprehensive Assessment Report in sixth-grade math. High school students also reported a 42 percent variation with the addition of technology on the state college preparatory exam in math and a 12 percent variation with the addition of technology on the state college preparatory exam in English.

According to Page (2002), students in technology-enriched classrooms appeared to score significantly higher in mathematics achievement than their peers in non-technology-enriched classrooms. Page's study consisted of 211 students of low socioeconomic status and of various backgrounds, races, and ability levels from 10 Louisiana classrooms (five technology-enriched environments and five without technology). Therefore, incorporating technology is no longer a special effect or idea; it is a necessity for today's and tomorrow's world. (Morrow, Barnhart, & Rooyakkers, 2002).

Research on one program, Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS), compared the results of the 2004 Missouri Assessment Program (MAP) for 4,322 third and fourth grade students in 40 school districts. The eMINTS Evaluation Project (2005) revealed significant differences between eMINTS and Non-eMINTS schools. Students scored higher in communication arts and mathematics in eMINTS classrooms versus students in Non-eMINTS classrooms.

However, as schools and districts increasingly invest in new technologies, the actual use of technology in classrooms remains meager (Mouza, 2002/2003). The mere presence of technology in classrooms is no assurance that teachers use technology to support and promote the curriculum they teach. As schools and their communities rush to provide students with access to technology, the vital issue of implementation is largely overlooked. Technology access does not immediately equal implementation of technology (Smith & Robinson, 2003). As quoted by Schroder (1999), "We have spent millions of dollars on educational technology, but have not yet seen much of a return on this investment" (p.76).

For technology to become a core component of teachers' instructional repertoire, teachers need time to explore, reflect, collaborate with peers and engage in hands-on learning. (WestEd, 2002). Teachers need to be taught how to use technology to deliver instruction (White, Ringstaff, & Kelley, 2002; Albee, 2003; WestEd, 2002).

Technology needs to be integrated as a tool so that curriculum and student needs drive technology, not the reverse (Dockstader, 1999; Wolosoff, 1998; Mann & Shafer, 1997; Harvey & Purnell, 1995). Research has indicated that many teachers do not feel prepared to integrate technology into their classroom instruction (Charp, 2003). Smith and Robinson (2003) found that because of an absence of technical skills, teachers become frustrated quickly. Teachers often feel uncomfortable using technology and are unaware of the teaching and learning pedagogies that technology and the Internet are able to support (Mouza, 2002/2003). In particular, teachers' beliefs about their ability to use technology in instruction may be key (Ertmer, et al., 2003).

For teachers to be able to effectively integrate technology with instruction, extant literature points to the fact that teachers need to integrate technology with their personal lives (Nisan-Nelson, 2001). When teachers know how to use and then actually do use all the tools at their disposal, the potential for student learning is also increased (Mills & Tincher, 2003).

Results of research on use of technology have also indicated that teachers must be supported as they introduce technology and must be sufficiently flexible to adapt and integrate technologically based or supported instruction as problems occur. Teachers who lack support and encouragement are likely to abandon a technology-enriched lesson when it goes awry (Hornung & Bronack, 2000). Doersch (2002) states that teachers are willing to try new things if they know they will have help and support when they need it. Armstrong (1996) also discusses the necessity of proper support in a non-threatening environment. In such an environment, teachers are more willing to take a chance and see where technology integration will take them.

Therefore, if teachers are going to embrace technology and integrate it into the elementary curriculum, they need meaningful professional development. Mouza (2002/2003) indicated that professional development is a critical ingredient in effective use of technology in the classroom. Kopp and Ferguson (1996) state that teachers cannot just magically utilize the many facets of technology without training, guidance, and models. Teachers' effective use of technology will make the difference. Clearly, the teacher is the most important ingredient for success in schools using technology (Mandell, Sorge, & Russell, 2002). Professional development sessions in integrating technology into the curriculum and classroom will more effectively enable the teachers to know what technology can do to support and enhance their teaching strategies.

Purpose

The purpose of this study was to investigate the use and integration of technology into the elementary curriculum and to explore the influence of technology on student success. Through a comparative study of two elementary schools in a mid-western state, this study concentrated on the teachers' knowledge and technological skill levels as they integrate technology into the curriculum and on the professional development opportunities in technology integration provided to the teachers.

Research Questions

The overarching question guiding this mixed method comparative study is: Does the use of technology influence student success in elementary classrooms? The following research questions were designed to address this overarching question: (1) What are the teachers' perceptions of their role and responsibility in integrating technology? (2) What are the teachers' perceptions of technology influence on student success? and (3) Are there differences in the professional development related to integrating in elementary classrooms?

Limitations

One school in this study was selected because of the technological interventions present in that school, and the other school was selected because of geographic proximity and demographic similarity with the technology school. This study utilized self-reporting data. Findings of the study are based on the perception data of teachers and the assumption that teachers will respond honestly and interpret the instrument as intended.

Definition of Terms

Cooperative learning. Cooperative learning is a teaching strategy that involves students working together in teams to accomplish a common goal with positive interdependence, individual accountability, interpersonal skills, interaction and group processing (Johnson, Johnson, & Smith, 1991).

Educational technology. Educational technology involves using technological resources to aid in teaching all subjects and is concerned with creating the optimum teaching and learning environment through the use of technology (Dugger, 1999).

Implementation. In this study, implementation means how the teachers and students used technology; how often various technological tools were used; where technology was used; and to what degree or extent was technology being utilized (Dexter, Anderson, & Becker, 1999).

Inservice. Providing opportunities for teachers to learn new educational topics as well as perform activities to enhance their teaching and learning strategies (Ertmer, et. al., 2003).

Integration. Integration in this study was defined as the process of blending technology into curricula disciplines (Pierson, 2001).

Professional development. Professional development is the degree to which teachers value continuous personal development and school-wide improvement. Teachers seek ideas from seminars, colleagues, organizations, and other professional sources to maintain current knowledge, particularly current knowledge about instructional practices (Gruenert, 1998).

Self-efficacy. Self-efficacy refers to personal beliefs about one's capability to learn or perform actions at designated levels (Bandura, 1997).

Student achievement. Student achievement refers to the measure of student learning by means of national and state standardized tests and teacher reports (Colbaugh, 2001).

Student success. Student success refers to an accomplishment or attainment of a desired end (Keeler, 1996).

Technology. For this study technology is the myriad of electronic tools used to enrich the educational experiences of students. It includes, but is not limited to, computers, laptops, audiovisual equipment, digital cameras, graphing calculators, scanners, projectors, and printers (Morrison & Lowther, 2002).

Technology-enriched. Technology-enriched refers to environments that utilize technological resources to assist in the learning process of students while taking notes, producing assignments, and constructing projects (Simms & Knezek, 2001-2002).

Technological fluency. Technology fluency is a combination of the information skills, communication skills, and technology skills necessary to function in a technological environment. (Fulton, K. 1997).

Technology integration. Technology integration is the process of using technology to achieve educational objectives and to cause students to engage in more meaningful learning experiences (Dias, 1999).

Technology training. Teachers expand their repertoire by learning to use word processing, databases, spreadsheets, and presentation graphics to enhance classroom teaching and learning activities (Wilkes, 2000).

Rationale of the Study

More teacher inservice focusing on integrating technology needs to be developed (Smith & Robinson, 2003; Desimone, et al., 2002; Ertmer, et al., 2003). Although, professional development is critical for classroom teachers to successfully integrate technology, extant research has indicated that current teacher training methods often fall short (Lieberman, 1995). Abbott and Faris (2000) cited computer technology components as requisite to teacher education programs, but few programs provide application of technology in instruction.

Educators need to enable students to use technology of their time; teaching today's children in ways that educators were taught is insufficient (Jacobsen & Lock, 2004). Rushkoff (1996) refers to children today as screenagers, "born into a culture mediated by the television and the computer" in which they participate fluidly in online, interactive digital environments and media (p. 3). Integrating technology is much more than simply learning how to use the equipment; such integration is more about the fundamental changes to teaching and learning that are enabled and required (Jacobsen, 2001).

Pierson and McNeil (2000) proposed improving the use of technology in teacher preparation programs through the "purposeful creation of collaborative, authentic and content-focused learning environments" (p. 9). Moursund and Bielefeldt (1999) also noted that increased levels of technology integration versus the delivery in a few isolated classes are needed throughout the entire teacher preparation program.

Ringstaff and Yocam (1994) stated "current methods of professional development are woefully inadequate because most focus on learning about computers rather than learning how to integrate computers into the curriculum" (p. 31). Redesigning current professional development may help reduce some of the barriers experienced during the implementation. Smith and Robinson (2003) found that changes in the delivery of professional development opportunities must be considered to avoid teacher frustration.

Schmeltzer (1995) and Charp (1996) clearly agree that if educators are asked about challenges related to effective technology in schools, they will invariably bring up the issue of professional development. Schmeltzer cites one of the biggest obstacles to the integration of technology is the lack of teacher training. Hurst (1994) maintains if classroom teachers are to use technology effectively in their classrooms, they must be provided with adequate training.

Nevertheless, over the past decades, schools have made limited progress toward integrating technology into the curriculum (Becker, 1992; Cuban 1993). Thurston and Levin (1996) address the urgent need for professional development: “Teachers need appropriate infrastructure and access, opportunities to integrate technology into the curriculum, and technical and administrative support; but they also need effective training” (p. 48). “Technology adds value to schools when it is an integral part of a comprehensive plan for instructional improvement and when teachers are adequately prepared to use it as one more tool in their arsenal” (Dwyer, 1996b, p. 26). Consequently, an urgent need exists to integrate technology.

This study concentrated on how elementary teachers use and integrate technology resources into the elementary curriculum while exploring the influence of technology on student success. The primary focus of the study was the role and perception of classroom teachers along with the effect professional development activities in technology integration had on student success.

Overview of the Study

The literature review related to technology in the classroom, its influence on student learning, and teachers’ roles in technology integration are presented in Chapter 2. Chapter 2 includes a review of technology in teacher pre-service preparation and professional development and an analysis of the barriers and enhancers to the effective use of technology in the classroom. The methods and procedures for conducting this research are presented in Chapter 3. The data findings are presented in Chapter 4, and the discussion of findings, conclusions, and recommendations are presented in Chapter 5.

CHAPTER 2

Review of Literature

The purpose of this chapter is to review selected literature relevant to this study. Areas of literature addressed include (1) student achievement (2) technology in the classroom, (3) technology influence on student achievement, (4) learning, (5) teachers' roles and responsibilities for technology integration, (6) barriers and facilitators to technology integration, and (7) professional development.

Student Achievement

The role of student achievement and assessment has shifted greatly in the United States (Darling-Hammond & Wise, 1985). In the years past, before state-mandated criterion-referenced tests existed, most school districts administered only nationally normed achievement tests that had been designed to compare the student population in a district with students throughout the nation. In the eyes of various authors, public education had begun to assume a close relationship with the continuation of the American way of life. In 1947 New York Times editor, Benjamin Fine, alluding to a crisis facing education declared that the United States would surely suffer the consequences of the present neglect of education in generations yet to come. A 1955 best seller, Why Johnny Can't Read, warned that the refusal of educators to use research-based phonics methods would destroy democracy in the country (Rothstein, 1998).

The Soviet launch of Sputnik in 1957 accelerated complaints about declining student achievement in the United States. For the first time, schools were seen as an integral part of national security. The United States needed a great number of engineers, mathematicians, scientists, and foreign language speakers, and these specialists were not being produced by America's public schools and postsecondary institutions in sufficient numbers to compete with the numbers being produced and utilized by the U.S.S.R. (Bracey, 1997).

The 1960s and 1970s saw strong public concern accompanied by extensive and continuing efforts at all levels of government to improve the public education system (Congress of the United States Congressional Budget Office, 1987). Scores on standardized achievement tests played a central role in this debate. American students' test scores declined during the 1960s and 1970s and compared poorly with test scores of students in other countries. Fluctuations in student achievement during these decades were compounded by radical changes in the federal government's role in education. These changes were brought about by the implementation of the Economic Opportunity Act of 1964, which created Head Start, and by the Civil Rights Act of 1964, which focused on social inequalities and prohibited discrimination in the use of federal funds (Congress of the United States Congressional Budget Office, 1987; Berends, 2004).

The notions of equity and excellence dominated the educational landscape in the 1980s (Keith & Girling, 1991). Since the early 1980s, national efforts focused on reestablishing the United States as a major world competitor. The National Commission on Excellence in Education's (1983) report, A Nation at Risk, captured national attention when the report findings indicated, "The educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people" (p. 5). A number of the report's findings and recommendations sought more rigorous curricula and higher standards of performance for students and teachers. A Nation at Risk (1983) expressed the fear that high school students in the

United States might now be scoring lower on achievement tests than when Sputnik was launched in 1957 and called for school reform. As a result, education reform became a number one national issue (Nystrand, 1992).

During the 1980s and 1990s, individual states, including Missouri, joined the standards movement to improve instruction. As a result of the Outstanding Schools Act of 1993, the Missouri Assessment Program (MAP) was developed. In developing the MAP, Missouri officials followed the standards for assessment established by the National Assessment Governing Board. These standards, known as the Show-Me Standards, provided a definition of what Missouri students should know and be able to demonstrate by high school graduation. The MAP test was intended to raise the bar for students' learning (Missouri Department of Elementary and Secondary Education, 2000).

The Goals 2000: Educate America Act (P.L. 103-227) was signed into law on March 31, 1994, and provided resources to states and communities to ensure that all students reach their full potential. Goals 2000 was based on the premise that students will reach higher levels of achievement when more is expected of them and established a framework for identifying world-class academic standards, measuring student progress, and providing the support those students may need to meet the standards. This Act codified into law the six original education goals concerning school readiness, school completion, student academic achievement, leadership in math and science, adult literacy, and safe and drug-free schools and added two new goals encouraging teacher professional development and parental participation (Goals 2000, 1994).

In January 2002, President Bush signed the "The No Child Left Behind Act (NCLB)" and reauthorized the existing Elementary and Secondary Education Act

(ESEA). Containing the most sweeping changes in federal law regarding public schools in nearly 40 years, NCLB includes significant new accountability measures for all public schools and is based on the ambitious goal that ALL children will be proficient in reading and math by 2014. By 2006, Missouri must develop new, annual tests in reading and math for grades 3-8 to measure students' academic progress. The law requires that all children be taught by "highly qualified" teachers and emphasizes improving communication with parents and making all schools safer for students (Missouri Department of Elementary and Secondary Education, 2004). One aspect of NCLB that separates it from previous national mandates on education is the law's emphasis on the integration of technology into classrooms to support and improve teaching and learning. The Act requires state educational agencies to assist every student in crossing the digital divide and to ensure that every student, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability, is technologically literate by the time the student finishes the eighth grade.

Technology in the Classroom

Technology is not new in the education field. Microcomputers have been available in some school settings since the 1970s. As microcomputers entered increasing number of schools, educators struggled with defining appropriate computer skills for students (Bitter, 1983). Primarily used to support the traditional instruction mode, technology was routinely used to reinforce memorization of facts rather than promote higher-order thinking and problem-solving skills (Becker, 1992; Sandholtz, Ringstaff & Dwyer, 1997). Technology integration was often equated with basic operations and programming, and standards had yet to be established by the late 1980s (Roblyer, 2000).

The Enhancing Education through Technology Act, Title IID of NCLB, currently requires technology to be fully integrated into the curricula and instruction by December 31, 2006 (NCLB, 2002).

Today, technology affects virtually every aspect of our lives, from enabling citizens to perform routine tasks to requiring them to be able to make responsible, informed decisions that affect individuals, society, and the environment. Students need and deserve the opportunity to attain technological literacy through their educational process (Dugger, Meade, Delany, & Nichols, 2003).

With this increasing expectation of technology literacy, the International Society for Technology in Education (ISTE) and its partners have developed the National Educational Technology Standards for Students (2000) and the National Educational Technology Standards for Teachers (2000). These documents clearly indicate expectations for effective computer usage in teaching and learning.

Technology should be viewed as a means to achieve educational objectives, not an objective in and of itself (WestEd, 2002; Morrison & Lowther, 2002). Technology should be a tool available to students to aid in the learning process and should be used as a problem-solving tool in open-ended learning environments, not just as a substitute for presenting material to the students (Morrison & Lowther).

Results from Cohen’s (2001) study on learning styles and technology indicate that a technology-rich environment promoting collaborative learning affects the learning styles of students. Technology in the classroom can also help the students learn how to learn. Teachers who help students learn how to find information on their own provide students with a valuable skill. Acquisition of this skill is perhaps more important than any factual knowledge imparted to students (Mandell, Sorge, & Russell, 2002). Mandell, Sorge, and Russell also noted that technology can provide students with opportunities to discover and create knowledge and thereby permit teachers to better take on the role of facilitator.

Technology appears to motivate children and to increase the time they are willing to spend practicing important academic skills (Morrow, Barnhart, & Rooyakkers, 2002). The potential for technology to help people learn has been largely overlooked until recently (Winn & Synder, 2001). Educators are beginning to comprehend the potential for technology to help students construct meaning for themselves based on learning activities. Technology is quickly becoming more than just a tool for acquiring content or skill more efficiently and effectively (Mills & Tincher, 2003).

Cuban (1993) attributes technology's appeal to three factors: (1) the desire to prepare students for the transition into an increasing technological workforce; (2) the potential for technology to provide a vehicle for self-directed learning; and (3) the perception that technology use in the classroom will increase productivity. According to Wenglinsky's (1998) study, technology can and does matter, but it is highly dependent upon the context in which it is used.

White, Ringstaff, and Kelley (2002) point out two different uses of technology in the classroom—learning "from" computers and learning "with" computers. Learning from computers occurs when the technology functions as a tutor directing the student through a learning process. Learning with computers occurs when students take a more active role exploring the Internet and using email. Technology should be seen as a tool that supports and extends student understanding, providing a means to authentic, hands-on inquiry related to a problem, issue, or theme (Moersch, 1995).

Bitner and Bitner (2002) point out eight areas of consideration that have been shown to be important as teachers successfully integrate technology. These considerations are fear of change, training of basics, personal use, teaching models, learning styles and strategies, climate, motivation, and support. Mouza (2002/2003) suggests major factors that appeared to influence teacher use of technology in the classroom are: (a) support teachers received from the school administration, (b) student population and needs, (c) collaboration with other teachers, and (d) availability of school resources (Mouza, 2002/2003). Cuban (2001) states that teacher belief systems about technology significantly influence actual classroom practice using technology.

Along with these factors, ongoing support is critical. Teachers are more willing to take a chance and try new things with technology integration if they know they will have help and support when they need it (Doersch, 2002). Smith and Robinson (2003) also state that integration is most likely to occur if the support system for such innovation is already in place.

Technology Influence on Student Achievement

According to Eachus and Cassidy (1999), “self-efficacy has repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers” (p. 2). Significant increases in students’ ratings of perceived self-efficacy regarding technology integration were noted by Ertmer, et. al. (2003). Numerous studies, summarized by Bialo and Sivin-Kachala (1996), revealed students are motivated to learn and feel more successful in school when using technology. Keeler

(1996) also reported that students felt positive about using the computers. The results represented a positive attitude toward the use of the computer in the classroom, and students enjoyed having some instruction on computers. When teachers increase their use of technology in the classroom, students are engaged, and learning is exponentially enhanced (Falba, et. al., 2001; Mills & Tincher, 2003).

Based on a study focused around the effects of technology on academic accomplishments of elementary students, Page (2002) indicated that children in technology-enriched classrooms appear to score higher on standardized tests in mathematics. Participants consisted of 211 low socioeconomic status students from 10 classrooms (five technology-enriched environments and five without technology). Results of univariate analysis of covariance (ANCOVA), performed to determine if a statistically significant difference existed, indicated classroom technology contributed significantly to the academic achievement and self-esteem of elementary students of low socioeconomic status.

An analysis of student test scores in Missouri offers solid evidence to suggest that using technology as a primary tool in their classroom to facilitate learning can boost student achievement (Missouri Department of Elementary and Secondary Education, 2002). This boost in achievement was a result of the Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) program which helps teachers use technology in ways that change student engagement and student products through high-quality professional development (eMINTS Evaluation Project, 2005).

The eMINTS philosophy is based on transforming teaching using inquiry-based methods and strategies powered by technology (eMINTS National Center, 2005). This inquiry-based approach that emphasizes the importance of students exploring ideas, engaging in projects of choice, working collaboratively, and gaining conceptual understanding is valued by many advocates of technology (Kleiman, 2004).

The eMINTS program has undergone rigorous external program evaluation by Missouri's Office of Social and Economic Data Analysis (OSEDA) and has been recognized by the U.S. Department of Education as a key strategy in helping schools and districts meet the requirements of NCLB legislation (eMINTS Evaluation Project, 2004). Three years of data analysis verify that students enrolled in eMINTS classrooms at the third and fourth grade levels on average perform at a higher level when compared to students not enrolled in eMINTS classrooms (eMINTS Evaluation Project, 2005).

The analysis of the 2004 Missouri Assessment Program (MAP) compared the results of 4,332 third and fourth grade students in 40 school districts and revealed eMINTS students scored higher than Non-eMINTS students on both the communication arts and mathematics tests. The analysis of the MAP scores shows positive differences associated with the eMINTS enrollment. The differences on the communication arts test were clearly significant and showed that students enrolled in eMINTS classrooms outperformed all other students. The differences on the mathematics test were more subtle; nevertheless, the results suggest that students enrolled in eMINTS classrooms did perform better on the mathematics test than other students (eMINTS Evaluation Project, 2005).

Results from the 2004 MAP Communication Arts test show significant differences between the eMINTS and Non-eMINTS schools and significant differences by the number of years a teacher has been in the eMINTS professional development program (eMINTS Evaluation Project, 2005). The percentage of students scoring in the Proficient and Advanced categories of second-year eMINTS classrooms exceeds other first-year eMINTS classrooms and Non-eMINTS classrooms, which indicates the teacher’s completion of the eMINTS professional development program does have a positive impact on test performance (eMINTS Evaluation Report, 2005).

Results from Donaldson’s study (2001) indicate the integration of technology into life science and biology instruction from elementary through college level had an impact on students’ attitude about the subject matter. The project focused on more student-directed and collaborative learning activities. Students completed an online survey using a Likert-type scale and a set of open-ended questions. A total of 157 pre-surveys and 132 post-surveys were completed. The greatest increase was reflected in the acquisition of transferable skills to other classes.

The Apple Classrooms of Tomorrow (ACOT) project focused on the process of K-12 schools technology integration in which teachers and students could use technology on a routine basis (Sandholtz, Ringstaff, & Dwyer, 1997; Bitner & Bitner, 2002). Findings from this study indicated that technology encouraged interaction among students and between students and teachers as well as engaged students in high-order cognitive tasks. This study reported technology as an integral part of teaching and learning.

Keeler (1996) reported that technology created a community of learners in which student motivation and behavior improved as students were allowed to make choices and learn to become responsible for their own learning. Computers brought about changes in traditional teaching strategies, including moving from a more teacher-centered to a more student-centered environment (Keeler). Keeler also noted that computer implementation can meet the needs of all types of learners while acting as a catalyst for change in the classroom, building, and district.

Mann and Shafer (1997) found that when technology was introduced to the classroom environment, profound effects on achievement were observed. When teachers know how to use technology and then actually use all the tools at their disposal, the potential for student learning is increased (Mills & Tincher, 2003). Page (2002) suggests that computer environments, after aiding the knowledge gain of the participants involved, encouraged lifelong learning habits and increased commitment for further learning or learning to learn. However, Stellwagen (1999) suggests the effect of computer usage varies with the diverse student ability levels.

While 84 percent of teachers responding to one survey believe that computers and access to the Internet improve the quality of education in the school setting (NetDay, 2001), two-thirds report that the Internet is not well integrated into their classes. Shields (2003) suggests that technology and curriculum are still not fully connected.

> Computers are capable of helping kids do discovery learning. But computer technology in schools—even though it's practically in every classroom in some form—still isn't configured to allow kids to go off and do curiosity things. Schools have to be model-based reasoning places. But the money that has been poured into computers in recent years is still just an enhancement of the old construct: schools give information. So we've got wonderful airplanes, with no wings, that drive on roads. (p. 27)

As quoted in Shields (2003), Rob Reilly, a former elementary computer teacher, stated that curriculum development and technology plans should not be allowed to happen in separate rooms. “It’s like a Reese’s peanut butter cup….the curriculum chocolate and the peanut butter technology have to go together. Schools will proudly announce their computer-to-student ratio, but that’s only a statement about hardware—just the peanut butter part” (p. 27).

According to White, Ringstaff, and Kelley (2002), if technology is to improve student learning, then the teachers’ beliefs must be consistent with this integrated use of technology in teaching and learning. Much work remains to be done in regard to both acknowledging the role that beliefs play in the integration process and assisting teachers to adapt their beliefs to accommodate technology in the classroom (Albion & Ertmer, 2002). Understanding how such visions and beliefs are formed and transformed is important in creating a technology rich learning environment. Providing opportunities for teachers to examine the beliefs and practices of exemplary technology-using teachers offers a promising starting point (Albion & Ertmer). As a result, the student learning process will become more learner-centered as teachers focus on the utilization of technology in the classroom.

Learning

Ensuring students’ success in learning has long been the goal of teachers, but over the years student learning has become even more critical (Brown, 2003). The groundwork for making a shift in basic beliefs and assumptions about learning and the learner was laid in 1990, when the American Psychological Association [APA] and the Mid-Continent Regional Education Laboratory [McREL] joined to form the APA Presidential

Task Force on Psychology in Education. The purpose of this task force was twofold: (1) to determine ways in which the psychological knowledge base related to learning, motivation, and individual differences could contribute directly to improvements in the quality of student achievement and (2) to provide guidance for the design of educational systems that would best support individual student learning and achievement (McCombs & Whisler, 1997). The task force studied research focused on learning that inspired educators to place increased emphasis on high standards, effective instructional practices, and improved assessment methods (McCombs & Whisler).

As a result of this emphasis, technical and organizational changes occurred to enable students to achieve higher levels of learning (McCombs & Whisler, 1997). However, these educators and researchers overlooked the impact of the changes on students in areas other than in the area of academic achievement. Consequently, educational systems were not structured to provide support for the complex needs of the students (McCombs & Whisler).

By synthesizing the research in the areas of learning and instruction, members of the task force created a framework, the APA Learner-Centered Psychological Principles, to improve the educational experience of all learners (Alexander & Murphy, 1998). The central understanding of the learner-centered principles called for educational systems to effectively meet the needs of all learners by providing, “a focus on the individual learner as well as an understanding of the learning process and the essential knowledge and skills to be learned” (McCombs, 2000, p. 31). The learner-centered principles were defined by a theoretical perspective rather than a prescribed method of instruction and set of practices (McCombs & Whisler, 1997).

The fourteen learner-centered principles were categorized into four domains of basic factors that have been identified in research as critical to achieving increased motivation, learning, and academic achievement. These four domains include cognitive and metacognitive factors, motivational and affective factors, developmental and social factors, and individual differences. An understanding of these domains and the principles within them establishes a framework for designing learner-centered practices at all levels of schooling (American Psychological Association, 1997).

Learner-centered classroom practices, which allow students choice and opportunities to interact with students of varying abilities, cultures, and ages, should foster greater learning. Mastering content can be demonstrated in more than one way, and students are allowed to work individually. Teachers function as facilitators holding high expectations for all students and respecting the opinions and viewpoints of all. Finally, instructional strategies and methods make learning relevant to the students. Higher level thinking skills are emphasized, and students are encouraged to become more responsible for their own learning. Students are able to assist each other in constructing meaning. (Alexander & Murphy, 1998; McCombs & Whisler, 1997).

McCombs and Whisler (1997) described practices that enhance learning, including tying learning both to prior learning and to authentic tasks, knowing the individual needs of students and their unique backgrounds, respecting diversity, and developing relationships. The importance of collaboration in the learning process was noted in many publications (Bruffee, 1999; Paul & Marfa, 2001; APA, 1997). In a collaborative learning process, students construct knowledge socially.

Teachers' Roles and Responsibilities for Technology Integration

As the demand for K-12 technology use increases, many teachers feel unprepared to integrate technology into the classrooms (Sprague, Kopfman, & Dorsey, 1998). With technology as an integral part of everyday life, educators are responsible for teaching students how to use relevant equipment. Technology incorporation in the classroom is no longer a special effect or idea; technology integration is a necessity in preparing teachers for today's and tomorrow's world (Morrow, Barnhart, & Rooyakkers, 2002). Teachers must learn to use technology and must allow it to change their present teaching paradigm (Bitner & Bitner, 2002).

The word *integrate,* according to The Merriam-Webster's Dictionary (1997, p. 391), is defined as "to form, coordinate, or blend into a functioning whole." Pierson (2001) noted that technology integration occurs when a teacher draws on extensive content knowledge and pedagogical knowledge in combination with technological knowledge to provide a learning experience. The intersection of the three knowledge areas (technological-pedagogical-content knowledge) would define effective technology integration.

As indicated earlier, NCBL (2002) establishes significant accountability measures for student achievement for all public schools by the year 2014. The impact of NCLB on technology is revealed through The Enhancing Education through Technology Act (NCLB Act, Title II, Part D, 2402) requires state educational agencies to assist every student in crossing the digital divide to ensure that every student is technologically literate by the time he or she finishes the eighth grade, regardless of his or her race, ethnicity, gender, family income, geographic location, or disability. As technology standards related to this Act are being implemented to support the integration of technology into classrooms to improve teaching and learning, measures related to technology integration become crucial. However, for technology to become a core component of teachers' instructional repertoire, they need time to explore, reflect, collaborate with peers, and engage in hands-on learning (WestEd, 2002).

The U.S. Congress Office of Technology Assessment (1995) report stated that helping teachers "effectively incorporate technology into the teaching and learning process is one of the most important steps the nation can take to make the most of past and continuing investments in educational technology" (p. 8). Moersch (1995) asserted that the aim of technology integration is to find authentic ways to use technology for concept/process-based instruction, higher-level thinking, and qualitative assessment. Technology should be seen as a tool that supports and extends student understanding as well as providing a hands-on inquiry to a problem or issue.

Dexter, Anderson, and Becker (1999) explained that as teachers implement any new instructional strategy, they must first acquire the knowledge and then weave this new knowledge into the curriculum and existing instructional skills. According to Sandholtz, Ringstaff, and Dwyer (1997), the Apple Classrooms of Tomorrow (ACOT) research produced the Stages of Instructional Evolution, an adoption model for the use of technology in the classroom. This model describes the five stages of thought and practice utilized when integrating technology. The five stages are entry, adoption, adaptation, appropriation, and invention.

- Entry-stage teachers use text-based materials and instruction to support teacher-directed activities. In this stage, teachers learn the basics of using technology.
- Adoption-stage teachers use technology for keyboarding, word processing, or drill-and-practice software to support traditional instruction.
- Adaptation-phase teachers integrate new technologies into traditional classroom practices and students use word processors, databases, graphic programs, and computer-assisted instruction.
- Appropriation-stage teachers begin to understand the usefulness of technology and students work at computers frequently as cooperative, project-based instruction begins to take place.
- In the invention-stage, learning becomes more student-centered as multi-disciplinary, project-based instruction, peer tutoring, and individually paced instruction occurs. During this stage, discovering new uses for technology tools occurs.

As teachers advance through the developmental stages of technology integration, they begin to realize that technology is more than a teaching tool, and then they start using technology to create learning environments that augment student learning (Mills & Tincher, 2003; Hadley & Sheingold, 1993).

According to the Office of Educational Research and Improvement (1993), teachers are not motivated to tackle challenges of integrating technology unless they have a vision for how it will improve teaching and learning. To maximize the probability that teachers will effectively integrate technology into their teaching, the goals for learning the technology must be clear, an explicit connection must be made between the technology and teaching, and teachers must have experience with powerful technology tools that provide access to rich information (MacKenzie, 1999).

McCombs (2003) stated that students no longer see technology as a separate course; instead, they seamlessly apply technology tools in a wide assortment of meaningful projects. Therefore, teachers need to establish an environment by using the best resources available to assure that students learn and can construct their own learning environment (Charp, 2003). Trilling and Hood (1999) stated, “We need to apply all of our educational technology talent to the challenge of preparing teachers, parents, and other helpers into the everyday experiences of all learners” (p. 25).

Barron, Kemker, Harmes, and Kalaydjian’s study (2003) focused on teachers’ instructional modes related to technology integration. In this study (N=2,156) with a response rate of 35 percent, results indicated that many teachers are implementing technology as a tool for research, communication, productivity, and problem-solving; however, the integration across all subject areas and grade level is yet to be reached. The study found that elementary teachers were twice as likely to use technology than high school teachers. These results support findings by Becker, Ravitz, and Wong (1999), who found elementary teachers use technology on a regular basis with their students.

Barriers and Facilitators to Integration

Barriers. Although most teachers recognize the importance of using technology in their classrooms, numerous barriers can block implementation efforts (Roblyer, 1994). Whelan, Frantz, Guerin, and Bienvenu (1997) indicated five barriers to the acquisition and use of telecommunications are (1) lack of funds specifically allocated for telecommunications (2) lack of or outdated equipment (3) inaccessibility of equipment, (4) lack of inservice or training, and (5) lack of knowledge of ways to integrate advanced telecommunications into the curriculum. Although teachers may not face all of these barriers, literature suggests that any one of these barriers alone can significantly impede meaningful classroom use (Hadley & Sheingold, 1993; Hannafin & Savenye, 1993).

Norris, Sullivan, Poirot, and Soloway (2003) reported that teachers’ use of technology is dependent upon their access to technology. If the opportunity to access technology is limited, use and integration of technology is minimal. Additional research also revealed barriers to the integration of technology include lack of time, need for ongoing assistance, required changes in attitude and pedagogical beliefs, need for a shift in traditional teacher’s role, fear and confidence levels, and lack of relevancy of training to instructional setting (Hruskocy, et al., 2000).

Lack of time is a critical issue (Barnett & Nichols, 1994). Many teachers are overwhelmed by the prospect of spending additional hours after school learning to use the computer-based technologies placed in their classrooms (Falba, et al., 2001). Whelan, et. al., (1997) reported the biggest obstacle to using the Internet was time. Teachers needed more time for learning to search the Internet, accessing the net, practicing their technology skills, developing lesson plans, and correlating lesson plans with the curriculum. “Most teachers reported spending almost three times as much as their own time learning about computer-related technology as they spent in district-sponsored training” (Mann & Shafer, 1997, p. 23). Findings from Mouza’s (2002/2003) study demonstrate that expecting teachers to integrate computers into their classroom in innovative ways in a short period of time would be unrealistic.

Bailey and Pownell (1998) compared using and integrating technology to the basic physical needs in Maslow’s Hierarchy of Needs. Bailey and Pownell identified six basic technology “physiological needs” which must be satisfied before higher-level needs, such as the continuous application of technology, could be achieved. The first basic need identified was time—time to learn new skills, time to think, time to practice, coach, and collect feedback. A second “physiological need” was a detailed technology plan that provides direction, vision, and projected outcomes. Third was a solid, well-planned professional development program. Next were fundamental hardware, software, and Internet access resources for teachers to be able to integrate into their curriculums. The fifth need identified was a technology-facilitating infrastructure, the physical availability of technology equipment and support necessary for the program to succeed. And the sixth basic need was effective technical support readily available to provide problem-solving and educational assistance.

Unfortunately, most schools do not allocate adequate funds for staff development. While the private sector claims to spend 30 percent of technology budgets on training, schools typically spend 10 percent or less (Mann & Shafer, 1997; WestEd, 2002). Organizations should spend 30 percent of their technology budget on equipment and 70 percent on the “human infrastructure” to support ongoing training and technical assistance (White, Ringstaff, & Kelley, 2002).

Smith and Robinson (2003) found that teachers are quickly frustrated in technology usage by their lack of technical skills. Therefore, technical assistance and support are also essential for curricular integration (Whelan, Frantz, Guerin, & Bienvenu, 1997). Boone (2001) discussed the importance of troubleshooting and the impact technological failures have on the teaching and learning process. Those using technology should consider all ramifications of technological failures.

Another barrier identified by Ertmer (2003, as stated by Hruskocy, 1999, and Novak & Knowles, 1991) was the lack of knowledge among typical beginning teachers about how to integrate computers within the more routine tasks of teaching and managing their classrooms even though they have the technical skills and desire. Lack of confidence for teaching with computers has been shown to influence the levels of student computer use by beginning teachers (Ertmer, et al., 2003).

Teacher preservice preparation. Preservice teachers need more experience with technology to be prepared to teach in our increasingly global and technological world (Cavanaugh, 2003). According to the President's Committee of Advisors on Science and Technology, field experience is a critical aspect of preservice technology preparation because it enables preservice teachers the opportunity to observe the use of educational technology and to practice teaching with technology in schools (PCAST, 1997). Yet, Hornung and Bronack (2000) noted that many preservice teachers find that experience with the practical application of technology is lacking.

A survey by the American Association of Colleges of Teacher Education (AACTE) found that one-third of preservice teachers surveyed were not required to incorporate technology during their student teaching (Persichitte, Tharp, & Caffarella, 1997). To assist in the development of effective teacher training regarding technology integration, Congress created the Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) grant program (Brush, 2003). PT3 was formed on the principle that educators must understand how to create and deliver high quality, technology lessons that engage students and improve learning (Mitchem, Wells, & Wells, 2003). Mitchem, Wells, and Wells reported that as teachers increase their use of instructional technologies a concomitant increase in student engagement and instructional practices also occurs.

Pierson (2001) stated that unless a teacher views technology use as an integral part of the learning process, the use of technology will remain peripherally ancillary to his or her teaching. Beyerbach, et al., (2001) reported focus group results of preservice teachers in which the preservice teachers stated, “We learned about it, but never got to apply it” (p. 116). These preservice teachers viewed technology as an “add-on” and wanted more exposure to technology integration. During Beyerbach’s second year of the study, results indicated a 15.9 percent to 68.9 percent increase in the area of instructional methods of technology integration.

According to the most recent report of the National Center of Education Statistics (NCES, 2000), nearly 70 percent of teachers reported not feeling well prepared to use computers and the Internet in their teaching (Ertmer, et al., 2003). Research shows that coursework alone is inadequate to prepare preservice teachers to be technology-using teachers (Stuhlman, 1998). Ertmer, et al., (2003, as stated by Carlson & Gooden, 1999) stated that few of our current or future teachers have either observed or experienced learning with or from computers. Schrum (1999) noted that technology use is not being effectively modeled for future teachers.

A study of Michigan preservice elementary teachers by Albee (2003) revealed that 90 percent (n=1100) wanted more experience with using technology. Studies have shown that preservice teachers are inadequately prepared to use instructional technology and effectively integrate technology into the curriculum (Beaver, 1990; Brooks & Kopp, 1989; Roblyer, 1994). Hurteau (1990) reported only 20 percent of New York teachers felt they had received sufficient preservice training in the integration of technology into their classrooms. Traditionally, technology training has been software-based rather than curriculum-based (Gilmore, 1995). Teachers lack knowledge about how to integrate technology within the more routine tasks of teaching and managing their classrooms (Hruskocy, 1999; Novak & Knowles, 1991). Teachers need specific ideas about how to use technology in the classroom (Ertmer, 2003).

Ertmer, et al., (2003) reported that preservice teachers can benefit from observing teacher models, and this modeling can help preservice teachers develop a vision for what technology integration looks like in real classrooms as well as strategies for implementing those visions. Data from this study suggest that providing preservice teachers with opportunities to interact with exemplary technology users, through electronic models, is a viable means for increasing capacity for technology integration. Beyerbach, et al., (2001) also states that collaboration with peers is essential to successfully integrate technology in the classroom.

America's technological-based society is advancing at such a rapid pace that universities are struggling to prepare students with the technology skills needed for today (Albee, 2003). As university educators begin to realize that skill training is not enough to prepare teachers to integrate technology within the curriculum, the attention and focus must turn to helping both preservice and inservice teachers gain specific ideas and confidence for technology integration (Ertmer, et al., 2003).

Moursund and Bielefeldt (1999) conducted a nationwide survey of 416 colleges and schools of education in preparing teachers to use technology effectively. Results indicated that few programs are adequately preparing preservice teachers to use technology. Moursund and Bielefeldt noted that while a required educational technology course may provide a useful foundation, a technology course by itself is inadequate in preparing teachers to use technology effectively. Preservice teachers need greater opportunities to use technology.

Beyerbach, et al., (2001) revealed that students want more technology integration activities and desire these opportunities much earlier in their teacher preparation programs. Using the technology, gives students more choices and direction in their own learning (Beyerbach).

Teacher learning. Not only are preservice teachers in need of increased preparation in technology integration, the National Center for Education Statistics (NCES, 2000) reported that 70 percent of teachers are not well prepared to use technology in their teaching. Rosen and Weil (1995) estimate that between one-third and two-thirds of all teachers do not take full advantage of the technology available to them for instruction because they do not feel confident of their own abilities to use them.

According to the research by McCannon and Crews (2000), technology is available in schools; however, teachers use the technology for administrative tasks instead of as an integral part of instruction. McCannon and Crews, in surveying over 170 K-5 teachers, identified six reasons why teachers have not participated in training offered to them. These reasons are: (a) teachers were too busy; (b) they had too far to travel after school; (c) release time was not provided during the school day; (d) no stipends were offered; (e) traffic on the way to the training site was too heavy; and (f) someone else was already providing individual help.

Facilitators. Teachers are often resistant to using technology in the classroom; therefore, changing teachers' attitude is key (Marcinkiewicz, 1993-1994). Research on teachers' beliefs found that beliefs are the best indicators of the decision individuals make. The relationship among these beliefs and the teachers' instructional decisions and practices are strong (Pajares, 1992). Kagan (1992) also reported that teachers' beliefs appear to lie at the heart of teaching and tend to be associated with a congruent style of teaching. Knezek and Christensen (2002) noted that teachers' attitudes toward technology become more positive with ongoing training. Anxiety levels tend to be reduced rather quickly with exposure to technology. According to Akbaba and Kurubacak (1998), training programs must be designed not only to improve teachers' skills with technology but also to help teachers change their attitudes toward the use of technology.

Research studies highlight the correlation between "teacher attitude" and the successful integration of technology (Becker, 1999; Ertmer, et al., 1999; Harvey & Purnell, 1995). Teachers with positive attitudes toward computers have been shown to demonstrate more successful integration of technology, while teachers with negative attitudes do not.

Rogers (1999) noted that as teachers become more comfortable with technology, their focus on barriers decreases. Advance technology users find ways to work around problems; whereas, novice users are more likely to be frustrated and give up due to their lack of skills or confidence to overcome these barriers.

Several studies suggest that attitudes are an important factor in the use of technology (Todman & Dick, 1993; Woodrow, 1990; and Hignite & Echternacht, 1992). Ertmer, et al., (2003) state that teachers' beliefs about their ability to use technology in instruction may be key, given the role self-efficacy appears to play in determining behavior. As noted by Eachus and Cassidy (1999) "self-efficacy has repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers" (p. 2).

Many characteristics affect attitudes toward new interventions in schools, but certainly the teacher's level of knowledge is critical (Keeler, 1996). Pierson (2001) reported that the ways in which teachers used technology determined their personal definitions of technology integration. Beyerbach (2001) stated that teachers learn by doing. Technology infusion to enhance teaching is a multifaceted process that takes time, support, and collaboration.

Coley, et. al., (1997) noted peer collaboration as essential for continuous learning. Teachers benefit when they learn about technology from one another and provide one another with motivation to continue learning. According to Cole (2000), individual modeling by one teacher for others can be a valuable tool. Teachers who actually see what another teacher has developed may come up with more ideas of how they can use technology.

Becker and Riel (2000) found the more that teachers were involved in formal and informal communication with their peers, the more they used technology in exemplary ways. Time spent with other teachers in their own school and from other schools appeared to have a strong, positive affect on their use of technology in the classroom.

Perhaps one of the most effective strategies an educator can use for gaining support for integrating technology into the curriculum is to be an example and offer support to peers (Karene, Grabinger, & Duffield, 1999). Karene, Grabinger, and Duffield also stressed the need for administrative support. Administrators play a critical role in facilitating change associated with integrating technology through (1) providing opportunities to make the classroom change possible, (2) allowing time for staff development activities, (3) sharing the vision for technology in the school, and (4) allocating funding to technology.

Variations in technology use are closely linked to the teachers' respective levels of general teaching expertise. The methods teachers use to teach with and about technology reflect ways in which he or she learns best (Pierson, 2001). Pierson states that true integration can only be understood as the intersection of multiple types of teacher knowledge, and, therefore, is likely as rare as expertise.

Technology should be used as a problem-solving tool in open-ended learning environments. Morrison and Lowther (2002) noted that if a survey was conducted on students' parents who use technology at work, the results would most likely indicate that parents use technology to solve problems. Education must shift the focus from the skill of using technology to the solving of problems.

Doersch (2002) provided several tips in coaching teachers to integrate technology. The tips include (1) assist teachers in designing lessons that integrate technology into their regular lessons, (2) model good teaching-with-technology skills for teachers and students, (3) co-teach with other teachers, (4) act as a resource person who can acquaint teachers with resources that will be best for the chosen project, (5) serve as head cheerleader and support person for teachers who are working hard to integrate technology into their lessons, (6) be available in the computer lab to assist in troubleshooting, and (7) teach the teacher how to solve common technical problems. ACOT (1999) found that teachers who work collaboratively with others are more likely to integrate technology in their classroom.

Professional Development

Teachers are consistently reporting an increased need for professional development to enable them to effectively use technology to improve student learning (NCES, 2000). Yet, best practice technology applications are not being fully implemented into preK-12 classrooms because of limited teacher technology training (Smith & Robinson, 2003). NCLB (2002) requires school districts to use at least 25 percent of their allocation for high quality professional development activities to prepare teachers to integrate technology into instruction.

The Outstanding Schools Act of 1993 (SB380) indicates that each school district shall allocate one percent of its revenue from the foundation formula for professional development. Of the funds allocated, 75 percent shall be spent in the same fiscal year on activities approved and consistent with the district’s improvement plans. The remaining 25 percent must also be spent on professional development but may be carried over to the succeeding year (Missouri Department of Elementary and Secondary Education, 2004).

Desimone, et. al., (2002) states that professional development focusing on specific training practices increased teachers’ use of those practices in the classroom. However, Desimone, et. al., (2002) also noted that schools generally do not have an approach that is effective in building consistency among teachers much less a coherent, coordinated approach to professional development and instruction. Professional development must be an ongoing activity in order to promote real change in education (Slavit, Sawyer, & Curley, 2003).

Findings from longitudinal data reports reveal that professional development is more effective in changing teachers' classroom practices when collective participation of teachers from the same school, department, or grade occurs. Teachers benefit from relying on one another in developing technology skills and become "active learners" (Desimone, et. al., 2002). Lieberman (1995) suggest that participants in professional development should be part of a collegial network with opportunities for observation, practice, and instructional approaches. Opportunities for teachers to observe for themselves the impact of technology use on learning and teaching in their colleagues' classrooms can often serve as a strong impetus for changing teachers' beliefs (White, Ringstaff, & Kelley, 2002).

Beyerbach's (2001) survey findings indicated a need for more focus on instructional methods of integrating technology. Teachers want more technology but need step-by-step instruction and collaboration. Younger teachers may have the ability to use word-processing applications, spreadsheets, presentation software, and Internet browsers, but they still need help in applying these skills to teaching and learning (Charp, 2003).

As teachers advance through the developmental stages of technology integration, they begin to realize that technology is more than a teaching tool, and then they start using technology to create learning environments that augment student learning (Mills & Tincher, 2003).

Technology infusion can transform the education process, facilitate incremental improvements in learning, be a vital tool for educator's professional growth, and prepare students for a life in a high-tech world. Successful integration strategies combine these aspects of technology, drawing support from the unique contribution of technology to instruction, professional development, and administration. (Miller, 2001, p. 43)

According to Mouza (2002/2003), teachers need professional development that is hands-on, is directly related to curriculum goals, and allows for follow-up support in their classrooms. Professional development is a critical ingredient in effective use of technology in the classroom and must be aligned to the teachers' needs.

Pierson (2001) reported findings on exemplary technology-using teachers. These teachers spent a good deal of personal time working with computers but also had more extensive computer training and teaching experience. Mouza (2002/2003) noted that teachers who received skill-based training felt more confident using technology, made more use of digital content in their classrooms, and were more willing to experiment than teachers who received no such training. By exposing teachers to effective classroom strategies involving the integration of technology and by providing time for teachers to learn and adapt those strategies, professional development does affect classroom practices (U.S. Department of Education, 2000).

Results from the U.S. Department of Education Office of Educational Research and Improvement (2000) indicated that professional development and teachers' feelings of preparation are related. The more time teachers spend in technology related professional development activities, the better prepared they are to use technology for classroom instruction. When teachers know how to use and then actually do use all the technology tools at their disposal, the potential for student learning is increased (Mills & Tincher, 2003).

Even when available, technological training can create a digital divide. Teachers interested in technology increased their skills in great leaps, while the others fall further behind in what they could offer their students. This learning differential creates a wider gap in technology skills and applications and thus creates a digital divide (McCombs, 2003).

One must note that technology training is not a one-time effort. One or two computer courses will not be enough to prepare teachers to integrate technology into their classrooms. Moving teachers into more advanced levels of technology integration requires three to five years with at least 80 hours of training (Anderson, 1998; Becker, 1994). Research and best teaching practices consistently show that without effective staff development and continuous support, technology integration will not be achieved (Bailey & Powell, 1998).

This continuous technology support can be found in the eMINTS program. The eMINTS program offers extensive professional development, which includes 200 hours of training over a two-year period along with classroom visits and access to electronic materials (eMINTS National Center, 2005). Through the professional development sessions and ongoing classroom support, teachers learn how to incorporate more inquiry-based lessons and learning activities using technology into their curricula. The mission of eMINTS is to support Missouri educators as they integrate technology into inquiry-based, student-centered, interdisciplinary, collaborative teaching practices that result in higher levels of student performance (Kleiman, 2004).

eMINTS results showed students of teachers who consistently apply the inquiry-based instructional practices with the use of technology scored higher on the MAP tests than did students whose teachers used other instructional practices (Kleiman, 2004). The eMINTS Evaluation Project (2005) noted that second-year teachers in the eMINTS program adopted more inquiry-based instructional practices utilizing technology than first-year eMINTS teachers. This finding is expected, as teachers in their first year of eMINTS are just beginning to teach in a fully operational eMINTS environment, but through time and continuous training change their instructional practices to include more inquiry-based activities (eMINTS Evaluation Project).

A number of reasons are cited in the literature as being responsible for the failure of many professional development efforts. These reasons include: (1) the development of activities away from the school site, (2) the irrelevance of activities to teacher classroom practices, (3) provision of one-shot workshops without follow-up support, and (4) the inability to address the individual needs and concerns of the teachers. (Fullan, 1991; Miller 1998, as cited in Mouza 2002/2003).

Although lack of professional development opportunities is often reported in terms of quantity, quality also seems to be an important issue. Traditional sit-and-get training sessions lacking follow-up support have not been effective in preparing teachers to integrate classroom technologies (Mouza, 2002/2003). One reason for the lack of quality professional development is that most school districts have been preoccupied with the acquisition of equipment rather than the allocation of adequate funds to the professional development of their teachers (Mouza, 2002/2003).

Summary

The purpose of this literature review was to provide a background for the study. Areas examined included student achievement, technology in the classroom, its influence on student achievement, learning, and teachers' roles and responsibilities in technology integration. Other areas relating to teacher preservice preparation, professional development, plus barriers and facilitators to integration were reviewed to validate and strengthen the study.

This literature review revealed the history of student achievement and the emphasis of the integration of technology in classrooms to support learning through the No Child Left Behind legislation, the use of technology as a tool to help students learn, and the increase of student success through the use of technology. Ongoing professional development, teacher attitude, and barriers of time, access, and knowledge were also addressed.

Chapter 3 describes the methodology used in this study. The purpose, research questions, participants, data collection, and data analysis for both the quantitative and qualitative research methods are presented.

CHAPTER 3

Research Design and Methods

Introduction

In this chapter, the problem and purpose overview of the study, research methods, study design, procedures and research questions are presented. The appropriateness of the methods used and the limitations of the study are discussed. The population for the study is identified, and the methods of data collection and analysis are described.

Purpose

The purpose of this study was to investigate the use and integration of technology into the elementary curriculum and to explore the influence of technology on student success. This study concentrated on the teachers' knowledge and skill levels as they integrate technology into the curriculum and on the professional development opportunities in technology integration provided to teachers.

Research Methods

Given the nature and focus of this investigation and research questions, a mixed method comparative design of both quantitative and qualitative research was conducted to more fully understand how technology is used in elementary classrooms. Data were generated from a survey questionnaire, interviews with individual teachers, and focus group interviews consisting of administrators and department heads. Triangulation of data (survey questionnaire, individual interviews, and focus group interviews) provided consistent evidence and increased the validity of the findings.

Setting

North Elementary School is a school of 689 students located in an urban setting in a mid-western state. The district has five elementary schools, with a total district student population of 3,131. The history of North Elementary School as a successful technology-using school made it a desirable location to investigate. The site was chosen for this study for the following reasons: (a) the school has incorporated several technology classrooms, (b) the number of staff members was sufficiently large to support the study, (c) the school was close in proximity to the researcher, and (d) the administration and faculty were open to participating in the study.

South Elementary School is a school of 354 students located in an urban setting in a mid-western state. The district has eight elementary schools with a total district population of 5,839 students. This school was chosen for the study for the following reasons: (a) similar grade pattern configurations, student demographics, free/reduced lunch percentages, and level of technology access as North Elementary School, (b) the school was close in proximity for the researcher, and (c) the administration and faculty were open to participating in the study.

Research Questions

The overarching question guiding this multi-site mixed method comparative design is: Does the use of technology influence student success in elementary classrooms? The following research questions were designed to address this overarching question: (1) What are the teachers' perceptions of their role and responsibility in integrating technology? (2) What are the teachers' perceptions of technology influence on student success? and (3) What types of professional development activities related to integrating technology in elementary classrooms have been conducted?

Quantitative Research

Null Hypotheses

The following hypotheses were tested in this study:

HO_1: There are no significant differences between teachers' perception about their roles and responsibilities in the use of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_2: There are no significant differences in teachers' perception of technology influence on student success in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_3: There are no significant differences in the type of professional development activities related to integrating of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

Participants

This multi-site mixed method comparative design investigated the integration of technology in two urban elementary schools, South Elementary School and North Elementary School. School names were changed to protect the anonymity of the school and its staff members. These schools are both urban elementary schools with similar demographics. The criterion for selection were based on size of school, ethnicity of school, free and reduced lunch statistics, rate of attendance, and level of technology access.

Student demographic data consisted of South Elementary with 354 students in grades one through three and North Elementary with 689 students, kindergarten through grade six. Ethnicity data of the comparing schools included 93.2% African-American, 4.2% Caucasian, 1.4% Hispanic-American, and Asian-American 1.1% at South Elementary School and 96.7% African-American, 3.2% Caucasian, and 0.1% American Indian at North Elementary School. MAP data in grade three communication arts for 2004 reported South Elementary's Step 1/Progressing at 48.5 and Proficient/Advanced at 12.9. North Elementary MAP data in grade three communication arts for Step 1/Progressing reflects 54.7 and 4.7 for Proficient/Advanced. Socioeconomic status reflected through free and reduced lunch rates are 86.3% for South Elementary and 80.7% for North Elementary. The level of technology access for the schools indicated

3.78 students per computer for South Elementary and 3.46 students per computer for North Elementary.

Teacher demographic data revealed 28 certificated staff members for South Elementary and 59 certificated staff members at North Elementary. Ethnicity data of staff at each school included 47.1% Caucasian, 29.4% African-American, 5.9% Hispanic-American, and 17.6% not indicated at South Elementary with 80.5% Caucasian, 14.6% African-American, and 4.9% not indicated at North Elementary. The average years of experience for South Elementary is 10.6 years with North Elementary having 6.9 years. The percentage of teachers with a Master Degree or higher was very similar between South and North Elementary with a 29.3% and 29.4% respectively.

Instrumentation

Once the administration from each school agreed to participate in the study, a letter (see Appendix A) explaining the purpose and focus of the study along with the survey questionnaire (see Appendix C) were sent to each building principal. At a staff meeting in both elementary schools, participants signed a consent form (see Appendix B) explaining the study and reassuring them that their answers will remain confidential and would only be used for this study. With the receipt of the signed consent form, survey questionnaires were distributed to certificated staff members in both elementary schools at a staff meeting and collected when completed.

The survey questionnaire (see Appendix C) was constructed by the researcher to obtain feedback from participants regarding the use and integration of technology. The survey questionnaire was field tested with pilot groups of administrators and teachers to ensure validity. The survey questionnaire consisted of 37 Likert-type items using a 5 point scale: “1” Strongly Disagree, “2” Disagree, “3” Neutral, “4” Agree, and “5” Strongly Agree; 2 open-ended questions; and 16 questions focusing on demographic data. Examples of questions posed include: (1) Teachers are reluctant to use computers in our school; (2) I think technology has empowered teachers; and (3) Staff development in technology is encouraged.

Data Collection

Through this multi-site comparative case study design, three phases of data collection took place. Data collection for the case study began with literature and survey questionnaire data. Phase one included a survey questionnaire sent to all teachers in both elementary schools (n=87). Prior to completing the survey questionnaire, participants signed a consent form describing the study and assuring the participants that their responses would be confidential.

Data Analysis

Through the quantitative method, data from the survey questionnaire were analyzed using descriptive statistics through a statistical package, Statistical Package for Social Sciences (SPSS) version 12.0. Frequencies and percentages on the demographic characteristics of the respondents present a descriptive profile of those individuals who actually responded to the survey questionnaire. A t-test was utilized to test the significance of differences for the research questions.

Qualitative Research

Bogdan and Biklen (1998) defined qualitative data analysis as “working with data, organizing them, breaking them into manageable units, synthesizing them, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others" (p. 157). Qualitative data analysis consisted of individual and focus group interviews. With the interviewees' consent, all interviews were tape recorded and transcribed to ensure that all the information was available for analysis. This analysis, which involved open and axial coding, permitted the emergence of categories and themes, and through selective coding, the development of interthematic relationships.

Development of Categories

Initial open coding of the interview data revealed components that fit into categories described in the literature. Axial coding methods were used to chart recurring codes into categories. After reassembling and reconceptualizing the data and searching for causal conditions through the process of axial coding and an affinity diagram, selective coding was used to develop interrelationships among the categories for theme development (Bogdan & Biklen, 1998; Creswell, 1994).

Participants

Participants involved in the qualitative research process included five individuals teacher interviews and one focus group interview consisting of the building administrator and department heads from both urban elementary schools, South Elementary and North Elementary. The nature of qualitative research required the use of schools within close proximity of the investigator. Repeated visits were made, so proximity was a viable issue.

Data Sources

A purposeful sampling of certificated teachers identified by their level of technology usage from each elementary school was utilized to select participants to be interviewed (Bogdan & Biklen, 1998). Informed consent was obtained prior to the interviews. Prior to the start of the interview process, all certificated staff members were requested to and did sign a consent form (see Appendix D and F) explaining the study and its purpose. To gain a thorough understanding of the integration of technology in elementary classrooms, a set of interview questions for the individual interviews (Appendix E) and the focus group interviews (Appendix G) were asked to each participant in order to provide consistent data.

Data Collection

Phase two involved interviews of individual certificated staff members from both elementary schools (n=10) who were responsible for technology integration in their classroom. Random purposeful sampling (Bogdan & Biklen, 1998) of teachers in both elementary schools was utilized for interview participants. Participants were certificated staff members and were randomly selected based on their grade level and level of technology usage to facilitate this comparative study. Phase three included a focus group interview of administrators and department heads was conducted at both elementary schools.

As encouraged by Bogdan and Biklen (1998), protocols with points of emphasis to cover at the beginning of each interview were designed to provide a consistent foundation for the researcher. Each interviewee was provided with a consent form (see Appendix D) with the purpose of the study and assurance of confidentiality outlined. Sample questions that were asked of participants included: Do you think technology positively or negatively influences student learning? Do you use technology in your classroom? If so, when did you first begin to use it and why did you decide to use technology? If not, why don't you use technology? What do you think are benefits to using technology? What are the pitfalls of using technology in the classroom? Is technology used to increase basic skills and knowledge or as a resource helping students develop higher order thinking skills?

These in-depth, semi-structured individual teacher and focus group interviews were used to determine the perceptions of the participants around issues of technology usage in the classroom. The research questions were explored by asking participants to respond to interview questions (see Appendix E and G) about their role and responsibility in integrating technology and the relationship of professional development activities with the level of integration. Follow-up questions probed for deeper meaning and clarification of the interviewee's experience.

Interviews were conducted before, after, and during the day over a period of several weeks. Most interviews were conducted in the area where the staff member worked, although some had to be conducted in other areas of the building for logistical reasons.

Data Analysis

All individual interviews and focus group interviews were conducted in person by the researcher. Individual and focus group interview data were recorded, transcribed, and analyzed to identify patterns, themes, threads, and topics of beliefs, values, and practices as related to the teachers' classroom technology use. Strauss and Corbin (as cited in Hoepfl, 1997) indicate that qualitative methods can be used to better understand any phenomenon about which little is yet known. The inductive process of qualitative methods permits a more in-depth comprehension of a social or human problem as well as building a complex picture with words that provide rich detail and insights into participants' experiences (Creswell, 1994).

To analyze the interview data, the process of open and axial coding was developed as described by Bodgan and Biklen (1998). The coding process included identifying concepts embedded within the data, organizing discrete concepts into categories, and linking them to broad themes. The researcher read the data in search of regularities and patterns as well as topics the data revealed. An affinity diagram was used to reassemble and reconceptualize the data for theme development.

Focus group interview responses were also recorded, transcribed, and coded through the open and axial coding system. Observation data were also analyzed to identify patterns and topics. The observation data were used to substantiate the survey questionnaire data. Triangulation of data (survey questionnaire, individual interviews, and focus group interviews) provided consistent evidence and increased the validity.

Summary

This study employed a mixed method case study design of both quantitative and qualitative investigation. The study examined how technology is used and integrated into the elementary classroom of South Elementary School and North Elementary School and the influence of technology on student success. Specifically, the role of the teacher with regard to the teacher's knowledge and skill level plus the professional development opportunities provided to these teachers in the area of technology integration was studied.

The research problem and purposes overview, research methods, research questions, research hypothesis, participants, instrumentation, data collection, and data analysis were presented in Chapter 3. Results from the data analyses will be presented in

Chapter 4. The study’s findings, recommendations, and conclusions will be included in Chapter 5.

Chapter 4

Presentation and Analysis of Data

Introduction

Since the 1960s, school reform issues have focused on restructuring schools to include more rigorous and measurable standards to improve student academic success. In 2002, the No Child Left Behind Act (NCLB), containing the most sweeping changes in federal law effecting education, was signed into law. One aspect of NCLB, a government mandate establishing significant accountability measures for public schools by the year 2014, focused on the integration of technology into classrooms to improve teaching and learning.

Many national, state, and local initiatives have provided schools with computer hardware and software, allowed schools and classrooms to connect to the Internet, and supported technology-focused professional opportunities for teachers (Coley, 1997; U.S. Department of Education, 1996). These initiatives have been aimed at understanding how best to use technology to improve teaching and learning as well as training educators to effectively use technology (Williams, 2000).

Teaching with technology requires a shift from the traditional teaching practice. For technology to transform teaching and learning, the teacher's role must be redefined, and existing teaching practice must change (Wiburg, 1997). While the Technology Policy Brief of WestEd (2002) noted that the use of technology can have a transformative effect on education by redefining teacher and student roles, few empirical studies have been conducted to determine the influence of technology on student success (Page, 2002; Mann & Shafer, 1997).

Study Design

The purpose of this study was to investigate the use and integration of technology into the elementary curriculum and to explore the influence of technology on student success. This study focused on teachers' perception of their knowledge and skills and their professional development experiences as they integrate technology into the curriculum for two urban elementary schools in a mid-western state. Data were generated from a survey questionnaire of teachers and interviews. One school, with the pseudonym of South Elementary, was referred to as the "non-technology" school. The other school, referred to as North Elementary, was the "technology" school for the purpose of this study.

As a mixed method design this study utilized both quantitative and qualitative data. A survey instrument (see Appendix C) was used to collect quantitative data for analysis to determine (a) the teachers' perceptions of their role and responsibility in integrating technology, (b) the teachers' perceptions of the influence of the use of technology on student success, and (c) the type of professional development activities related to integrating technology in elementary classrooms.

Respondents from two urban elementary schools were certificated staff members. Teacher demographic data revealed 28 certificated staff members for South Elementary and 59 certificated staff members at North Elementary. Ethnicity data of staff at each school included 47.1% Caucasian, 29.4% African-American, 5.9% Hispanic-American, and 17.6% not indicated at South Elementary with 80.5% Caucasian, 14.6% African-American, and 4.9% not indicated at North Elementary. The average years of experience for South Elementary was 10.6 years with North Elementary having 6.9 years. The percentage of teachers with a Master Degree or higher was very similar between South and North Elementary with a 29.3% and 29.4% respectively.

The teachers from the two schools were asked to complete a 37-item survey (see Appendix C) designed to identify the respondents’ perceptions about the use of technology in their school and classroom. The survey used a five-point Likert-type scale of 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The survey also included two open-ended questions and 16 descriptive demographic questions. The questions were developed to measure teachers’ perceptions about technology and the influence of technology on student success. The subscales in the survey were ideology, student success, time, computer efficacy, empowerment, importance, external pressure, training, competence, resources, and technical support.

Following the analysis of quantitative survey data, qualitative data from individual interviews and focus group interviews were used to better understand the influence of technology on student success. Five individual teachers were interviewed from each school. The focus group interview included the building administrator and department heads or lead teachers at each elementary school. These in-depth, semi-structured interviews were used to determine the perceptions of the participants about issues of technology usage in the classroom. Through these interviews, participants shared their role and responsibility in integrating technology and the relationship of professional development activities about technology with the level of integration of technology. Follow-up questions probed for deeper meaning and clarification of the interviewee’s experience.

Interviews were conducted before, after, and during the day. Most interviews were conducted in the area where the staff members worked, although some had to be conducted in other areas of the building for logistical reasons.

Research Questions

The overarching question guiding this mixed method comparative study was: Does the use of technology influence student success in elementary classrooms? The following research questions were examined during the completion of this study:

1. What are the teachers' perceptions of their roles and responsibilities for integrating technology in the classroom?
2. What are the teachers' perceptions of the influence of technology on student success?
3. What types of professional development activities related to integrating technology in elementary classrooms have been conducted?

Limitations

One school in this study was selected because of the technological interventions present in that school, and the other school was selected because of geographic proximity and demographic similarity with the technology school. This study utilized self-reporting data. Findings of the study are based on the perception data of teachers and the assumption that teachers will respond honestly and interpret the instrument as intended.

Null Hypotheses

The following hypotheses were tested in this study:

HO_1: There are no significant differences between teachers' perception about their roles and responsibilities in the use of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_2: There are no significant differences in teachers' perception of technology influence on student success in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_3: There are no significant differences in the type of professional development activities related to integrating technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools

b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6

c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

Demographic Data

School, student, and teacher demographic data from the two schools participating in this study are presented in Table 1. School demographic data included the grade levels for each school site, the enrollment for those sites, and the number of certificated teachers per site. Student demographic data included enrollment, race, free or reduced lunch, 2004 Missouri Assessment Program (MAP) results in third grade communication arts, and students per computer ratio. The MAP data results are reported on a 5-level system identifying the number of students scoring in the top two levels, level 4 and 5, and the bottom two levels, level 1 and 2. Teacher demographic data included the number of certificated staff in each school, the number of staff surveyed for the study, the percent of teachers surveyed who responded, and respondents' gender, race, average years of experience, and educational level.

Table 1

School Demographic Data

School Demographic Data		
	South Elementary Non-Technology School	North Elementary Technology School
Grade Levels	1-3	K-4/5-6
Enrollment by School Sites	1-3: 354	K-4: 483 5-6: 206
Certificated Staff by Site	1-3: 28	K-4: 40 5-6: 19
Student Demographic Data		
Enrollment	354	689
Caucasian	4.2%	3.2%
African-American	93.2%	96.7%
Asian-American	1.1%	0.0%
Hispanic-American	1.4%	0.0%
American Indian	0.0%	0.1%
Free/Reduced Lunch	86.3%	80.7%

Table 1 (continued)

Student Demographic Data (continued)		
	South Elementary	North Elementary
Communication Arts – Students at Proficient/Advanced Levels (Levels 4 & 5 of a 5-level system)	12.9%	4.7%
Communication Arts – Students at Step1/Progressing Levels (Levels 1 & 2 of a 5-level system)	48.5%	54.7%
Ratio of students per computer	3.78: 1	3.46: 1

Teacher Respondents' Demographic Data		
	South Elementary	North Elementary
Number of Certificated Staff	28	59
Number of Staff Surveyed	17	41
Percent Returned	60.7%	69.5%
Male	2	8
Female	15	32
Caucasian	47.1%	80.5%
African-American	29.4%	14.6%
Hispanic-American	5.9%	0.0%
Not Indicated	17.6%	4.9%
Average Years of Experience	10.6	6.9
Percentage of Teachers with Master Degree or Higher	29.3%	29.4%

South Elementary had an enrollment of 354 students in grades 1-3 and a certificated staff of 28 teachers. North Elementary was a two-site school, with the two buildings supervised by one principal and an assistant principal and located five city blocks apart, with an enrollment of 698 students in grades K-6 and 59 certificated staff members. School socio-economic status of students qualifying for free or reduced lunches ranged from 86.3 percent of the students at South Elementary to 80.7 percent at North Elementary. The majority of the student population at both elementary schools is African-American, with 93.2 percent at South Elementary and 96.7 percent at North Elementary. On the 2004 state assessment test for third grade communication arts test, 12.9 percent of the students at South Elementary scored at the Proficient/Advanced level and 48.5 percent at the Step 1/Progressing level. The Proficient/Advanced levels are the two highest levels of the 5-level system on the state assessment and represent scores above grade level. The Step 1/Progressing levels are the two lowest levels on the state assessment and represent scores below grade level. At North Elementary the comparable assessment data were 4.7% in the Proficient/Advanced level and 54.7% in the Step 1/Progressing level. The ratio of students per computer for the two schools was 3.78:1 for South Elementary and 3.46:1 for North Elementary.

Teacher demographic data are also presented in Table 1. North Elementary schools had more than twice as many staff as South Elementary. The percent of teachers completing the survey at each school were 60.7 percent (n=17) from South Elementary and 69.5 percent (n=41) from North Elementary. Teacher ethnicity at South Elementary was 47.1 percent Caucasian, 29.4 percent African-American, 5.9 percent Hispanic-American, and 17.6 percent of respondents did not indicate ethnicity. The comparable percentages for North Elementary respondents were 80.5 percent Caucasian, 14.6 percent African-American, and 4.9 percent of respondents did not indicate ethnicity. Average years teaching experience were 10.6 years for South Elementary and 6.9 years for North Elementary respondents. The percentages of respondents with a Master Degree or higher were the same for both schools.

Quantitative Data

Teacher responses to the survey instrument were recorded in an Excel spreadsheet and then transferred into the Statistical Package for Social Sciences (SPSS), version 12.0 for analysis. The 37 Likert-type questions were clustered into eleven areas: ideology, student success, time, computer efficacy, empowerment, importance, external pressure, training, competence, resources, and technical support. From these eleven areas, two broad categories, beliefs and realities, were created. A t-test was utilized to test significant differences between the teachers' perceptions in the two schools for the broad categories of beliefs and realities as well as the specific sub-scales for the two broad categories. Numerous t-tests were run during this exploratory study. Caution should be used because the potential to obtain statistically significant findings by chance is high due to the number of tests run and the size of the "n".

Data for HO_1 are presented in Tables 2A through 5B. Hypothesis two findings are in Tables 6 through 9. Data for HO_3 are presented in Tables 10 through 13.

Hypothesis One

Hypothesis one (HO_1): There are no significant differences between teachers' perception about their roles and responsibilities in the use of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

The means and test of differences for this hypothesis are presented in Table 2A through 5B. The data in Table 2A and 2B are for respondents from staff in grades 1-3 from both schools, the grade levels that are directly comparable in the two schools. The survey items were grouped by “beliefs” and “reality”. The data were analyzed for the items associated with “beliefs” and thus included the subscales of (a) ideology, (b) time, (c) computer efficacy, (d) empowerment, and (e) importance. The data were also analyzed for the items associated with “reality” which included the subscales of (a) external pressure, (b) competence, (c) resources, and (d) technical support.

The belief statements were reported in Table 2A. The ideology category was the only cluster of items that showed a significant difference (t:2.115; p:.042). The mean for South Elementary was 4.1282 and the mean for North Elementary was 3.8500. The significantly different items were (a) “Computers motivate students” with the mean for

South Elementary at 4.35 and the mean for North Elementary at 3.89, significance of .025 and (b) "Computers are essential" at a significance level of .049 between the mean for South Elementary of 4.25 and the mean for North Elementary of 3.78. Cluster of items that did not show a significant difference were time (t:1.959; p:.058), computer efficacy (t:.815; p:.423), empowerment (t:-1.50; p:.881), and importance (t:-.183; p:.856).

Table 2A

Teachers' Roles and Responsibilities – Belief Statements (Grades 1 – 3)

Belief Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	17	4.1282	.4188	27	3.8500	.434	2.115	35.10	.042*
Time	17	3.4647	.4936	27	3.1537	.541	1.959	36.54	.058
Computer Efficacy	17	3.7059	1.159	27	3.4444	.801	.815	25.62	.423
Empowerment	17	3.7059	.7717	27	3.7407	.712	-.150	32.08	.881
Importance	16	3.8750	.7188	27	3.9259	1.11	-.183	40.56	.856

Belief Items									
	South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	17	4.1282	.4188	27	3.8500	.434	2.115	35.10	.042*
1. Students like to use computers.	17	4.76	.437	27	4.52	.580	1.599	40.49	.118
2. Computers are an important resources.	17	4.41	.618	26	4.46	.582	-.264	32.84	.793

Table 2A (Continued)

Belief Items (continued)										
		South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
		N	Mean	SD	N	Mean	SD	t	Df	Sig.
3.	Computers will advance beyond drill and practice.	17	3.88	1.269	27	3.78	.847	.300	25.03	.766
4.	Student collaboration increases with computers.	17	3.53	.874	27	3.11	.641	1.705	26.75	.100
5.	Computers in education are not just another fad.	17	4.18	.809	27	3.93	.781	1.014	33.23	.318
6.	Computers can revolutionize schooling.	17	3.82	.728	27	3.59	.747	1.014	34.85	.317
7.	Being computer literate is just as important as being reading literate or number literate.	17	4.00	.791	27	3.63	1.01	1.359	39.79	.182
8.	Computers motivate students.	17	4.35	.606	27	3.89	.698	2.330	37.69	.025*
9.	Computers are essential.	16	4.25	.775	27	3.78	.641	2.057	27.05	.049*
Time		17	3.4647	.4936	27	3.1537	.541	1.959	36.54	.058
1.	I need to spend more time on computer training.	17	3.88	.697	27	3.74	.859	.599	39.19	.553
2.	Time spent with computers enhances needed information.	17	3.65	.931	27	3.22	1.05	1.402	37.19	.169

Table 2A (Continued)

Belief Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
3. I have seen time-on task improve from students using computers.	17	3.59	.795	24	3.29	.751	1.204	33.33	.237
4. Computer lessons do not require more planning time than others.	16	3.31	.946	27	2.85	.864	1.593	29.34	.122
5. Release time for technology training is provided.	17	2.88	1.166	27	2.67	1.20	.589	35.08	.560
Computer Efficacy	17	3.7059	1.159	27	3.4444	.801	.815	25.62	.423
1. Using computers make me a better teacher.	17	3.71	1.160	27	3.44	.801	.815	25.62	.423
Empowerment	17	3.7059	.7717	27	3.7407	.712	-.150	32.08	.881
1. I think technology has empowered teachers.	17	3.71	.772	27	3.74	.712	-.150	32.08	.881
Importance	16	3.8750	.7188	27	3.9259	1.11	-.183	40.56	.856
1. In our school, technology is important.	16	3.88	.719	27	3.93	1.11	-.183	40.56	.856

Reality statements data are reported in Table 2B. The technical support category was the only cluster of items that showed a significant difference (t:-3.562; p:.001). The mean for South Elementary was 2.7059 and the mean for North Elementary was 3.7407.

The technical support item that showed a significant difference was “Technical support is available to me when I have a problem” with the mean for South Elementary at 2.71 and the mean for North Elementary at 3.74, significance of .001. Clusters of items that did not show a significant difference were external pressure (t:.540; p:.593), competence (t:.767; p:.450), and resources (t:-1.006; p:.321).

Table 2B

Teachers’ Roles and Responsibilities – Reality Statements (Grades 1 – 3)

Reality Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
External Pressure	16	3.5000	1.033	27	3.3300	.877	.540	27.65	.593
Competence	17	3.8876	.4906	27	3.7807	.378	.767	27.80	.450
Resources	17	3.0735	.5979	27	3.2685	.668	-1.006	36.99	.321
Technical Support	17	2.7059	.9852	27	3.7407	.859	-3.562	30.66	.001*

Reality Items									
	South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
External Pressure	16	3.5000	1.033	27	3.3300	.877	.540	27.65	.593
1. I do not feel pressured to use computers in my teaching.	16	3.50	1.033	27	3.33	.877	.540	27.65	.593

Table 2B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Competence	17	3.8876	.4906	27	3.7807	.378	.767	27.80	.450
1. Teachers are willing to use computers in our school.	17	3.41	1.004	27	3.70	.724	-1.041	26.46	.307
2. Students are willing to use computers in our school.	16	4.19	1.167	27	3.81	.736	1.149	22.19	.263
3. I am comfortable using technology.	16	3.94	.680	27	3.85	.864	.360	37.58	.721
4. Using technology in a lesson does not make me feel out of control and unprepared.	17	4.12	.781	26	3.77	.765	1.442	33.83	.159
Resources	17	3.0735	.5979	27	3.2685	.668	-1.006	36.99	.321
1. The availability of computers increases my ability to integrate technology.	17	3.59	.870	27	2.93	1.21	2.111	41.11	.041*
2. Adequate technological resources are available.	17	3.24	.970	27	3.44	1.01	-.685	35.27	.498
3. Our school has plenty of technology.	17	3.12	.993	27	3.70	.912	-1.967	31.97	.058

Table 2B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
4. Our school had adequate instructional software programs.	17	2.35	1.115	27	3.00	.620	-2.189	22.32	.039*
Technical Support	17	2.7059	.9852	27	3.7407	.859	-3.562	30.66	.001*
1. Technical support is available to me when I have a problem.	17	2.71	.985	27	3.74	.859	-3.562	30.66	.001*

Data in Table 3A and Table 3B are for respondents from staff in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6. The survey items were grouped by “beliefs” and “reality”. The data were analyzed for the items associated “beliefs” based upon subscales that were categorized as (a) ideology, (b) time, (c) computer efficacy, (d) empowerment, and (e) importance. The data were also analyzed for the items associated with “reality” using the subscales categorized as (a) external pressure, (b) competence, (c) resources, and (d) technical support.

In the Belief Statements of Table 3A, no one cluster with ideology (t:.761; p:.454), time (t:-.206; p:.839), computer efficacy (t:-.255; p: .801), empowerment (t:1.318; p: .203), and importance (t:.591; p: .563) showed a significant difference. However, two items in the ideology and time cluster of items were significantly different. The ideology items that showed a significant difference were (a) “Students like to use computers” with a mean for South Elementary at 4.75 and the mean for North

Elementary at 4.46, significance of .041 and (b) "Computers will advance beyond drill and practice" at a significance level of .017 between the mean for South Elementary of 3.88 and the mean for North Elementary of 3.75. The time items that showed a significant difference were (a) "Computer lessons do not require more planning time than others" with the mean for South Elementary at 3.47 and the mean for North Elementary at 2.93, significance of .004 and (b) "Release time for technology training is provided" at a significance level of .044 between the mean for South Elementary of 2.81 and the mean for North Elementary of 2.54.

Table 3A

Teachers' Roles and Responsibilities – Belief Statements – Non-Technology School (Grades 1 – 3) vs. Non-eMINTS in Technology School (Grades K – 6)

Belief Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	16	4.1294	.4326	28	3.7843	.422	.761	23.86	.454
Time	16	3.4688	.5095	28	3.1089	.424	-.206	20.24	.839
Computer Efficacy	16	3.6875	1.195	28	3.4643	.744	-.255	21.88	.801
Empowerment	16	3.7500	.7746	28	3.7143	.599	1.318	19.72	.203
Importance	15	3.8667	.7432	28	4.0714	1.02	.591	15.18	.563

Table 3A (Continued)

Belief Items									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	16	4.1294	.4326	28	3.7843	.422	.761	23.86	.454
1. Students like to use computers.	16	4.75	.447	28	4.46	.576	2.236	15.00	.041*
2. Computers are an important resources.	16	4.38	.619	27	4.37	.565	1.494	22.65	.149
3. Computers will advance beyond drill and practice.	16	3.88	1.130	28	3.75	.701	2.616	19.49	.017*
4. Student collaboration increases with computers.	16	3.50	.894	28	3.11	.567	.669	14.96	.514
5. Computers in education are not just another fad.	16	4.19	.834	28	3.82	.819	.802	23.99	.430
6. Computers can revolutionize schooling.	16	3.81	.750	28	3.50	.638	-.396	20.81	.696
7. Being computer literate is just as important as being reading literate or number literate.	16	4.00	.816	28	3.46	1.17	-.753	18.92	.461
8. Computers motivate students.	16	4.44	.512	28	3.89	.629	.317	21.99	.754
9. Computers are essential.	15	4.27	.799	28	3.71	.713	-.399	22.40	.693

Table 3A (Continued)

Belief Items									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Time	16	3.4688	.5095	28	3.1089	.424	-.206	20.24	.839
1. I need to spend more time on computer training.	16	3.88	.719	28	3.86	.756	-.393	17.14	.699
2. Time spent with computers enhances needed information.	16	3.63	.957	28	3.18	.945	708	19.99	.487
3. I have seen time-on task improve from students using computers.	16	3.56	.814	26	3.04	.599	.980	14.16	.343
4. Computer lessons do not require more planning time than others.	15	3.47	.743	28	2.93	.663	-3.451	12.92	.004*
5. Release time for technology training is provided.	16	2.81	1.167	28	2.54	1.04	2.127	23.99	.044*
Computer Efficacy	16	3.6875	1.195	28	3.4643	.744	-.255	21.88	.801
1. Using computers make me a better teacher.	16	3.69	1.195	28	3.46	.744	-.255	21.88	.801
Empowerment	16	3.7500	.7746	28	3.7143	.599	1.318	19.72	.203
1. I think technology has empowered teachers.	16	3.75	.775	28	3.71	.600	1.132	19.31	.272

Table 3A (Continued)

Belief Items									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Importance	15	3.8667	.7432	28	4.0714	1.02	.591	15.18	.563
1. In our school, technology is important.	15	3.87	.743	28	4.07	1.02	.346	13.41	.735

In the Reality Statements section of Table 3B, all clusters showed a significant difference. External pressure showed a significant difference of .009 with the mean for South Elementary at 3.5333 and the mean for North Elementary at 3.4286. The external pressure item “I do not feel pressured to use computers in my teaching” revealed a .009 significance level with a 3.53 mean for South Elementary and a 3.43 mean at North Elementary. Competence cluster showed a significant difference of .028 between the mean for South Elementary of 3.8963 and the mean for North Elementary of 3.7171. Resources cluster shows a significant difference of .001 with the mean for South Elementary at 3.0938 and the mean for North Elementary at 3.2143. Three resource items were significantly different: (a) “The availability of computers increase my ability to integrate technology” at a .009 significance level with a 3.69 mean for South Elementary and a 2.54 mean for North Elementary; (b) “Adequate technological resources are available” with a 3.25 mean for South Elementary and a 3.32 mean for North Elementary, a significance level of .000; and (c) “Our school has plenty of technology” at a significance level of .000 between a 3.13 mean for South Elementary and a 3.75 mean for North Elementary. Technical support cluster showed a significant difference of .000 with the mean for South Elementary at 2.8125 and the mean for North Elementary at 3.9643. The technical support item "Technical support is available to me when I have a problem" revealed a .000 significance level with the mean for South Elementary at 2.81 and a 3.96 mean for North Elementary.

Table 3B

Teachers' Roles and Responsibilities – Reality Statements – Non-Technology School (Grades 1 – 3) vs. Non-eMINTS in Technology School (Grades K – 6)

Reality Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
External Pressure	15	3.5333	1.060	28	3.4286	.790	-2.835	23.76	.009*
Competence	16	3.8963	.5053	28	3.7171	.487	2.354	21.24	.028*
Resources	16	3.0938	.6115	28	3.2143	.683	3.968	24.27	.001*
Technical Support	16	2.8125	.9106	28	3.9643	.693	4.568	24.70	.000*

Reality Items									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
External Pressure	15	3.5333	1.060	28	3.4286	.790	-2.835	23.76	.009*
1. I do not feel pressured to use computers in my teaching.	15	3.53	1.060	28	3.43	.790	-2.838	23.76	.009*

Table 3B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Competence	16	3.8963	.5053	28	3.7171	.487	2.354	21.24	.028*
1. Teachers are willing to use computers in our school.	16	3.44	1.031	28	3.75	.752	1.024	20.41	.318
2. Students are willing to use computers in our school.	15	4.13	1.187	28	3.82	.819	1.290	22.30	.210
3. I am comfortable using technology.	15	3.93	.704	28	3.61	.994	2.002	18.67	.060
4. Using technology in a lesson does not make me feel out of control and unprepared.	16	4.19	.750	27	3.70	.724	1.333	23.72	.195
Resources	16	3.0938	.6115	28	3.2143	.683	3.968	24.27	.001*
1. The availability of computers increases my ability to integrate technology.	16	3.69	.793	28	2.54	1.11	2.903	20.69	.009*
2. Adequate technological resources are available.	16	3.25	1.000	28	3.32	.983	4.386	24.93	.000*
3. Our school has plenty of technology.	16	3.13	1.025	28	3.75	.967	4.953	24.76	.000*

Table 3B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
4. Our school had adequate instructional software programs.	16	2.31	1.138	28	3.25	.701	1.801	20.82	.086
Technical Support	16	2.8125	.9106	28	3.9643	.693	4.568	24.70	.000*
1. Technical support is available to me when I have a problem.	16	2.81	.911	28	3.96	.693	4.568	24.70	.000*

Data presented in Table 4A and Table 4B includes the teachers' perception of their roles and responsibilities in the non-technology school grades 1-3 and in the eMINTS program of the technology school grades 3-6. No one cluster showed a significant difference in the Belief Statements section of Table 4A. Data from the clusters included ideology (t:.761; p:.454), time (t: -.206; p: .839), computer efficacy (t:-.255; p:.801), empowerment (t:1.318; p:.203), and importance (t:.591; p:.563). However, two items in the ideology and time clusters were significantly different. The ideology items that showed a significant difference were (a) "Students like to use computers" at a significance level of .041 between the mean for South Elementary of 4.75 and the mean for North Elementary of 5.00 and (b) "Computers will advance beyond drill and practice" with the mean for South Elementary at 3.88 and the mean for North Elementary at 4.80, a significance of .017. The time items that showed a significant difference were (a) "Computer lessons do not require more planning time than others" at significance level of

.004 between the mean for South Elementary of 3.50 and the mean for North Elementary of 2.00 and (b) “Release time for technology training is provided” with the mean for South Elementary at 2.88 and the mean for North Elementary at 3.70, a significance of .044.

Table 4A

Teachers' Roles and Responsibilities – Belief Statements – Non-Technology School (Grades 1 – 3) vs. eMINTS of Technology School (Grades 3 – 6)

Belief Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	17	4.1806	.4690	10	4.2990	.335	.761	23.86	.454
Time	17	3.5000	.5099	10	3.4600	.472	-.206	20.24	.839
Computer Efficacy	17	3.7059	1.159	10	3.6000	.966	-.255	21.88	.801
Empowerment	17	3.7059	.7717	10	4.1000	.738	1.318	19.72	.203
Importance	16	3.7500	.8564	10	4.0000	1.15	.591	15.18	.563

Belief Items									
	South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	17	4.1806	.4690	10	4.2990	.335	.761	23.86	.454
1. Students like to use computers.	16	4.75	.447	10	5.00	.000	2.236	15.00	.041*
2. Computers are an important resources.	16	1.38	.619	10	4.70	.483	1.494	22.65	.149

Table 4A (Continued)

Belief Items (continued)										
		South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
		N	Mean	SD	N	Mean	SD	t	Df	Sig.
3.	Computers will advance beyond drill and practice.	16	3.88	1.310	10	4.80	.422	2.616	19.49	.017*
4.	Student collaboration increases with computers.	16	3.50	.894	10	3.80	1.23	.669	14.96	.514
5.	Computers in education are not just another fad.	16	4.19	.834	10	4.40	.516	.802	23.99	.430
6.	Computers can revolutionize schooling.	16	3.81	.750	10	3.70	.675	-.396	20.81	.696
7.	Being computer literate is just as important as being reading literate or number literate.	17	3.82	1.074	10	3.50	1.08	-.753	18.92	.461
8.	Computers motivate students.	17	4.53	.624	10	4.60	.516	.317	21.99	.754
9.	Computers are essential.	16	4.31	.793	10	4.20	.632	-.399	22.40	.693
Time		17	3.5000	.5099	10	3.4600	.472	-.206	20.24	.839
1.	I need to spend more time on computer training.	17	3.82	.728	10	3.70	.823	-.393	17.14	.699
2.	Time spent with computers enhances needed information.	17	3.65	.931	10	3.90	.876	.708	19.99	.487

Table 4A (Continued)

Belief Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
3. I have seen time-on task improve from students using computers.	17	3.59	.799	10	4.00	1.16	.980	14.16	.343
4. Computer lessons do not require more planning time than others.	16	3.50	.730	10	2.00	1.25	-3.451	12.92	.004*
5. Release time for technology training is provided.	17	2.88	1.166	10	3.70	.823	2.127	23.99	.044*
Computer Efficacy	17	3.7059	1.159	10	3.6000	.966	-.255	21.88	.801
1. Using computers make me a better teacher.	17	3.71	1.160	10	3.60	.966	-.255	21.88	.801
Empowerment	17	3.7059	.7717	10	4.1000	.738	1.318	19.72	.203
1. I think technology has empowered teachers.	17	3.76	.752	10	4.10	.738	1.132	19.31	.272
Importance	16	3.7500	.8564	10	4.0000	1.15	.591	15.18	.563
1. In our school, technology is important.	16	3.86	.719	10	4.00	1.16	.46	13.42	.735

In the Reality Statements section of Table 4B, all clusters showed a significant difference. External pressure showed a significant difference of .009 between the mean for South Elementary of 3.5625 and the mean for North Elementary of 2.6000. The external pressure item “I do not feel pressured to use computers in my teaching” revealed a .009 significance level between the 3.56 mean for South Elementary and a 2.60 mean at North Elementary. Competence cluster showed a significant difference with the mean for South Elementary at 3.9024 and the mean for North Elementary at 4.2350, a significance of .028. Resources cluster showed a significant difference of .001 with the mean for South Elementary at 3.2059 and the mean for North Elementary at 4.1750. Three resource items showed significant differences: (a) “The availability of computers increase my ability to integrate technology” at a .009 significance level between the 3.65 mean for South Elementary and a 4.50 mean for North Elementary; (b) “Adequate technological resources are available” at a .000 significance level with a 3.24 mean for South Elementary and a 4.50 mean for North Elementary; and (c) “Our school has plenty of technology” at a .000 with a 3.15 mean for South Elementary and a 4.60 mean for North Elementary. Technical support cluster showed a significant difference of .000 between the mean for South Elementary of 2.8235 and the mean for North Elementary of 4.1000. The technical support item “Technical support is available to me when I have a problem” revealed a .000 significance level with the mean for South Elementary at 2.82 and a 4.10 mean for North Elementary.

Table 4B

Teachers' Roles and Responsibilities – Reality Statements – Non-Technology School (Grades 1 – 3) vs. eMINTS of Technology School (Grades 3 – 6)

Reality Statements									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
External Pressure	16	3.5625	1.031	10	2.6000	.699	-2.835	23.76	.009*
Competence	17	3.9024	.4899	10	4.2350	.426	2.354	21.24	.028*
Resources	17	3.2059	.7512	10	4.1750	.514	3.968	24.27	.001*
Technical Support	17	2.8235	.8828	10	4.1000	.568	4.568	24.70	.000*

Reality Items									
	South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
External Pressure	16	3.5625	1.031	10	2.6000	.699	-2.835	23.76	.009*
1. I do not feel pressured to use computers in my teaching.	16	3.56	1.031	10	2.60	.699	-2.835	23.76	.009*
Competence	17	3.9024	.4899	10	4.2350	.426	2.354	21.24	.028*
1. Teachers are willing to use computers in our school.	17	3.41	1.004	10	3.80	.919	1.024	20.41	.318

Table 4B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
2. Students are willing to use computers in our school.	16	4.06	1.181	10	4.50	.527	1.290	22.30	.210
3. I am comfortable using technology.	16	3.94	.680	10	4.50	.707	2.002	18.67	.060
4. Using technology in a lesson does not make me feel out of control and unprepared.	17	4.18	.728	10	4.50	.527	1.333	23.72	.195
Resources	17	3.2059	.7512	10	4.1750	.514	3.968	24.27	.001*
1. The availability of computers increases my ability to integrate technology.	17	3.65	.786	10	4.50	.707	2.903	20.69	.009*
2. Adequate technological resources are available.	17	3.24	.970	10	4.50	.527	4.386	24.93	.000*
3. Our school has plenty of technology.	17	3.15	.999	10	4.60	.516	4.953	24.76	.000*
4. Our school had adequate instructional software programs.	17	2.35	1.115	10	3.10	.994	1.801	20.82	.086

Table 4B (Continued)

Reality Items (continued)									
	South Elementary (Grades 1-3)			North Elementary (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Technical Support	17	2.8235	.8828	10	4.1000	.568	4.568	24.70	.000*
1. Technical support is available to me when I have a problem.	17	2.82	.883	10	4.10	.568	4.568	24.70	.000*

Data presented in Table 5A and Table 5B revealed teachers' perceptions of their roles and responsibilities for integrating technology of the grades 3-6 eMINTS teachers of the technology school and teachers in the same school who were not eMINTS teachers. The ideology cluster was the only cluster that showed a significant difference of .001 between the mean for North Elementary eMINTS of 4.2990 and the mean for North Elementary Non-eMINTS of 3.7843 in Table 5A. Four ideology items that showed a significant difference include: (a) "Students like to use computers" at a significance level of .000 level between the 5.00 mean for North Elementary eMINTS and a 4.46 mean for North Elementary Non-eMINTS; (b) "Computers will advance beyond drill and practice" with a 4.80 mean for North Elementary eMINTS and a 3.75 mean for North Elementary Non-eMINTS, a significance of .000; (c) "Computers in education are not just another fad" at a significance level of .016 between the mean for North Elementary eMINTS of 4.40 and a 3.82 mean for North Elementary Non-eMINTS; and (d) "Computers motivate students" at a .002 significance level between a 4.60 mean for North Elementary eMINTS and a 3.89 mean for North Elementary Non-eMINTS. Clusters of items that did not show a significant difference in the Belief Statements were time (t:2.073; p:.056), computer efficacy (t:.403; p:.693), empowerment (t:1.487; p:.160), and importance (t:-.173; p:.865).

As the other Belief Statements in Table 5A were analyzed, the time cluster revealed four items with significant differences. The time items that showed a significant difference are: (a) “Time spent with computers enhances needed information” at a significance level of .043 between the mean of 3.90 for North Elementary eMINTS and a 3.18 mean for North Elementary Non-eMINTS; (b) “I have seen time-on task improve from students using computers” with a 4.00 mean for North Elementary eMINTS and a 3.04 mean for North Elementary Non-eMINTS, a significance level of .029; (c) “Computer lessons do not require more planning time than others” at a significance level of .047 between the mean of 2.00 mean for North Elementary eMINTS and a 2.93 mean for North Elementary Non-eMINTS; and (d) “Release time for technology training is provided” with a 3.70 mean for North Elementary eMINTS and a 2.54 mean for North Elementary Non-eMINTS, a significance level of .002.

Table 5A

Teachers' Roles and Responsibilities – Belief Statements – Technology School eMINTS (Grades 3 – 6) vs. Non-eMINTS (Grades K – 6)

Belief Statements									
	North eMINTS Technology (Grades 3-6)			North Non-eMINTS Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	10	4.2990	.3354	28	3.7843	.422	3.879	19.920	.001*
Time	10	3.4600	.4719	28	3.1089	.424	2.073	14.531	.056
Computer Efficacy	10	3.6000	.9661	28	3.4643	.744	.403	13.027	.693
Empowerment	10	4.1000	.7377	28	3.7143	.599	1.487	13.499	.160
Importance	10	4.0000	1.155	28	4.0714	1.02	-.173	14.298	.865

Belief Items									
	North eMINTS (Grades 3-6)			North Non-eMINTS (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Ideology	10	4.2990	.3354	28	3.7843	.422	3.879	19.92	.001*
1. Students like to use computers.	10	5.00	.000	28	4.46	.576	4.920	27.00	.000*
2. Computers are an important resources.	10	4.70	.483	27	4.37	.565	1.758	18.76	.095
3. Computers will advance beyond drill and practice.	10	4.80	.422	28	3.75	.701	5.588	26.81	.000*
4. Student collaboration increases with computers.	10	3.80	1.229	28	3.11	.567	1.718	10.40	.115

Table 5A (Continued)

	Belief Items (continued)									
		North eMINTS (Grades 3-6)			North Non-eMINTS (Grades K-6)			Independent T-Test		
		N	Mean	SD	N	Mean	SD	t	Df	Sig.
5.	Computers in education are not just another fad.	10	4.40	.516	28	3.82	.819	2.572	25.56	.016*
6.	Computers can revolutionize schooling.	10	3.70	.675	28	3.50	.683	.816	15.15	.427
7.	Being computer literate is just as important as being reading literate or number literate.	10	3.50	1.080	28	3.46	1.17	.088	17.12	.931
8.	Computers motivate students.	10	4.60	.516	28	3.89	.629	3.501	19.26	.002*
9.	Computers are essential.	10	4.20	.632	28	3.71	.713	2.014	17.79	.059
Time		10	3.4600	.4719	28	3.1089	.424	2.073	14.53	.056
1.	I need to spend more time on computer training.	10	3.70	.823	28	3.86	.756	-.529	14.79	.605
2.	Time spent with computers enhances needed information.	10	3.90	.876	28	3.18	.945	2.190	17.06	.043*
3.	I have seen time-on task improve from students using computers.	10	4.00	1.155	26	3.04	.599	2.507	10.92	.029*

Table 5A (Continued)

Belief Items (continued)									
	North eMINTS (Grades 3-6)			North Non-eMINTS (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
4. Computer lessons do not require more planning time than others.	10	2.00	1.247	28	2.93	.663	-2.244	10.87	.047*
5. Release time for technology training is provided.	10	3.70	.823	28	2.54	1.04	3.575	19.93	.002*
Computer Efficacy	10	3.6000	.9661	28	3.4643	.744	.403	13.03	.693
1. Using computers make me a better teacher.	10	3.60	.966	28	3.46	.744	.403	13.03	.693
Empowerment	10	4.1000	.7377	28	3.7143	.599	1.487	13.50	.160
1. I think technology has empowered teachers.	10	4.10	.738	28	3.71	.600	1.487	13.50	.160
Importance	10	4.0000	1.155	28	4.0714	1.02	-.173	14.30	.865
1. In our school, technology is important.	10	4.00	1.155	28	4.07	1.02	-.173	14.30	.865

In the Reality Statements section of Table 5B, three of the four clusters showed a significant difference. The cluster of items that did not show a significant difference was technical support (t:.611; p:.548). External pressure showed a significant difference of .006 with the mean for North Elementary eMINTS of 2.6000 and the mean for North Elementary Non-eMINTS of 3.4286. The external pressure item “I do not feel pressured to use computers in my teaching" revealed a .006 significance level with a 3.56 mean for North Elementary eMINTS and a 2.60 mean for North Elementary Non-eMINTS.

Competence cluster showed a significant difference of .002 with the mean for North Elementary eMINTS of 4.3250 and the mean for North Elementary Non-eMINTS of 3.7171. Two competence items revealed a significance difference: (a) "Students are willing to use computers in our school" at a .006 significance level with a 4.50 mean for North Elementary eMINTS and a 3.82 mean for North Elementary Non-eMINTS; and (b) "I am comfortable using technology" with a 4.50 mean for North Elementary eMINTS and a 3.61 mean for North Elementary Non-eMINTS, a .006 significance level.

Resources cluster showed a significant difference of .001 with the mean for North Elementary eMINTS of 4.1750 and the mean for North Elementary Non-eMINTS of 3.2143. Three resource items showed significant differences: (a) "The availability of computers increase my ability to integrate technology" at a .000 significance level with a 4.50 mean for North Elementary eMINTS and a 2.54 mean for North Elementary Non-eMINTS; (b) "Adequate technological resources are available" with a 4.50 mean for North Elementary eMINTS and a 3.32 mean for North Elementary Non-eMINTS, a .000 significance level; and (c) "Our school has plenty of technology" at a significance level of .002 between a 4.60 mean for North Elementary eMINTS and a 3.75 mean for North Elementary Non-eMINTS.

Table 5B

Teachers' Roles and Responsibilities – Reality Statements – Technology School eMINTS (Grades 3 – 6) vs. Non-eMINTS (Grades K – 6)

Reality Statements

	North eMINTS Technology (Grades 3-6)			North Non-eMINTS Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
External Pressure	10	2.6000	.6992	28	3.4286	.790	-3.105	17.84	.006*
Competence	10	4.3250	.4257	28	3.7171	.487	3.728	18.05	.002*
Resources	10	4.1750	.5144	28	3.2143	.683	4.627	21.11	.000*
Technical Support	10	4.1000	.5676	28	3.9643	.693	.611	19.31	.548

Reality Items

	North eMINTS (Grades 3-6)			North Non-eMINTS (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
External Pressure	10	2.6000	.6992	28	3.4286	.790	-3.105	17.84	.006*
1. I do not feel pressured to use computers in my teaching.	10	2.60	.699	28	3.43	.790	-3.105	17.84	.006*
Competence	10	4.3250	.4257	28	3.7171	.487	3.728	18.05	.002*
1. Teachers are willing to use computers in our school.	10	3.80	.919	28	3.75	.752	.155	13.56	.879
2. Students are willing to use computers in our school.	10	4.50	.527	28	3.82	.819	2.984	25.01	.006*

Table 5B (Continued)

Reality Items (continued)									
	North eMINTS (Grades 3-6)			North Non-eMINTS (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
3. I am comfortable using technology.	10	4.50	.707	28	3.61	.994	3.057	22.46	.006*
4. Using technology in a lesson does not make me feel out of control and unprepared.	10	4.50	.527	27	3.70	.724	3.666	22.22	.001*
Resources	10	4.1750	.5144	28	3.2143	.683	4.627	21.11	.000*
1. The availability of computers increases my ability to integrate technology.	10	4.50	.707	28	2.54	1.11	6.420	25.16	.000*
2. Adequate technological resources are available.	10	4.50	.527	28	3.32	.983	4.721	29.89	.000*
3. Our school has plenty of technology.	10	4.60	.516	28	3.75	.967	3.468	29.98	.002*
4. Our school had adequate instructional software programs.	10	3.10	.994	28	3.25	.701	-.440	12.34	.668
Technical Support	10	4.1000	.5676	28	3.9643	.693	.611	19.31	.548
1. Technical support is available to me when I have a problem.	10	4.10	.568	28	3.96	.693	.611	19.31	.548

Summary. The analysis of data for the first hypothesis identified two subscales that were significantly different for the two schools. Therefore, null hypotheses one was rejected.

Hypothesis Two

Hypothesis two (HO_2) was there are no significant differences in teachers' perception of technology influence on student success in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

The means and test of differences on the learning cluster for the teacher respondents in the two schools are presented in Tables 6 through 9. The data in Table 6 are for respondents from staff in grades 1-3, the grade levels that are directly comparable in the two schools. The learning cluster did not show a significant difference (t:1.501; p:.145). In addition, none of the four learning cluster items (a) "Computers engage students in the learning process", (b) "Computers have led to gains in student achievement”, (c) “Computer technology alters the way students learn and teachers teach”, and (d) “Technology adds creativity and enthusiasm to lessons” were significantly different between the two elementary schools.

Table 6

Student Success – (Grades 1 – 3)

Student Success Subscale and Items									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
Learning	17	3.9947	.8555	27	3.6296	.689	1.501	27.81	.145
1. Computers engage students in the learning process.	17	4.29	.686	27	4.11	.698	.856	34.61	.398
2. Computers have led to gains in student achievement.	16	3.44	1.031	27	3.37	.688	.232	23.03	.819
3. Computer technology alters the way students learn and teachers teach.	16	3.38	1.025	27	3.37	.926	.015	29.10	.988
4. Technology adds creativity and enthusiasm to lessons.	17	4.88	2.395	27	3.67	.832	2.018	18.46	.058

Data from teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school grades K-6 regarding student success are presented in Table 7. The significance level of .254 reveals no significant difference between the two schools in the learning cluster. Additionally, none of the four learning cluster items were significantly different between the two elementary schools.

Table 7

Student Success – Non-Technology School (Grades 1 – 3) vs. Non-eMINTS in Technology School (Grades K – 6)

Student Success Subscale and Items									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
Learning	16	3.9944	.8836	28	3.5921	.451	1.168	23.80	.254
1. Computers engage students in the learning process.	16	4.31	.704	27	3.96	.587	1.797	24.01	.085
2. Computers have led to gains in student achievement.	15	3.40	1.056	28	3.36	.488	1.889	22.52	.072
3. Computer technology alters the way students learn and teachers teach.	15	3.33	1.047	28	3.43	.742	1.787	19.70	.089
4. Technology adds creativity and enthusiasm to lessons.	16	4.94	2.462	28	3.64	.731	-.941	19.97	.358

Data from teachers in the non-technology school grades 1-3 and teachers in the eMINTS program of the technology school grades 3-6 regarding student success are presented in Table 8. The learning cluster data revealed a .254 significance level with none of the learning cluster items below .05 significance level.

Table 8

Student Success – Non-Technology School (Grades 1 – 3) vs. eMINTS Program of Technology School (Grades 3 – 6)

Student Success Subscale and Items									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Learning	17	3.9947	.8555	10	4.2750	.381	1.168	23.80	.254
1. Computers engage students in the learning process.	17	4.29	.686	10	4.70	.483	1.797	24.01	.085
2. Computers have led to gains in student achievement.	16	3.44	1.031	10	4.00	.471	1.889	22.52	.072
3. Computer technology alters the way students learn and teachers teach.	16	3.38	1.025	10	4.10	.994	1.787	19.70	.089
4. Technology adds creativity and enthusiasm to lessons.	17	4.88	2.395	10	4.30	.675	-.941	19.97	.358

Data in Table 9 revealed student success data from eMINTS teachers in the technology school grades 3-6 and Non-eMINTS teachers grades K-6 in the same school. Data presented a .000 significance level between the 4.2750 mean for North Elementary eMINTS and the 3.5921 mean for North Elementary Non-eMINTS. In Table 9, three learning items showed a significance level below .05: (a) “Computers engage students in the learning process” at a significance level of .001 between a 4.70 mean for North Elementary eMINTS and a 3.96 mean for North Elementary Non-eMINTS; (b)

"Computers have led to gains in student achievement" with a 4.00 mean for North Elementary eMINTS and a 3.36 mean for North Elementary Non-eMINTS, a significance of .002; and (c) "Technology adds creativity and enthusiasm to lessons" at a .019 significance level between the 4.30 mean for North Elementary eMINTS and the 3.64 mean for North Elementary Non-eMINTS.

Table 9

Student Success – Technology School eMINTS (Grades 3 – 6) vs. Technology School Non-eMINTS (Grades K – 6)

Student Success Subscale and Items	North eMINTS Technology (Grades 3-6)			North Non-eMINTS Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Learning	10	4.2750	.3809	28	3.5921	.450	4.629	18.68	.000*
1. Computers engage students in the learning process.	10	4.70	.483	27	3.96	.587	3.879	19.52	.001*
2. Computers have led to gains in student achievement.	10	4.00	.471	28	3.36	.488	3.667	16.41	.002*
3. Computer technology alters the way students learn and teachers teach.	10	4.10	.994	28	3.43	.742	1.950	12.77	.073
4. Technology adds creativity and enthusiasm to lessons.	10	4.30	.675	28	3.64	.731	2.585	17.12	.019*

Summary. The analysis of data for the second hypothesis identified a significant difference between the two schools. Therefore, null hypotheses two was rejected.

Hypothesis Three

Hypothesis three (HO_3) was there are no significant differences in the type of professional development activities related to integrating of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools

b) teachers in the non-technology school grades 1-3 and non-eMINTS teachers in the technology school K-6

c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

The means and test of differences regarding professional development activities for the teacher respondents in the two schools are presented in Tables 10 through 13. Data on the training cluster are presented in Table 10 with a significance level of .038. South Elementary had a mean of 3.6147 while North Elementary revealed a 3.2963 mean. Two training items showed a significance level below .05: (a) “I would be willing to attend computer training on my own time” at a significance level of .026 between the 3.76 mean for South Elementary and the 3.22 mean for North Elementary; and (b) “Staff development in technology is encouraged" with a 4.06 mean for South Elementary and a 3.52 mean for North Elementary, a significance of .010.

Table 10

Teacher Professional Development – (Grades 1 – 3)

Professional Development Subscale and Items									
	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 1-3)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	t	Df	Sig.
Training	17	3.6147	.3999	27	3.2963	.583	2.147	41.61	.038*
1. I would be willing to attend computer training on my own time.	17	3.76	.437	27	3.22	1.09	2.315	37.11	.026*
2. I should have more computer training.	17	3.65	.702	27	3.15	.989	1.954	42.29	.057
3. College or graduate work has prepared me to use computers.	17	2.76	1.300	27	3.11	1.22	-.881	32.49	.385
4. Inservice training for technology is conducted regularly.	16	3.88	.719	27	3.48	.935	1.547	38.08	.130
5. Staff development in technology is encouraged.	17	4.06	.429	27	3.52	.893	2.690	39.84	.010*

Data on professional development activities from teacher respondents in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school grades K-6 are presented in Table 11. No significant difference between the two schools was revealed with a .959 significance level. Also, all training cluster items did not reveal a significant difference between the two elementary schools.

Table 11

Teacher Professional Development – Non-Technology School (Grades 1 – 3) vs. Non-eMINTS Teachers in the Technology School (Grades K – 6)

Professional Development Subscale and Items	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
Training	16	3.6156	.4130	28	3.2857	.515	-.052	19.87	.959
1. I would be willing to attend computer training on my own time.	16	3.75	.447	28	3.46	.881	-2.186	10.85	.052
2. I should have more computer training.	16	3.63	.719	28	3.25	.928	-.373	17.71	.714
3. College or graduate work has prepared me to use computers.	16	2.69	1.302	28	3.14	1.11	.801	17.88	.433
4. Inservice training for technology is conducted regularly.	15	3.93	.704	28	3.18	.983	1.732	23.61	.096
5. Staff development in technology is encouraged.	16	4.13	.342	28	3.39	.956	.799	11.61	.440

Professional development activities data from teachers in the non-technology school grades 1-3 and teachers in the eMINTS program of the technology school grades

3-6 are presented in Table 12. No significant difference in the training cluster and training cluster items were identified between the two schools.

Table 12

Teacher Professional Development – Non-Technology School (Grades 1 – 3) vs. eMINTS Program of the Technology School (Grades 3 – 6)

Professional Development Subscale and Items	South Elementary Non-Technology (Grades 1-3)			North Elementary Technology (Grades 3-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
Training	17	3.6382	.4106	10	3.6300	.389	-.052	19.87	.959
1. I would be willing to attend computer training on my own time.	17	3.76	.437	10	3.00	1.05	-2.186	10.85	.052
2. I should have more computer training.	17	3.47	.943	9	3.33	.866	-.373	17.71	.714
3. College or graduate work has prepared me to use computers.	17	2.76	1.300	10	3.20	1.40	.801	17.88	.433
4. Inservice training for technology is conducted regularly.	16	3.90	.693	10	4.30	.483	1.732	23.61	.960
5. Staff development in technology is encouraged.	17	4.12	.332	10	4.30	.675	.799	11.61	.440

Data from eMINTS teachers in the technology school grades 3-6 and teachers in the same school grades K-6 who were not eMINTS teachers regarding professional development activities are presented in Table 13. Data on the professional development cluster presented a .039 significance level between the 3.6300 mean for North Elementary eMINTS and the 3.2857 mean for North Elementary Non-eMINTS.

Table 13

Teacher Professional Development – Technology eMINTS (Grades 3 – 6) vs. Technology Non-eMINTS (Grades K – 6)

Professional Development Subscale and Items	North eMINTS Technology (Grades 3-6)			North Non-eMINTS Technology (Grades K-6)			Independent T-Test		
	N	Mean	SD	N	Mean	SD	T	Df	Sig.
Training	10	3.6300	.3888	28	3.2857	.515	2.196	21.04	.039*
1. I would be willing to attend computer training on my own time.	10	3.00	1.054	28	3.46	.881	-1.246	13.77	.234
2. I should have more computer training.	9	3.33	.866	28	3.25	.928	.247	14.41	.809
3. College or graduate work has prepared me to use computers.	10	3.20	1.398	28	3.14	1.11	.117	13.30	.909
4. Inservice training for technology is conducted regularly.	10	4.30	.483	28	3.18	.983	4.662	31.99	.000*
5. Staff development in technology is encouraged.	10	4.30	.675	28	3.39	.956	3.244	22.64	.004*

In Table 13, the significantly different professional development items were (a) “Inservice training for technology is conducted regularly” with the mean for North eMINTS at 4.30 and the mean for North Non-eMINTS at 3.18, a significance of .000 and

(b) “Staff development in technology is encouraged” at a significance level of .004 between the mean for North eMINTS of 4.30 and the mean for North Non-eMINTS of 3.39.

Summary. Significant differences were identified between the two schools; therefore, null hypothesis three was rejected.

Summary of Quantitative Findings

Table 14 summarizes the statistically significant quantitative findings for this exploratory study. Significant data findings for each hypothesis (HO_1, HO_2, and HO_3) by subgroups of teachers within both schools are presented. The hypotheses are listed across the top of the table followed by the category and item cluster that relate to each hypothesis. On the left side of the table, the subgroups of teachers from both schools and how they were grouped for this investigation are identified. The subgroups of teachers include (a) teachers in the non-technology school in grades 1- 3, (b) teachers in the technology school with both technology and non-technology classrooms in grades 1-3, (c) teachers in the technology school who were not in technology classrooms grades K-6, and (d) teachers in the technology school who were in technology classrooms grades 3-6. The non-technology school was considered the control group, and the technology school was considered the experimental school for this study.

The first grouping of teachers from both schools included (a) teachers in the non-technology school in grades 1- 3 versus (b) teachers in the technology school with both technology and non-technology classrooms in grades 1-3. Data from Table 14 revealed that teachers in the non-technology school grades 1-3 had stronger views in ideology and training than did the teachers in the technology school grades 1-3. The teachers in the non-technology school in grades 1-3 were willing to attend more computer training on their own time and staff development in technology was strongly encouraged. Teachers from the technology school grades 1-3 felt they had more technical support than those teachers in the non-technology school grades 1-3.

The next grouping of teachers consisted of (a) teachers in the non-technology school in grades 1- 3 versus (c) teachers in the technology school who were not in technology classrooms grades K-6. The area of differences was noticed in the Reality section of Table 14. Teachers in the non-technology school in grades 1-3 felt more external pressure to use technology in the classroom, and they felt more competent using technology in the classroom than the teachers from the technology school who were not in technology classrooms in grades K-6. However, the K-6 teachers in the technology who were not in technology classrooms felt they had more resources and technical support available to them than did the teachers at the non-technology school.

The third group of teachers that were studied included (a) teachers in the non-technology school in grades 1- 3 versus (d) teachers in the technology school who were in technology classrooms grades 3-6. Differences in the Reality section were noted between the groups in Table 14. Teachers in the non-technology school in grades 1-3 felt more external pressure to use technology in the classroom than the teachers in the technology school who were in technology classrooms in grades 3-6. However, teachers in the technology school who were in technology classrooms in grades 3-6 felt more competent using technology and had greater resources and technical support available than those teachers at the non-technology school in grades 1-3.

The last group of teachers that were compared included (d) teachers in the technology school who were in technology classrooms grades 3-6 versus (c) teachers in the technology school who were not in technology classrooms grades K-6. Many significant differences were found between these groups in Table 14. External pressure was stronger for teachers who were not in technology classrooms in grades K-6. Data on roles and responsibilities from teachers who were in technology classrooms in grades 3-6 revealed a greater ideology of using technology in the classrooms, a greater competence level, and more resources were available than did the teachers who were not in technology classrooms in grades K-6. Technology influence on learning data identified a greater influence in technology classrooms. The items that were highlighted include (1) computers engage students in the learning process, (2) computers have led to gains in student achievement, and (3) technology adds creativity and enthusiasm to lessons. Training data from Table 14 identified teachers in technology classrooms in grades 3-6 had stronger views relating to training than did those teachers who were not in technology classrooms in grades K-6. Items that were significantly greater were (1) inservice training for technology is conducted regularly and (2) staff development in technology is encouraged.

The data reported in Table 14 rejects all three hypotheses.

Table 14

Summary of Statistically Significant Quantitative Findings

Hypothesis	HO_1		HO_2	HO_3
Category	Roles/Responsibilities		Technology Influence	Professional Development
Item Cluster	**Beliefs**	**Realities**	**Learning/Items**	**Training/Items**
(a) Teachers in the non-technology school in grades 1- 3 vs. (b) Teachers in the technology school with both technology and non-technology classrooms in grades 1-3	Table 2A Ideology (a > b)	Table 2B Technical Support (b > a)	Table 6 None	Table 10 Training (a > b) Items: (a > b) - Willing to attend computer training on my own time - Staff development in technology is encouraged
(a) Teachers in the non-technology school in grades 1- 3 vs. (c) Teachers in the technology school who were not in technology classrooms grades K-6	Table 3A None	Table 3B External Pressure (a > c) Competence (a > c) Resources (c > a) Technical Support (c > a)	Table 7 None	Table 11 None
(a) Teachers in the non-technology school in grades 1- 3 vs. (d) Teachers in the technology school who were in technology classrooms grades 3-6	Table 4A None	Table 4B External Pressure (a > d) Competence (d > a) Resources (d > a) Technical Support (d > a)	Table 8 None	Table 12 None
(d) Teachers in the technology school who were in technology classrooms grades 3-6 vs. (c) Teachers in the technology school who were not in technology classrooms grades K-6	Table 5A Ideology (d > c)	Table 5B External Pressure (c > d) Competence (d > c) Resources (d > c)	Table 9 Learning (d > c) Items: (d > c) - Computers engage students in learning process - Computers have led to gains in student achievement - Technology adds creativity and enthusiasm to lessons	Table 13 Training (d > c) Items: (d > c) - Inservice training for technology is conducted regularly - Staff development in technology is encouraged
	HO_1 Rejected		**HO_2 Rejected**	**HO_3 Rejected**

Qualitative Data

For this study, two urban elementary schools with 58 certificated staff members participated. Each participant completed the survey instrument to investigate the use and integration of technology into the elementary curriculum and to explore the influence of technology on student success. Five individual interviews and a focus group interview with the building administrator and department heads were conducted at each elementary school to gather a more in-depth understanding of the use and integration of technology in elementary classrooms and to explore the influence of technology on student success.

Analysis of the qualitative data revealed three primary themes with subthemes embedded within each of the primary themes. These themes were (a) barriers to technology integration, (b) importance of technology training, and (c) learning environment.

Barriers to Technology Integration

The first theme to emerge from this study was barriers to technology integration. Further examination of the data from which this theme emerged revealed three subthemes: (1) time; (2) resources; and (3) technical support. Each of the subthemes directly affects technology integration.

Time. The first subtheme associated with barriers to technology integration was time. Interview participants from South Elementary and North Elementary stressed the challenge of time. Teachers from the non-technology school responded, “Time is a big issue because all the stuff I look up on my own time when I am at home or have a few extra minutes” (JS). “Actually finding time to find different things in different subjects is the challenge” (EC). Data support the view of extant literature that using computers in the classrooms requires a considerable time investment by teachers (Bitner & Bitner, 2002). “It is a lot of work to have to do as a teacher and takes time” is a response from a teacher at the technology school who does not work in a technology classroom (BS). One teacher in a technology classroom responded, “Finding time to prepare which programs are good and going to best help me instruct my class is a challenge” (NG).

Participants from both schools suggested that preparing lessons that integrate technology requires more planning time. Responses from participants at the technology school who teach in technology classrooms are: “It takes a long time. I try to bring in technology as much as I can but it almost doubles your planning time” (CM). “It is difficult to do because it takes time to find web sites and put them in web quest. It is a time constraint” (NG). “It is time consuming finding web sites and lessons that fit my students and are not too hard or too easy” (KR). “The challenges are organizing all of the information on the Internet to help meet the needs of the students in my classroom. There are so many web sites and so many web quests, so many helpful things that will help you as the teacher and help the students that you have to really pick and choose which one will benefit the most” (CM).

Time coupled with all the demands on teachers increases the barrier to successful technology integration (Ertmer, Addison, Lane, Ross, Woods, 1999). Data revealed that both elementary schools are balancing implementation of a new curriculum and achievement of adequate yearly progress gains with technology integration. A teacher at the technology school responded, “It’s been a balancing act trying to mesh our curriculum and technology. They are both constructivist views. How do you do it and provide time to see how that works” (NG). “I just wish we had more time to use it” (KR).

Teachers from the non-technology school responded, “I think we are all so busy. We got a new curriculum. We are on a learning curve right now with that new curriculum” (CD). “There is not enough time in the day. What do I have to give up in order for the student to have technology” (JS).

Resources. The second subtheme supporting barriers to technology integration was resources. The availability of hardware and software resources is essential for technology to positively influence student success (Dexter, Anderson, & Becker, 1999). Several participants from the two selected urban elementary schools discussed the importance of resources.

Participants suggested that the lack of equipment and limited access to computers limits the level of technology integration that will occur in the classroom. One teacher from the non-technology school responded, “There will have to be a big change in the way we implement this stuff to make an impact on achievement with 20 students and 2 computers for them to use” (JS). “I think we need more computers in each room” (PB). Teachers from the technology school responded, “Student access is important” (LW). “The lack of exposure is a challenge” (AB).

Another resource component that emerged as the qualitative data were analyzed was the availability of appropriate software programs. “It is important to make sure all software is appropriate for the students’ level” (CD). Interview participants at both South Elementary and North Elementary also discussed how more resources are needed. “We are starting a new unit on data in math and there is a whole section for technology to use on the computer, but we have to skip it because we don’t have enough computers” (AB).

"I have found some great web sites that have interactive things for the teachers and students, but I can't utilize them" (AB).

When utilizing various technological resources in the classroom, the level of technology integration amplifies (Dias,1999). "We have invested our money in more eMINTS classrooms versus a lab. Because in a lab, it is hit and miss. Kids get 30 minutes a week. So you are not really getting the full effect of technology" is the response for a participant at the technology school (NG). "SmartBoards take direct instruction to another level. It is not really instruction. You are bringing students up and they are interacting with the SmartBoard" (KR). "I literally think I am addicted to my SmartBoard. I could not use a chalkboard if I wanted to now because there are so many advantages of having a SmartBoard that I use it in reading, writing, science, social studies and every subject of the day throughout the entire day" (CM).

Technical support. The final subtheme that influenced barriers to technology integration was technical support. Interview data revealed that teachers must have adequate technical support when integrating technology in the classrooms. "It is important to make sure everything is up and running" (SG). A teacher from the non-technology school responded, "Our computers this year have been on the blink" (CD).

Participants expressed their concerns regarding timely response to technical problems. "My computer keeps messing up so I haven't been able to use it" (BS). Responses from participants at the non-technology school, South Elementary, include "They [administration] want everything done on the computer. They [administration] want your lesson plans, progress reports, grades, test scores, but the computer doesn't always work" (JS). "We have gone through some problems with the virus. Now we are at the point still with reloading everything. We hired a new technology team to meet our needs" (PB).

Data from this exploratory study of two urban elementary schools revealed technical challenges in integrating technology. These challenges echoed a negative tone to the notion of technology integration (Hannafin, & Savenye, 1993). "The server being down is my biggest challenge" is a response for a teacher at the technology school, North Elementary, (KR). "You cannot use any program on the computer unless it is issued by the district. It has been a big hurdle" (JS). "We had a virus or something and lost everything. Any grades you had on there if you didn't save them they were lost" (JS).

Importance of Technology Training

The second theme that emerged from the analysis of the qualitative data gathered in this study was the importance of technology training. To successfully integrate technology in the classrooms, training is needed (Kopp, & Ferguson, 1996). Two subthemes that surfaced from the further analysis of the data included: (1) collaboration and (2) type of training. Data that transpired from the interviews of two urban elementary schools suggested that teachers are willing and do attend training sessions.

At South Elementary, teachers are required to use technology in their classrooms. With this requirement, technology training is mandatory and conducted mostly within the district. Teachers meet regularly to learn technology skills and to integrate technology into their lessons. "The push started a couple years ago when I asked all teachers to do their lesson plans on the computer" (FG). "Everything we do is on the computer. We do progress reports, grade cards, lessons. You name it. It's done on the computer" (SG). "We are going through stages and right now we are in stage one of our technology plan.

Training is mandatory. We have to turn in a performance event in order to get a certificate" (FG).

Technology training at North Elementary is voluntary. Teachers sign up for training sessions if interested. However, teachers cannot access the technology unless they have successfully completed training on the equipment. "I am taking technology courses right now to learn how to use a SmartBoard" (BS). "Next year I will be able to employ a lot more with math because there's graph paper and other things that I haven't been able to utilize" (RS). Teachers focus on inquiry based learning and developing lessons that fit the curriculum versus the tool.

Collaboration. The first subtheme of the importance of technology training was collaboration. Interview data from both elementary schools suggested that collaboration increases with the use of technology. "Every other month they'll teach us something new to use in our classroom and the other month we'll bring lessons and collaborate" (KR). "I think we collaborate a lot – more of it is unplanned. If I have a question about technology or a lesson through technology, I know that I can go to any of my teachers right here" responded a teacher from the technology school (CM). "We collaborate on just about everything on every subject" (RS).

With increased collaboration, teachers shorten the learning curve for using and integrating technology (MacKenzie, 1999). "We are always sharing websites with each other" (FG). It might be "emailing each other with different sites that we have come across that may be useful or helpful in the classroom" (KR). Both elementary schools conduct regular staff meetings and emphasize training. "Teachers meet regularly to share certain lessons and activities that the students have done on the computers" (CM).

“Technology has opened the door to getting online and looking at other teacher’s lessons. Collaboration has improved because you can get countless number of lessons from people across the country” (LW).

Type of training. The second subtheme in the importance of technology training was the type of training. These training types include basic skills, application software, administrative uses, and curriculum integration. “The type of training varies with the expertise of the teacher and the time that they have been exposed to it” (NG). Data from the interviews suggest that training sessions are held at each elementary school.

South Elementary has a technology team that conducts training sessions once a month for teachers to learn a new concept or skill. These sessions are referred to as Technology Tuesdays. Teachers are required by the district to attend and complete specific performance activities. “Everybody was trained to do basic things, but we had a lot of reluctant learners” (PB). Currently teachers are progressing through stage one learning the basics. Next year they will move on to stage two. “We have never done any training on integration. If you want to do it, you need to figure it out yourself and if you don’t know anything about computers you are sort of at a loss” (JS).

North Elementary offers various types of training within the district. Teachers can sign up for classes to learn basic skills, administrative uses, and application software. “On workdays, they always have computer courses available. I took two courses on computers, one was Microsoft basics and the other was how to put your grades online” (LW). “They showed us how to do our grades and keep records on the technology and not just using it for the students” (KR). “Couple computer classes after school taught us how to set up our email, but it has really been how to use versus utilizing it in your classroom" (AB). Interview data suggests that the integration training is minimal. "We are trying to figure out how we can integrate workshop and technology because we know that workshop works and we know that technology works, but we would like to bring them together. It is very challenging – having curriculum and having technology and trying to figure out how the two are supposed to work together" responded a teacher from the technology school (CM). "I have to learn how to include technology in my daily lessons" (LW).

Learning Environment

The third theme to emerge from this study was the how technology affected the learning environment of elementary classrooms. The data revealed two subthemes affecting the learning environment which include: (1) enhancement of curriculum and (2) effect on students.

Interview data suggested technology positively impacts student learning. Utilizing computers in the classroom broadens students' experiences while enhancing learning opportunities (Mann & Shafer, 1997; Missouri Department of Elementary and Secondary Education, 2002). A teacher from the non-technology school responded, "Technology is used as resource to find out more about something" (JS). "Technology gets them ready for the real world. Everything is computerized now and a lot of them don't have computers at home" (TG). "Technology lets children explore more than they are now. They get to see more and do more than they would just in the classroom" (LW). "It broadens students' horizons to things that they wouldn't probably get to see or do otherwise. The Internet can take you everywhere," responded a teacher from the technology school (KR).

All interview participants at both South Elementary and North Elementary suggested the use and integration of computers enhance the learning environment of elementary classrooms. The use and integration of technology provide another learning tool for the different types of learners in the classroom. “There are a lot of things out there on the web like forces in motion and very hard concepts my children have struggled with. Being able to pull technology into the lesson to help my children achieve has been beneficial” (RS). Using computers in the classroom “positively affects their learning because it motivates them and they can see things in different ways” (KR).

Computers enable students to participate in interactive and virtual learning (Sandholtz, Ringstaff, & Dwyer, 1997). “Technology positively influences student learning because it is just another avenue or way for students to learn” (CD). “Being able to access things on the Internet or put up their writing and interactively edit it has really made a difference” (RS). “Technology enhances the lessons. If they have a question they have to answer students have to go and find the answer” (SG).

Enhancement of curriculum. The first subtheme of learning environment is enhancement of curriculum. The interview participants from both South Elementary and North Elementary revealed the use and integration of technology in elementary classrooms enhance and enrich the curriculum. “Students have more access to recent research and information” (ZY). “The Internet has many virtual tours students can select. Right now we are studying weathering and they got to actually go out and look at the Grand Canyon. They get to see things that they will probably never see in their life” (KR). “It provides a lot of interactive learning for the whole classroom” (CM).

The availability of online research via the Internet provides increased learning opportunities in the classroom (Williams, 2000). “It enriches and brings something more to the table” response from a technology classsroom teacher (CM). “If I have something that is not covered in the curriculum, it is amazing. You just pick up Google and the information is endless. I use technology to locate information about a subject” response from a non-technology classroom teacher (PB).

Curriculum is also enhanced through inquiry-based learning. When students are constructing their knowledge, the level of learning is increased (eMINTS, 2005; Kleiman, 2004). One teacher from the technology school responded, “I would have my students do all their research and all the inquiry based stuff with partners to create projects. I saw great things out of them” (CM).

Effect on students. The second subtheme of learning environment is the effect on students. Data from the interviews revealed that teachers perceive students to be motivated and excited to use computers. “Kids are really focused on what they are doing and really enjoy it” (BS). “Students love to use computers. They don’t even know they are learning when they are on the computers. They are so excited to start a project about the life cycle of a frog because they get to get on Inspiration and do a PowerPoint presentation. They are learning so much about it that they don’t even know they are learning” (CM).

When using computers in the elementary classrooms, students are engaged in the learning process (Sandholtz, Ringstaff, & Dwyer, 1997). A teacher from the non-technology school responded, “Students become more aware of what’s going on. With the Tsunami disaster we were able to get on the computer and find out some things about what exactly a tsunami was and how tsunami occur. It allows them to expand their mind" (ML).

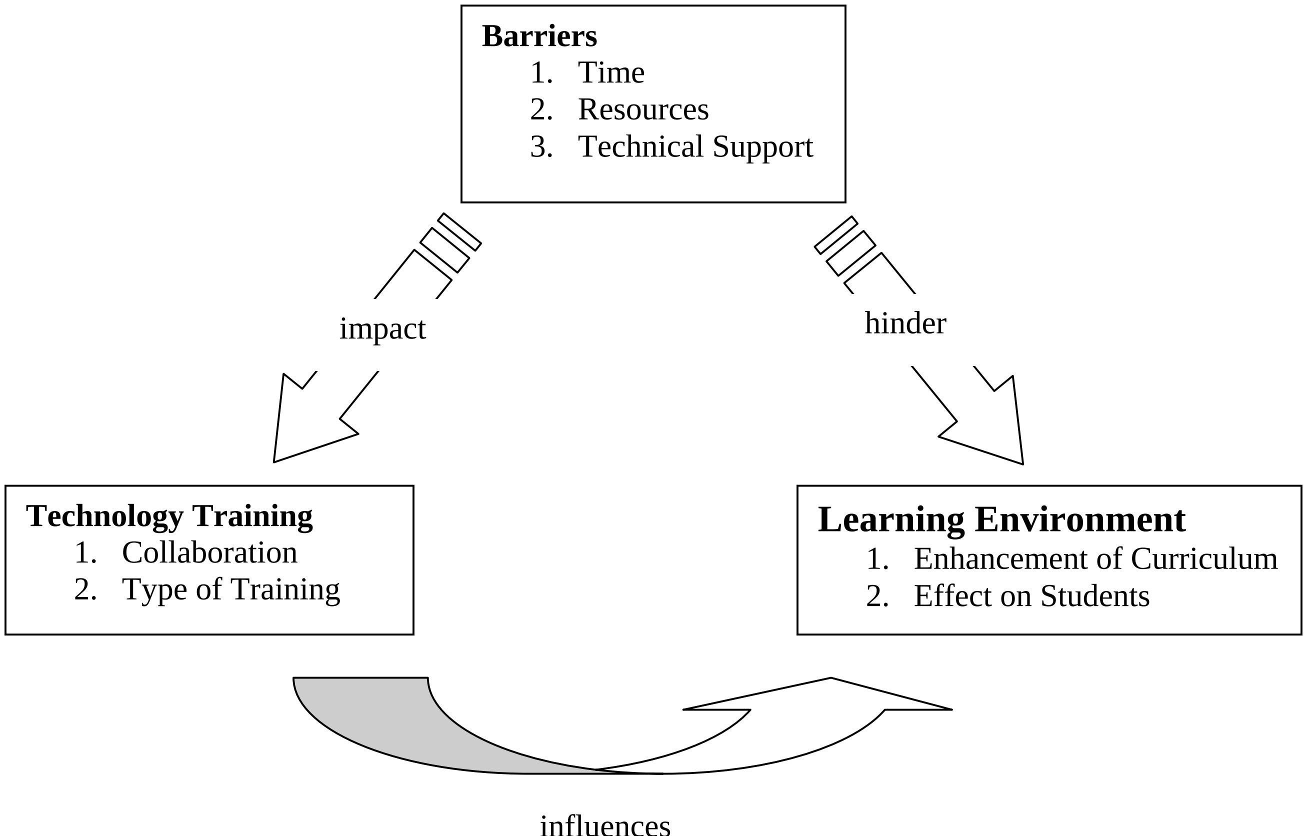
Students become more interested in learning when using technology (Charp, 2003). "Technology is a non-threatening learning tool and I think a lot of kids know that and appreciate it. Some of those kids who have poor motor skills can be put in front of a computer and not have to be worried about the quality of work they are turning out. Also kids that are needy, academically speaking, or very bright benefit an awful lot from technology. Those kids that are behavior concerns also benefit. You put them in front of the computer and those concerns go away" (PB). "Students are more engaged with it. If there is a problem, they would just figure it out because they are so interested in it" (BS).

Interthematic Relationships

The three primary themes that emerged from the analysis of the interviews were barriers to technology integration, importance of technology training, and learning environment. Figure 1 illustrates the interaction of these primary themes and subthemes of this exploratory study.

Barriers to technology integration that includes time, resources, and technical support impact technology training. Technology training through collaboration and the type of training influences the learning environment of elementary classrooms and the level of student success. Learning environment focuses on the enhancement of curriculum and the effect on students. Thus, the learning environment is hindered through the existence of barriers to technology integration and the level of technology training.

Figure 1: Interthematic Relationship



Summary of Qualitative Findings

Three primary themes emerged from this exploratory study of two urban elementary schools that appear to be essential to understanding the use and integration of technology in elementary classrooms and the influence of technology on student success: (1) barriers to technology integration; (2) importance of technology training; and (3) learning environment.

Chapter Summary

This chapter presented the findings generated by analysis of the quantitative and qualitative data collected in an exploratory study that examined the use and integration of technology in elementary classrooms and to explore the influence of technology on student success. Three hypotheses were tested for significant differences and each was rejected. From the qualitative data, three primary themes emerged that expanded the findings of this exploratory study.

This investigation was primarily a quantitative study focusing on the teachers' perceptions of their roles and responsibilities for integrating technology (HO_1), the influence of technology on student success (HO_2), and the effect of professional development on technology integration (HO_3). The quantitative foundation of this study was supported through the qualitative findings. The theme, barriers to technology integration, and subthemes consisting of time, resources, and technical support supplemented the findings for hypothesis one. Hypothesis two, focusing on the influence of technology on student success, was supported through the primary theme of the learning environment. The importance of technology training theme and the subthemes of collaboration and type of training expanded and enhanced hypothesis three findings.

The final chapter contains a summary of the findings of this exploratory study and a discussion of those findings. Implications for practice will be discussed and questions for further study will be posed.

CHAPTER 5

Findings, Conclusions, and Recommendations

Introduction

Since the launch of Sputnik, numerous educational reform initiatives including those generated after the publication of A Nation at Risk, Show-Me Standards, Missouri Assessment Program (MAP), and No Child Left Behind (NCLB) have focused on academic deficiencies and have greatly influenced student achievement (Berends, 2004; Goals 2000, 1994; Missouri Department of Elementary and Secondary Education, 2002; NCLB, 2002). NCLB, signed into law in 2002, established significant public school accountability measures focusing on the integration of technology into classrooms to improve teaching and learning (NCLB, 2002).

Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS), a technology enhancement program, which compared the results of the 2004 Missouri Assessment Program (MAP) for 4,322 third and fourth grade students in 40 school districts, reported the positive effects of technology on teaching and learning. Students in eMINTS classrooms scored higher in communication arts and mathematics versus students in Non-eMINTS classrooms (eMINTS Evaluation Project, 2005).

Mandell, Sorge, and Russell (2002) supported the notion that technology can provide students with opportunities to discover and create knowledge thereby permitting the teacher to take on the role of facilitator. Educators using technology help students learn how to learn and provide them with a valuable skill more important than the imparting of factual information.

Research has found that the availability of technology and the Internet has increased significantly in the nation's schools and classrooms (Williams, 2000). Technology has the potential to transform learning by creating an optimum teaching and learning environment (NCES, 2001). Therefore, teachers must be trained to create technology rich learning environments for students (Anderson & Becker, 2001).

More teacher inservice focusing on integrating technology needs to be developed (Smith & Robinson, 2003; Desimone, et al., 2002; Ertmer, et al., 2003). Ringstaff and Yocam (1994) noted that professional development that focuses on learning about computers rather than learning how to integrate computers into the curriculum is inadequate. Redesigning current professional development may help reduce some of the barriers experienced during the implementation (Smith and Robinson, 2003). According to Hurst (1994), if classroom teachers are to use technology effectively in their classrooms, these educators must be provided with adequate training.

Therefore, if teachers are going to embrace technology and integrate it into the elementary curriculum, they need meaningful professional development. Professional development sessions in integrating technology into the elementary classroom will more effectively enable the teachers to know what technology can do to support and enhance their teaching strategies (Mouza, 2002/2003). Clearly, the teacher is the most important ingredient for success in schools using technology (Mandell, Sorge, & Russell, 2002).

This study explored the perceptions of elementary certificated staff members about their roles and responsibilities for integrating technology and the impact of professional development in teacher integration of technology on student success. The findings of this study add some insight in how technology influences student success.

Overview of Study

The purpose of this mixed method comparative study was to investigate the use and integration of technology into the elementary curriculum and to explore the influence of technology on student success. This study focused on teachers' perception of their knowledge and skills and their professional development experiences as they integrate technology into the curriculum for two urban elementary schools in a mid-western state. Data were generated from a survey questionnaire, interviews with individual teachers and focus group interviews consisting of administrators and department heads.

Research Questions

The overarching question guiding this mixed method comparative study is: Does the use of technology influence student success in elementary classrooms? The following research questions were examined during the completion of this study:

1. What are the teachers' perceptions of their roles and responsibilities for integrating technology in the classroom?
2. What are the teachers' perceptions of the influence of technology on student success?
3. What types of professional development activities related to integrating technology in elementary classrooms have been conducted?

Limitations

One school in this study was selected because of the technological interventions present in that school, and the other school was selected because of geographic proximity and demographic similarity with the technology school. This study utilized self-reporting data. Findings of the study are based on the perception data of teachers and the assumption that teachers will respond honestly and interpret the instrument as intended.

Null Hypotheses

The following hypotheses were tested in this study:

HO_1: There are no significant differences between teachers' perception about their roles and responsibilities in the use of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools
b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6
c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6
d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_2: There are no significant differences in teachers' perception of technology influence on student success in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools

b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6

c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

HO_3: There are no significant differences in the type of professional development activities related to integrating of technology in one elementary school (technology school) that has an intensive technology program (eMINTS) and another elementary school (non-technology school) that does not have an intensive technology program for the following subgroups of teachers within the two schools:

a) teachers in grades K-3 of both schools

b) teachers in the non-technology school grades 1-3 and Non-eMINTS teachers in the technology school K-6

c) teachers in the non-technology school grades 1-3 and teachers in the eMINTS program grades 3-6

d) teachers in the technology school grades 3-6 that were eMINTS teachers and teachers in the same school grades K-6 that were not eMINTS teachers.

Summary of Findings

Given the nature and focus of this investigation and research questions, a mixed method comparative design of both quantitative and qualitative research was conducted to more fully understand how technology is used in elementary classrooms. Data were generated from a survey questionnaire, interviews with individual teachers, and focus group interviews consisting of administrators and department heads. Triangulation of data (survey questionnaire, individual interviews, and focus group interviews) provided consistent evidence and increased the validity of the findings.

Significant quantitative data findings for each hypothesis (HO_1, HO_2, and HO_3) by subgroups of teachers within both schools are presented. The subgroups of teachers included (a) teachers in the non-technology school in grades 1- 3, (b) teachers in the technology school with both technology and non-technology classrooms in grades 1-3, (c) teachers in the technology school who were not in technology classrooms grades K-6, and (d) teachers in the technology school who were in technology classrooms grades 3-6.

The first grouping of teachers from both schools included (a) teachers in the non-technology school in grades 1- 3 versus (b) teachers in the technology school with both technology and non-technology classrooms in grades 1-3. Data from Table 14 revealed that teachers in the non-technology school grades 1-3 had stronger views in ideology and training than did the teachers in the technology school grades 1-3. The teachers in the non-technology school in grades 1-3 were willing to attend more computer training on their own time and staff development in technology was strongly encouraged. Teachers from the technology school grades 1-3 felt they had more technical support than those teachers in the non-technology school grades 1-3.

The next grouping of teachers consisted of (a) teachers in the non-technology school in grades 1- 3 versus (c) teachers in the technology school who were not in technology classrooms grades K-6. The area of differences was noticed in the Reality section. Teachers in the non-technology school in grades 1-3 felt more external pressure to use technology in the classroom, and they felt more competent using technology in the classroom than the teachers from the technology school who were not in technology classrooms in grades K-6. However, the K-6 teachers in the technology who were not in technology classrooms felt they had more resources and technical support available to them than did the teachers at the non-technology school.

The third group of teachers that was studied included (a) teachers in the non-technology school in grades 1- 3 versus (d) teachers in the technology school who were in technology classrooms grades 3-6. Differences in the Reality section were noted between the groups of teachers. Teachers in the non-technology school in grades 1-3 felt more external pressure to use technology in the classroom than the teachers in the technology school who were in technology classrooms in grades 3-6. However, teachers in the technology school who were in technology classrooms in grades 3-6 felt more competent using technology and had greater resources and technical support available than those teachers at the non-technology school in grades 1-3.

The last group of teachers that was compared included (d) teachers in the technology school who were in technology classrooms grades 3-6 versus (c) teachers in the technology school who were not in technology classrooms grades K-6. Many significant differences were found between these groups of teachers at the technology school. External pressure was stronger for teachers who were not in technology classrooms in grades K-6. Data on roles and responsibilities from teachers who were in technology classrooms in grades 3-6 revealed a greater ideology of using technology in the classrooms, a greater competence level, and more resources were available than did the teachers who were not in technology classrooms in grades K-6. Technology influence on learning data identified a greater influence in technology classrooms. The items that were significant included (1) computers engage students in the learning process, (2) computers have led to gains in student achievement, and (3) technology adds creativity and enthusiasm to lessons. Training data identified teachers in technology classrooms in grades 3-6 had stronger views relating to training than did those teachers who were not in technology classrooms in grades K-6. Items that were significantly greater were (1) inservice training for technology is conducted regularly and (2) staff development in technology is encouraged.

The quantitative data findings rejected all three hypotheses. The data from this exploratory study supports the eMINTS program with the increased ideology, competence, resources, learning, and training views from teachers in the technology school who were in technology classrooms in grades 3-6.

Major themes and subthemes emerging from the qualitative data were noted and analyzed. The three major themes that appeared to be fundamental to the use and integration of technology in the classroom and the influence on student success include (a) barriers to technology integration, (b) importance of technology training, and (c) learning environment. Seven subthemes emerged from the factors and variables that influenced these major themes.

In the next section, the discussion of findings from this exploratory study is examined through the learning lens. Morgan (1997) described the learning lens framework as a metaphor. Learning organizations focus on how organizations learn, what organizations learn, and what limits learning. Double loop learning and tacit versus explicit knowledge are characteristics of learning organizations. The learning lens provides insight into the influence technology has on student success and provides the interaction of the quantitative and qualitative data findings.

Discussion of Findings

The overarching question guiding this mixed method comparative study is: Does the use of technology influence student success in elementary classrooms? Each research question is discussed in light of the quantitative and qualitative findings to form the basis for the discussion. The first section provides data from this investigation to answer research question 1: What are the teachers' perceptions of their roles and responsibilities for integrating technology in the classroom?

Research Question 1

Through the quantitative data analysis, hypothesis one was tested. The use of a t-test was conducted to determine if there was a statistical difference in the perceptions of teachers in the use and integration of technology and the influence on student success. The belief statements revealed a significance difference in the cluster of ideology with all teachers in grades 1-3 from both schools (p: .042) and between the Non-eMINTS teachers and eMINTS teachers at the technology school (p:.001). These findings support the notion that perceptions of the classroom teacher strongly affect the level of technology integration in the classroom and the literature according to Eachus and

Cassidy (1999), which reported that self-efficacy has been the major factor in understanding the success with which individuals use computers.

Reality statements of external pressure, competence, resources, and technical support showed significant differences between the subgroups of teachers within the two elementary schools. Data suggest that the teachers' perception vary between the two elementary schools in the ideology cluster and reality clusters.

Data from interviews suggest that the participants from both schools expressed concerns with the various barriers to technology integration. These barriers centered on time, resources, and technical support issues. Interview findings discussing time, resources, and technical support corroborate various pieces of literature (Hruskocy, et al, 2000; Ertmer, et al, 2003). "There is not enough time in the day" (JS). "The lack of exposure is a challenge" (AM). "My computer keeps messing up so I haven't been able to use it" (BS). Norris, Sullivan, Poirot, and Soloway (2003) reported that teachers' use of technology is dependent upon their access to technology. If the opportunity to access technology is limited, use and integration of technology will be minimal.

The research revealed that teachers' roles and responsibilities for using and integrating technology in the classroom to influence student success may be associated with teachers' ideology, level of technology training, and the amount of barriers that existed.

Through the interviews at both schools, certificated staff members indicated that they are experiencing some of the same barriers in integrating technology into their classroom as indicated in the literature (Etmer, et al, 1999). For example, most participants reported that time was a barrier; although, the time barrier apparently became less of a barrier as the staff member became more trained and skilled in technology.

Many teachers are overwhelmed by the amount of additional hours after school needed to learn how to use and integrate technology in their classrooms. Mann and Shafer (1997) reported teachers spend more of their own time learning how to use and integrate technology than in training sessions provided. Whelan, et. al., (1997) also reported time as the biggest obstacle for teachers.

Therefore, more time during the school day must be made available to teachers. Creative scheduling and increased opportunities for teachers to use and integrate technology in the classrooms will provide for a greater influence on student success.

The preceding section reported findings of this study as they relate to the first research question. The following section provides an analysis of the findings to answer research question 2: What are the teachers' perceptions of the influence of technology on student success?

Research Question 2

The second research question asked what are the teachers' perceptions of the influence of technology on student success. The means and test of differences on the learning cluster revealed a significant difference with only one subgroup of teachers, eMINTS teachers in the technology school grades 3-6 and Non-eMINTS teachers in grades K-6 in the same school, at a .000 significance level. Analysis of the perception of teachers regarding student success supports the eMINTS literature. Teachers in technology classroom believe computers engage students in the learning process, computers have led to gains in student achievement, and technology adds creativity and enthusiasm to the lessons.

With unlimited resources at learners' fingertips via the Internet, participants expressed how technology enhances and enriches the curriculum. Students are able to participate in interactive and virtual learning opportunities to enrich the curriculum. Utilizing these resources provides students an avenue to broaden their learning horizon by enabling students to see and do outside of the classroom. Murphy and Thuente (1995) echo the participants' perceptions that technology in pre-kindergarten through third-grade can expand and enhance learning.

Qualitative data revealed that participants perceive the learning environment to impact student success. Two subthemes that emerged from the interviews include enhancement of curriculum and effect on students. This primary theme along with the two subthemes supports the quantitative findings for hypothesis two in regards to the influence of technology on student success.

Interview data suggested technology positively impacts student learning. Teachers perceive students to be motivated and excited to use computers. Alden (2003) reported teachers are finding students more eager to sit down and concentrate on lessons using a computer than those using traditional methods. Mann and Shafer (1997) and Missouri Department of Elementary and Secondary Education (2002) noted utilizing computers in the classroom broadens students' experiences while enhancing learning. Using the eMINTS model of inquiry-based learning, teachers use technology to engage students in their learning. Students explore ideas, engage in projects of choice, work collaboratively, and gain conceptual understanding of the topic at hand. “Technology lets children explore more than they are now” (LW).

Teachers perceived student learning benefits include motivation, enthusiasm, engagement, interest in learning, and collaboration. Finally, teachers reported students are eager to use technology in the classroom. Additionally, teachers believed technology presented expanded learning opportunities and preparation for the future. Alden (2003) noted that using computers enhances and adds to a student’s learning experience and at the same time enhances teaching capabilities. David (1994) stressed that technology can serve as a vehicle for significantly changing what happens in the classroom and diversifies how and what students learn.

Findings from this study support the notion that technology is a tool that effectively supports student learning and collaboration. McCombs & Whistler (1997) described practices that enhance learning, including tying learning both to prior learning and to authentic tasks, knowing the individual needs of students and their unique backgrounds, respecting diversity, and developing relationships. The importance of collaboration in the learning process was noted in many publications (Bruffee, 1999; Paul & Marfa, 2001; APA, 1997). In a collaborative learning process, students construct knowledge socially.

Educators can structure students’ experiences to maximize learning. New learning should be tied to prior knowledge (Flannery & Vanterpool, 1990; Nonaka & Takeuchi, 1995; APA , 1997) in order to facilitate the assimilation of new knowledge. Utilizing technology and the Internet, unlimited resources are available to students while enhancing their learning opportunities. Alden (2003) stated that with computers, students have access to a new array of creativity tools, making it easier for them to express and explore their creativity. Technology energizes teaching and brings learning to life.

Responses of the participants also support the literature in the influence of technology on student success and the learning environment. Patton (2004) described the influence technology has on students. “Students never want to miss school. It stretches me and my students in all directions” (p. 51).

Knapp and Glenn (1996) claimed that studies have shown effective integration of technology naturally leads to greater student collaboration and learning. Shade and Watson (1990) stated that only where computers are integrated into the curriculum as a vital element for instruction will students use computers as natural tools for learning.

This section provided data relevant to the second research question that guided this exploratory study. The next section reports an analysis of findings to answer research question 3: What types of professional development activities related to integrating technology in elementary classrooms have been conducted?

Research Question 3

The last research question asked what types of professional development activities related to integrating technology in elementary classrooms have been conducted. The means and test of differences of the respondents in the two schools were conducted. Data revealed a significant difference in the analysis of two subgroups of teachers.

The first subgroup consisted of all certificated teachers in grades 1-3 from both schools with a significance level of .038. Data revealed that teachers in the non-technology school grades 1-3 had stronger views in ideology, technical support, and training than did the teachers in the technology school grades 1-3. The teachers in the non-technology school in grades 1-3 were willing to attend more computer training on their own time and staff development in technology was strongly encouraged.

The other subgroup of teachers included the eMINTS teachers in the technology school grades 3-6 and the Non-eMINTS teachers grades K-6 of the same school with a significant difference of .039. Training data identified teachers in technology classrooms in grades 3-6 had stronger views relating to training than did those teachers who were not in technology classrooms in grades K-6. Items that were significantly greater were (1) inservice training for technology is conducted regularly and (2) staff development in technology is encouraged.

Findings from this exploratory study suggest that current methods of technology training appear to utilize the single loop process and do not appear to facilitate technology integration into the learning process. Single-loop learning, designed to keep the organization "on course," is distinguished as the process of learning that rests in an ability to detect and correct error in relation to a given set of operating norms (Hanson, 2001). Teachers from both elementary schools are taught how to use computers but are not taught how to integrate the technology into their classrooms. For example, teachers are often taught computer basics, software applications of Word, PowerPoint, and Excel, and other administrative and management tasks including email, online attendance, and grades. The expectation that follows these training sessions is that teachers will be able to successfully integrate technology in their classrooms since they have been taught how to do these basic computer tasks and know how to use a software application packages. This expectation is an example of single loop learning.

Double loop learning exists when teachers look for innovative ways to use technology in the classroom to enhance and enrich the curriculum and develop projects that engage students in the learning process. Double-loop learning is distinguished as the process of learning to learn and depends on being able to take a “double look” at the situation by questioning the relevance of operating norms (Hanson, 2001). Teachers must examine existing technology use assumptions and practices derived from those assumptions regarding curriculum and technology’s role in presenting that curriculum to determine what type of learning activities increase student learning.

In a similar fashion, teachers need engaging opportunities to learn how to effectively integrate technology into the classrooms as opposed to simply attending sessions on how to use computers and software programs. This view supports the eMINTS design of providing extensive hours of professional development, interaction, and collaboration for teachers to effectively integrate technology.

Technology training is critical to successful integration of technology in the classrooms. Qualitative data that emerged from this study suggested that teachers are willing to attend more training. Participants from both schools articulated that their respective district focused on training the staff to use technology. “Everything we do is on the computer” (SG). White, Ringstaff, and Kelley (2002) express the need for organizations to spend more budget funds on training and technical assistance than equipment. Through training and technical support essential curricular integration will occur (Whelan, Frantz, Guerin, & Bienvenu, 1997).

Subthemes that supported this major theme included collaboration and type of training. Participants in this study communicated their desire to share lessons and ideas while working together to utilize technology. Teacher collaboration shortens the learning curve for using and integrating technology (MacKenzie, 1999). “We collaborate on just about everything on every subject” (FS). Clearly, the teacher is the most important ingredient for success in schools using technology (Mandell, Sorge, & Russell, 2002). This desire among teachers in this study to collaboratively share their technology experiences and learn how to more effectively utilize technology suggested the presence of at least a portion of Nonaka and Takeuchi’s knowledge creation spiral of tacit-explicit-tacit knowledge (1995).

In this knowledge creation spiral, tacit knowledge, knowledge that has been gained through experience and is not easily identified or verbalized, is made explicit and shared with other organizational members, realigned with the information others bring to the discussion topic, and then internalized again through four steps labeled socialization, externalization, combination, and internalization (Nonaka & Takeuchi, 1995). Organizational learning takes place during social interaction between group members (Nonaka & Takeuchi; Gabrys, Weiner, & Lesgold, 1993).Collaboration and cooperative learning tasks promote the social interaction that is the prerequisite of knowledge construction (Bruffee, 1999). Learning is an active, participatory experience (APA); thus, the most powerful learning comes from direct experience (Nonaka & Takeuchi, 1995).

Type of training, the second subtheme, includes mandatory versus voluntary training, basics versus application training, and training within the district or outside of the district. “The type of training varies with the expertise of the teacher and the time they have been exposed to it” (NG). However, interview data suggest that integration training is minimal. “I have to learn how to include technology in my daily lessons”

(LW). This notion of more integration training is supported through the literature (White, Ringstaff, & Kelley, 2002; Albee, 2003; WestEd, 2002; Mouza 2002/2003).

Findings for this exploratory study suggest that another professional development technique for integrating technology in the learning process that should be considered is mentorship. Through mentoring, teachers can share lessons and ideas that will enhance and enrich the curriculum. Utilizing the concept of mentoring for technology integration also provides teachers an avenue to participate in the knowledge creation process and, in turn, increase student success.

Figure 1 illustrates the relationship of the three primary themes, barriers, technology training, and learning environment, which emerged from the analysis of this study. Barriers to technology integration, which include time, resources, and technical support, directly impact the technology training that takes place within the school. These barriers also hinder the learning environment that includes the enhancement of curriculum and the effect on students. Teachers must be given adequate time, resources, and technical support to effectively integrate technology in the classrooms. With increased technology training with a focus on collaboration and the type of training, barriers to technology integration are reduced. The learning environment is influenced by the technology training available to teachers.

Through the learning lens, knowledge must be tied to the experiences of the learner as this knowledge moves from tacit to explicit and back again. Integrating technology in the classroom utilizes knowledge creation components and clearly influences student success.

Recommendations

Recommendations for Future Research

While the research findings of this study suggest a significant difference exists in certificated staff members' perception of their role and responsibility for integrating technology, the influence of technology on student success, and the types of professional development related to integrating technology, further quantitative and qualitative investigations should be undertaken. This study suggests six areas for further exploration.

1. A similar study of the use and integration of technology into elementary classrooms and the influence of technology on student success in other regions should be conducted to determine if the results are similar or different from the findings in this study.
2. A similar study of the use and integration of technology into elementary classrooms and the influence of technology on student success in other eMINTS schools should be conducted to determine if the results are similar or different from the findings in this study.
3. A similar study of the use and integration of technology into elementary classrooms and the influence of technology on student success in other Non-eMINTS schools should be conducted to determine if the results are similar or different from the findings in this study.
4. A similar study of the use and integration of technology into elementary classrooms and the influence of technology on student success in elementary schools with high socioeconomic status percentages should be conducted to determine if the results are similar or different from the findings in this study.

5. A similar study of the use and integration of technology and the influence of technology on student success in middle schools and high schools should be conducted to determine if the results are similar or different from the findings in this study.
6. A study investigating the benefits perceived by parents related to increased technology use by their children in elementary schools should be conducted.
7. A study should be conducted to investigate the appropriate technology training program for elementary schools.

Recommendations for Improving Educational Practice

The decision to study the use and integration of technology in elementary classrooms and the influence of technology on student success reflected the researcher's personal experiences as a technology teacher and the director of data and technology, strong support for integrating technology in education, and passion to utilize technology as another instructional tool with elementary students. Designed to examine the use and integration of technology in elementary classrooms for students in kindergarten through sixth grade, this investigation was specifically geared to students in grades one through three. Of particular importance were the objectives to determine the relationship of professional development activities and the perceptions of certificated staff members on technology.

Other recommendations for improving educational practice would include investigating the use of technology in teacher preparation programs and mentorship. Discovering how teacher preparation programs integrate technology and how teachers are taught to use technology throughout these programs should impact educational practice.

The use of human capitol through mentorship by using eMINTS teachers as mentors for Non-eMINTS teachers to integrate technology should enhance the use and integration of technology in classrooms. The findings of this study imply that the successful integration of technology in elementary classrooms and the influence on student success is underscored by the importance of technology training, elimination of barriers, and inquiry-based learning environment.

Recommendations for Professional Development

The findings of this study imply that more professional development activities on how to effectively integrate technology in the classroom need to occur. Current methods of technology training do not facilitate and focus on technology integration. Rather than simply being taught how to use computers and various software applications, teachers need to be taught how to use technology as a tool to support learning and enhance the curriculum. When this approach to professional development for technology integration is undertaken, learning with computers will occur and students will take a more active and engaging role in their learning process (Keeler, 1996).

Along with the integration training, more training designed to meet teachers' training needs and knowledge level should be conducted. Bitner and Bitner (2002) discussed several areas that are essential for teachers to successfully integrate technology. Some of these areas include training of basics, personal use, teaching models, and learning styles. Technology training focusing on the training needs of teachers becomes the catalyst for change in the classroom and provides another tool to support student learning.

Inquiry-based learning is another area in which more teachers need to be trained. This notion of inquiry-based learning has been successfully implemented in the eMINTS program (eMINTS National Center, 2005). The inquiry-based approach emphasizes the importance of students exploring ideas, engaging in projects, working collaboratively, and gaining conceptual understanding of the topic.

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Appendix A – Letter to Building Administration

Connie M. Crane

766 Frenchman Bluff Road Troy, MO 63379

January 14, 2005

Dear Principals:

Enclosed are the technology survey questionnaires to be distributed to all certified staff teachers in your building. This is part of the "Impact of Technology on Elementary Classrooms and Teaching" dissertation study I am conducting as a requirement for the doctoral program at University of Missouri - Columbia.

As previously mentioned to you, participation will require a very minor time commitment. This one-time survey should take teachers less than 20 minutes to complete. You can assure your staff that answers will remain confidential. Responses will be combined to provide descriptive statistics.

Teachers should complete and return the survey in the self-addressed, stamped envelope at their earliest convenience. Complete surveys are due by January 21. Please help to ensure that the surveys are completed and returned in a timely manner, as gathering accurate and thorough data will be critical to the success of this study.

Upon completion of this study, the school may request a complete report on these results. Your participation and support is greatly appreciated. If you have any questions, you may contact Dr. Jerry Valentine (my advisor) at 573-882-8221, the University of Missouri Institutional Review Board at 573-882-9585, or myself at work (636) 462-6098 ext. 164 or home (636) 528-5811.

Sincerely,

Connie M. Crane

Enclosure: Survey questionnaire

Appendix B – Consent for Survey

I understand that Connie M. Crane, a doctoral student in the Educational Leadership and Policy Analysis Program at the University of Missouri – Columbia, is working on a study exploring the impact of technology on elementary classrooms and teaching. The survey containing 37 Likert-scale questions, 2 open-ended questions, and 16 demographic questions will take less than 20 minutes to complete. I understand that all information will be kept confidential. If I have any questions, I can contact Ms. Crane by email (cranec@troy.k12.mo.us) or telephone (636-462-6098 ext. 164) to obtain answers to my questions. I may also contact the University of Missouri Institutional Review Board at 573-882-9585 with questions regarding my rights as a research participant. At any time during this study, I can stop participating in the study with no fear of concern or consequences. Under these conditions, I agree to participate in this study.

Printed Name: ____

Signature: ____

Date: ____

Appendix C – Survey Questionnaire

The following questions are intended to assess the impact technology has on elementary classrooms and the level of integration that exists. There are 37 Likert-type items using a 5 point scale: "1" Strongly Disagree, "2" Disagree, "3" Neutral, "4" Agree, and "5" Strongly Agree; 2 open-ended questions; and 16 questions focusing on demographic data. Please darken the appropriate circle. Your responses are very important to the research, and confidentiality is assured.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Students like to use computers.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers engage students in the learning process.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I spend too much time on computer training.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Time spent with computers takes away from needed instruction.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers are an important resource.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I have seen time-on task improve from students using computers.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers will never move beyond drill and practice.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Using computers makes me a better teacher.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computer lessons require more planning than others.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Student collaboration increases with computers.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I feel pressured to use computers in my teaching.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers in education are just another fad.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers can revolutionize schooling.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Being computer literate is just as important as being reading literate or number literate.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers motivate students.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers are a frill.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I would be willing to attend computer training on my own time.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I should have more computer training.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computers have led to gains in student achievement.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Teachers are reluctant to use computers in our school.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Students are reluctant to use computers in our school.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Computer technology alters the way students learn and teachers teach.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
College or graduate work has prepared me to use computers.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
The availability of computers hinders my ability to integrate technology.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯

The following questions relate to the more general use of technology. Technology refers to all forms of computers, handhelds, SmartBoards, video conferencing, Internet browsing, and all aspects associated with electronic equipment and the digitized world. Technology does not include overheads, filmstrips, calculators, and videocassette recorders.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am comfortable using technology.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Release time for technology training is provided.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Inservice training for technology is conducted regularly.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Staff development in technology is encouraged.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Adequate technological resources are available.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Using technology in a lesson makes me feel out of control and unprepared.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
I think technology has empowered teachers.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
In our school, technology is not important.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Technology adds creativity and enthusiasm to lessons.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Our school has plenty of technology.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Our school needs more technology.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Our school lacks instructional software programs.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯
Technical support is available to me when I have a problem.	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯

Open-ended Questions

Question #1

Do you believe that the use of technology positively or negatively influences student learning? Please explain or describe your thinking.

Question #2

Have you been involved in professional development designed to enhance your ability to effectively use computers and technology in the classrooms? If so, was the professional development of value? Please describe and explain.

Demographic Questions

Thank you for responding to the questions on computers and technology. Please take a moment to complete the 16 brief demographic items. Be assured that these items will be used only for general collective purposes and in no way be used to identify any individuals.

1. What is your age?
   - ◯ 21 – 30
   - ◯ 31 – 40
   - ◯ 41 – 50
   - ◯ 51 – 60
   - ◯ 61 or older

2. How many years have you been in the teaching profession?
   - ○ 1 – 5
   - ○ 6 – 10
   - ○ 11 – 15
   - ○ 16 – 20
   - ○ 21 or more

3. How many years have you been at this school?
   - ○ 1 – 5
   - ○ 6 – 10
   - ○ 11 – 15
   - ○ 16 – 20
   - ○ 21 or more

4. What is your gender?
   - ○ Male
   - ○ Female

5. What is your race?
   - ○ Asian
   - ○ Hispanic
   - ○ Native American
   - ○ White
   - ○ Pacific Islander
   - ○ Black
   - ○ Other

6. Are you?
   - ○ A regular classroom teacher
   - ○ A "specials" teacher such as PE, music, art, etc.
   - ○ A special education teacher
   - ○ Other

7. What grade do you teach?
   - ○ Kindergarten
   - ○ First Grade
   - ○ Second Grade
   - ○ Third Grade
   - ○ Fourth Grade
   - ○ Multiple Grades

8. How would you rate your level of computer experience?
   - ○ Nonuser
   - ○ Novice
   - ○ Intermediate
   - ○ Experienced

9. How would you rate your level of technology integration into your classroom?
   - ○ Once a week
   - ○ Few times a month
   - ○ Few times a year
   - ○ Not at all

10. Estimate how many hours of technology training have you received.
  - ○ 0 – 4 hours
  - ○ 5 – 10 hours
  - ○ 11 – 20 hours
  - ○ More than 20 hours

11. What is your highest degree in college?
  - ○ Bachelors
  - ○ Masters
  - ○ Specialists
  - ○ Doctorate

12. How often do you use a computer at home?
  - ○ Once a day
  - ○ Once a week
  - ○ Few times a month
  - ○ Few times a year
  - ○ Not at all

13. Which of the following activities do you use a computer?
  - ○ Word processing
  - ○ Drill and practice
  - ○ Solve problems and analyze data
  - ○ Create instruction materials
  - ○ Record keeping and grade book
  - ○ Lesson plans
  - ○ Internet
  - ○ Communication with students
  - ○ Communication with parents
  - ○ Presentations

14. What types of technology training have you participated in previously?
  - ○ Basic computer use
  - ○ Software applications
  - ○ Use of Internet
  - ○ Integration of technology
  - ○ Follow-up training sessions
  - ○ None

15. What is the best way for you to learn how to use technology?
  - ○ Independently
  - ○ Professional development activities
  - ○ Colleagues
  - ○ Students
  - ○ College or graduate work

16. Do you teach in a classroom designed for technology (meaning at least a computer for every three students and a SmartBoard or another computer-related learning device)?
  - ○ Yes
  - ○ No

Thank you very much for taking time to complete this survey! Your responses, pooled with those of many other teachers, will provide important insight about the effective use of computers and technology in the classroom.

Appendix D – Consent to Interview

I understand that Connie M. Crane, a doctoral student in the Educational Leadership and Policy Analysis Program at the University of Missouri – Columbia, is working on a study exploring the impact of technology on elementary classrooms and teaching. The interview will take approximately 30 minutes with questions focusing on how I use technology in the classroom and the professional development activities I have completed. I understand that all information will be kept confidential. If I have any questions, I can contact Ms. Crane by email (cranec@troy.k12.mo.us) or telephone (636-462-6098 ext. 164) to obtain answers to my questions. I may also contact the University of Missouri Institutional Review Board at 573-882-9585 with questions regarding my rights as a research participant. At any time during this study, I can stop participating in the study with no fear of concern or consequences. Under these conditions, I agree to participate in this study.

Printed Name: ____

Signature: ____

Date: ____

Appendix E – Interview Questions

I would like to talk to you today about the impact of technology on elementary classrooms and teaching. Of course, anything that you say will be kept confidential and I will not identify you. Do you have any questions that you would like to ask me at this time?

1. Do you think technology positively or negatively influences student learning? Describe.
2. Do you use technology in your classroom? If so, why did you decide to use technology? If not, why don’t you use technology?
3. What technologies are employed? For what duration and frequency are they employed? (type of usage: drill-and-practice, productivity, online, communication, problem-solving software)
4. Is technology used to increase basic skills and knowledge or as a resource helping students develop higher order thinking skills?
5. What do you think are benefits and challenges to using technology?
6. How do you perceive your role as a teacher to integrate technology?
7. What types of technology-focused professional development activities occur at your school? What activities have you participated within the last year?
8. How much time is devoted to technology integration?
9. To what extent does teacher collaboration exists?
10. How would you rate the effectiveness of educational technology at your school?

Appendix F – Consent for Focus Group Interview

I understand that Connie M. Crane, a doctoral student in the Educational Leadership and Policy Analysis Program at the University of Missouri – Columbia, is working on a study exploring the impact of technology on elementary classrooms and teaching. The focus group interview consisting of the building administrator and department heads will take approximately 30 minutes to complete. Questions will focus on the integration of technology in elementary classrooms and types of professional development activities provided. I understand that all information will be kept confidential. If I have any questions, I can contact Ms. Crane by email (cranec@troy.k12.mo.us) or telephone (636-462-6098 ext. 164) to obtain answers to my questions. I may also contact the University of Missouri Institutional Review Board at 573-882-9585 with questions regarding my rights as a research participant. At any time during this study, I can stop participating in the study with no fear of concern or consequences. Under these conditions, I agree to participate in this study.

Printed Name: ____

Signature: ____

Date: ____

Appendix G – Focus Group Interview Questions

I would like to talk to you today about the impact of technology on elementary classrooms and teaching. Of course, anything that you say will be kept confidential and I will not identify anyone individually. Does anyone have questions that you would like to ask me at this time?

1. Do you think technology positively or negatively influences student learning? Describe.
2. What technologies are employed? For what duration and frequency are they employed? (type of usage: drill-and-practice, productivity, online, communication, problem-solving software)
3. Is technology used to increase basic skills and knowledge or as a resource helping students develop higher order thinking skills?
4. What do you think are benefits and challenges to using technology?
5. What types of technology-focused professional development activities have occurred at this school within the past year?
6. Is the professional development mandatory or voluntary?
7. How many teachers participate in the technology-focused professional development activities?
8. How much time is devoted to technology integration?
9. To what extent does teacher collaboration exists?
10. How would you rate the effectiveness of educational technology at your school?

VITA

Connie Marie Crane was born January 24, 1967, in Columbia, Missouri. After graduating from Buchanan High School in Troy, Missouri, she attended the University of Missouri-Columbia and received a BSED in Business Education in May of 1988. In May of 1991, she received an M.B.A. degree from Maryville University in St. Louis, Missouri. She has earned an Educational Specialist degree in the educational leadership cohort program at the University of Missouri – Columbia in May of 1999 and participated in the University of Missouri – Columbia cohort doctoral program in Educational Leadership and Policy Analysis from 2001 to 2005.

Past teaching employments include a vocational education computer applications teacher at Pike/Lincoln Technical Center in Eolia, Missouri (1988-89), a junior high/middle school computer teacher at the Troy R-III School District in Troy, Missouri (1989- 1998), and a central office administrator at Troy R-III School Disrict in Troy, Missouri (1998-Present). Currently she is employed as the Director of Data and Technology with a focus in technology, data analysis, enrollment projections, Missouri School Improvement Program, summer school, grant writing, and food services.