MEETING THE STANDARDS:

A LOOK AT ONE UNIVERSITY'S EFFORTS

TO PREPARE TOMORROW'S TEACHERS

TO USE TECHNOLOGY

by

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A DISSERTATION

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ABSTRACT

What are the perceptions of elementary teachers regarding their ability to meet the state technology standards for teachers during their classroom instruction? What did the teachers perceive as current barriers in meeting the state technology standards and how have they been able to overcome the barriers? What are the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards? These questions are important because teachers have been given the responsibility of not only providing their students with content knowledge but also providing students the knowledge to use technology resources in the classroom. The preparedness of the teacher to provide this guidance begins in the teacher education program and continues through technology related professional development provided by the schools. However, teachers encounter barriers along the way that hamper their ability to successfully integrate technology. The survey instrument in this study was used to gather data from elementary teachers employed in sixteen schools representing three school systems in one southeastern university's service area. The data revealed that most teachers perceive that they are meeting the state technology standards. However, there are still perceived weaknesses in meeting some of the standards. The availability of technology resources and the lack of technology related professional development were barriers to successful technology integration. It is recommended that school districts provide more technology related professional development that is consistent with the new state technology

standards implemented in 2009. It is also recommended that future research focus on the relationship between technology integration and student achievement.

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CHAPTER I:

INTRODUCTION

"Give a man a fish and he will eat for a day. Teach a man to fish and he will eat for a lifetime." This widely known Chinese proverb may accurately characterize the changing emphasis on the view of technology in the classroom. For years, many school districts acquired grants and earmarked a vast amount of dollars in school budgets to acquire an assortment of hardware, software and network resources (Barron, Kemker, Harmes, & Kalaydjian, 2003; Niederhauser, Lindstrom & Strobel, 2007). Bill Gates (1996) stated in a speech to a group at Georgetown University that technology would be the key to improving education and that the computer would become an important learning tool. The Microsoft CEO had as a vision a *Connected Learning Community* (CLC) that brought students, teachers, parents and the community together via computers and the Internet. The vision of a CLC has been the goal of many in education and has been implemented in many schools with the addition of Internet connected computers in every classroom. In addition, some school systems are using the CLC concept to bring teachers, administrators and technology professionals together to develop a plan for technology integration in their schools (Sherry & Chiero, 2004; Young, 2007).

As of 2001, it is estimated that U.S. public schools had more than 10 million computers installed and that 99% of all schools and 87% of classrooms were connected to the Internet. The student to Internet-connected computer ratio was 5.4:1 (Barron et al., 2003; Hernandez-Ramos, 2005). Though access has improved in many school systems, some problems associated with this influx of technology remain. One such argument would be that the large number of computers in certain school systems just increases the digital divide in other systems. Studies show that while two-thirds of Caucasian and Asian students have been online, only 45% of black and 37% of Hispanic students have had the same opportunity (Mason & Dodds, 2005). Another

growing problem is the number of outdated and underused computers in the schools. While many classrooms are equipped with a teacher station connected to the Internet, the number of computers as well as the type and age of the computers varies greatly from system to system (O'Bannon & Judge, 2004).

The most crucial factor in effectiveness in using technology in the classroom is the preparedness of the teacher using the technology (Barron, Kemker, Harmes, & Kalaydjian, 2003; O'Bannon & Judge, 2004; Shuldman, 2004). There have been claims by many that the technology investment could not be fully realized until teachers receive the necessary training and support to use the technology to its potential (Mims, Polly, Shepherd, & Inan, 2005). Long-term research projects such as Apple Classrooms for Tomorrow (ACOT) that were started in the late 1980s concluded that technology by itself would not be the cure all for the problems in education. Also, any strides made concerning technology in education would not be made unless changes are seen in schools' organization, teachers' beliefs and pedagogical practices (Hernandez-Ramos, 2005).

A federal grant program called Preparing Tomorrow's Teachers to Use Technology (PT3) was issued in the late 1990s to combat the growing concern that teachers were not receiving adequate training on how to integrate technology (Benson, Farnsworth, Bahr, Lewis, & Shaha, 2004). PT3 was a national grant effort designed to ensure that teachers who earn teaching credentials were prepared to effectively use information technology in the classroom. According to the national PT3 website, there were 441 grants awarded during the funding years of 1999 - 2003 (The University of Kansas, 2005). These grants funded activities such as professional development for faculty, creating training and learning tools, and bridging the digital divide in teacher training. In addition, the PT3 initiative involved 52 of the top 100 largest teacher preparation colleges and universities (The University of Kansas, 2005).

In order to infuse technology with the curriculum, most PT3 grants focused on three distinct areas. These three areas included training teachers how to use technology, training teachers how to integrate the technology across the curriculum, and ensuring that pre-service

teachers had access to technology during their teacher preparation program (Duffield & Moore, 2006). The goals of many of the PT3 grants sought to expose students in teacher preparation programs to more technology experiences, not only in their skills based classes but also within their methods classes. Another goal of most of the PT3 grants gave the student a technology rich field experience (Mims, Polly, Shepherd, & Inan, 2005). Also, many PT3 grants sought to develop the competency level of the current faculty in the teacher preparation programs. Professional development along with support teams to increase the faculties' proficiency with technology was used in many PT3 projects (Hall, Fisher, Musanti, & Halquist, 2006).

In the year 2000, the International Society for Technology in Education (ISTE) produced a set of standards that became the model for many teacher preparation programs. These standards, called the National Educational Technology Standards for Teachers (NETS-T), were believed to be essential in producing a technology literate teacher than could be effective in utilizing technology to enhance learning in the classroom. The standards were comprised of six components:

1. technology operations and concepts;
2. planning and designing learning environments and experiences;
3. teaching, learning, and the curriculum;
4. assessment and evaluation;
5. productivity and professional practice; and
6. social, ethical, legal, and human issues.

With the issuance of these standards, all teacher education programs found themselves rethinking their current training methods (Bucci, Cherup, Cunningham & Petrosino, 2003).

During the implementation of the PT3 grants, many project teams produced useful tools, resources and strategies to successfully integrate technology in the classroom and give pre-service teachers the exposure they needed to utilize current technologies. These artifacts included online publications that document research on best practices on integrating technology, case studies that provide videos of technology integration, and online tutorials and assessments that

help faculty and pre-service teachers with the use of technology in the classroom (Ottenbreit-Leftwich & Cullen, 2006). PT3 projects such as the University of Dayton Teacherline project and the University of Illinois at Urbana-Champaign Flash tutorial project are just two examples of the products that were produced during the grant implementation. These training modules were created using NETS-T as a guide. Both schools reported that their faculty believed they had benefited from the technology training tools (Basham, Palla & Pianfetti, 2005; Rowley, Dysard, & Arnold, 2005). While these artifacts were available during the implementation stage of the grant, many of these useful resources have become unavailable and were not updated past the funding years (Ottenbreit-Leftwich & Cullen, 2006).

PT3 initiatives like the ones conducted at the University of Dayton and the University of Illinois at Urbana-Champaign concluded that training the faculty to better utilize technology and to model correct technology integration would enable pre-service teachers to be more likely to demonstrate this competency within their own classroom (Basham et al., 2005; Rowley, Dysard, & Arnold, 2005). However, most of the initiatives did not contain a follow-up study to determine whether first-year teachers were actually successful in integrating technology into the curriculum. Most surveys during these initiatives were only capturing the perceptions of the faculty on the usefulness of the training or the potential to increase technology use in the classroom (Basham et al., 2005; Rowley et al., 2005). Studies conducted in the earlier years of technology implementation generally focused on the amount of computers or Internet access that was available. Less frequent were follow-up studies on first year and veteran teachers' actual use of technology in the classroom. These types of studies have the potential to prove the effectiveness of the PT3 initiatives (Lawless & Pelligrino, 2007; Ludwig & Taymans, 2005).

The Alabama State Department of Education was awarded a PT3 catalyst grant to provide a framework to establish successful technology use and integration of standards into all state approved P-16 teacher preparation programs. The Alabama PT3 (ALAPT3) grant implementation began in 1999. During this time the ALAPT3 staff gathered information through surveys and interviews of pre-service teachers, first year teachers and teacher preparation faculty.

A major accomplishment of the PT3 Catalyst grant effort in the State of Alabama was the establishment of state technology standards for teachers. The grant effort and the establishment of state technology standards involved not only the ALAPT3 staff but included feedback and suggestions from all eight state school board districts through focus groups and received approval from the Alabama Association of Colleges and Teacher Education (ALACTE). The Alabama Teacher Technology Standards were developed using NETS-T as a guide (Alabama State Department of Education, 2001). The Alabama Teacher Technology Standards were adopted in 2002 and were mandated to be implemented by 2003. Table 1 lists the complete set of technology standards. A survey completed in late 2002 found that the elementary education programs had the highest implementation status with 80% of the standards being implemented (Nix, Snyder & Fritschi, 2002).

Table 1

Alabama Teacher Technology Standards

Knowledge of:	Ability to:
(i) strategies to identify and evaluate technology resources and technical assistance (i.e. those available on-line and on-site within a school and district setting).	(i) identify and evaluate technology resources and technical assistance (i.e. those available on-line and on-site within a school and district setting).
(ii) methods for assessing advantages and limitations of current and emerging technologies, and on-line and software content to facilitate teaching and student learning.	(ii) assess advantages and limitations of current and emerging technologies, and on-line and software content to facilitate teaching and student learning.
(iii) strategies for developing and implementing a classroom management plan to ensure equitable and effective student access to available technology resources.	(iii) develop and implement a classroom management plan to ensure equitable and effective student access to available technology resources.
(iv) safe, responsible, legal and ethical uses of technologies including fair-use and copyright guidelines and Internet user protection policies.	(iv) model safe, responsible, legal and ethical use of technology and implement school and district acceptable use policies including fair-use and copyright guidelines and Internet user protection policies.
(v) characteristics of appropriate and effective learner-centered lessons and units that integrate technology.	(v) design, implement, and assess learner-centered lessons and units that use appropriate and effective practices in teaching and learning with technology.
(vi) technology tools (including, but not limited to, spreadsheets, web page development, digital video, the Internet, and email).for instruction, student assessment, management, reporting purposes and communication with parents/guardians of students	(vi) use technology tools (including, but not limited to, spreadsheets, web page development, digital video, the Internet, and email) for instruction, student assessment, management, reporting purposes and communication with parents/guardians of students
(vii) how to facilitate students' individual and collaborative use of technologies (including, but not limited to, spreadsheets, web page development, digital video, the Internet, and email) to locate, collect, create, produce, communicate, and present information.	(vii) facilitate students' individual and collaborative use of technologies (including, but not limited to, spreadsheets, web page development, digital video, the Internet, and email) to locate, collect, create, produce, communicate, and present information.

Knowledge of:	Ability to:
(viii) the variety and application of technologies that are responsive to diversity of learners, learning styles and special needs of all students (for example, assistive technologies for students with special needs).	(viii) design, manage, and facilitate learning experiences incorporating technologies that are responsive to diversity of learners, learning styles and special needs of all students (for example, assistive technologies for students with special needs).
(ix) processes and criteria for evaluating students' technology proficiency and students' technology-based products within curricular areas.	(ix) evaluate students' technology proficiency and students' technology-based products within curricular areas.
(x) the resources for enhancing professional growth using technology (for example, through accessing web-based information, on-line collaboration with other educators and experts, and on-line professional courses).	(x) use technology to enhance professional growth (for example, through accessing web-based information, on-line collaboration with other educators and experts, and on-line professional courses).

Source: Alabama State Department of Education website

The state was also involved in a PT3 implementation grant. This grant was funded for three years and included a consortium of fifteen colleges and universities working together to create a new emphasis on integrating technology into the curriculum. The goals of the implementation grant were to train faculty on the use of technology within the teacher preparation program and how to model the use of technology within the courses, redesign methods courses to include adequate amounts of technology, and work with school systems to provide field experiences that were rich in technology modeling and use.

In January of 2002, President Bush signed the *No Child Left Behind Act* and brought a new wave of accountability into the education world. While the main thrust of NCLB was developing a system of measurement for student achievement, Title II Part D addresses technology integration. This part of the NCLB, referred to as the *Enhancing Education through Technology Act of 2001*, provided grants to states to infuse technology into the curriculum (Barron, Kemker, Harmes, & Kalaydjian, 2003). The infusing of technology in the classroom

has given teachers a new opportunity to reflect on best pedagogical practices using technology (Benson, Farnsworth, Bahr, Lewis, & Shaha, 2004). ISTE identified ten essential conditions that must be present in order for a teacher to create an environment that promotes the use of technology. These conditions are shared vision, access, skilled educators, professional development, technical assistance, content standards and curriculum resources, student-centered teaching, assessment, community support, and support policies (O'Bannon & Judge, 2005; Weinburgh, Collier, & Rivera, 2003).

Statement of the Problem

The PT3 grants provided a starting point for teacher preparation programs to include rich experiences in technology integration, but the grant alone may not have been enough to sustain the efforts of the institution. Research has shown that technology integration increases with time as long as access, support and professional development are maintained (O'Bannon & Judge, 2005). The NCLB act diverted money away from programs within teacher preparations programs and provided funding for professional development within school districts. Some teacher preparation programs have decided to continue their emphasis on technology integration. However, some cannot continue at the same level due to lack of funds (Ottenbreit-Leftwich & Cullen, 2006).

The Alabama State Technology Teacher Standards have been in place since 2002, but the teacher preparation programs may not have embraced these standards to the point of training pre-service teachers to meet these standards. Even if the teacher preparation programs are doing an adequate job of preparing pre-service teachers, the in-service teachers could be facing other barriers within the school system that prevent them from meeting these state standards. A report completed by the Alabama State Department of Education (2006) found several areas of needed improvement concerning technology integration. Among these areas were the teachers' ability to show students how to use technology to learn and the teachers' ability to assess students' use of technology. This report concluded that professional development within the schools may not be focusing on the right objectives for the teacher to properly integrate technology.

Purpose of Study

The purpose of this study was to examine how elementary teachers perceive their meeting of the state technology standards as mandated by the state. The teachers in the study were employed by schools that are within the service area of a southeastern university. This university provides a large portion of the needed teachers in the area. By using the Alabama Teacher Technology Standards as a benchmark, teachers were asked questions that gauged their use of technology in the classroom. The results of this study can be compared to the state study that was conducted in 2006 to determine whether there are comparable strengths and weaknesses in the meeting of the state standards. This study also recorded the perceptions of the effectiveness of current professional development efforts by the school. In addition, the teachers were able to reflect on barriers to technology integration within the school and what measures, if any, they have taken to overcome these barriers.

Research Questions

The research questions for this study were as follows:

1. What were the perceptions of elementary teachers regarding their ability to meet the state technology standards for teachers during their classroom instruction;
2. What did the teachers perceive as current barriers in meeting the state technology standards and how have they been able to overcome the barriers; and
3. What were the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards?

Importance of the Study

The southeastern university provides a large portion of teacher graduates to the local elementary schools in the surrounding region. The need for well-trained teachers who can utilize technology to enhance learning is vital. This study provided some indicators as to how well pre-service teachers are being trained to meet the state technology standards. The teacher preparation program would be able to reflect on the importance of giving students rich experiences in technology integration and making changes where needed. Current teachers can

provide a realistic look at how they attempt to integrate technology into their daily classroom environment. By aligning the training efforts with what is a realistic expectation of the use of technology in the classroom the teacher preparation program can better prepare its pre-service teachers. Administrators of the teacher preparation program can review the state technology standards and place emphasis on meeting these standards in the minds of the pre-service teachers. The program may also be able to overcome some of the barriers to successful technology integration by working with individual school systems to provide some needed support.

Definition of Terms

Behaviorism – Based upon works by John B. Watson, behaviorism deals only with observable behaviors. Learning can only be measured objectively. Man and animals only respond to how they have been conditioned. Conditioning comes by positive and negative reinforcements. Behaviorism is used widely in the education system for classroom management and standardized testing (Demar, 1988; Willis, 1993).

Constructivism – A learning theory brought to the forefront in the 1970's by psychologists like Bruner, Piaget and Vygotsky. This theory states that learning is constructed by the individual based on past experiences. Learners interpret new information based on information already received. In this context on learning, students are active participants in their own learning. Teachers no longer are the primary distributors of knowledge. Constructivism encourages creativity, problem solving and analysis instead of recall of facts, figures and procedures (Neo, 2007).

Student-centered Learning – An environment where knowledge is constructed by the student and the teacher acts as a facilitator of knowledge and not the holder of knowledge. Teachers give away some of their authority to the students to derive the what, how and why of the topic being addressed (O'Neill & McMahon, 2005).

Content Knowledge – Knowledge about the actual subject matter that is to be learned or taught (Shulman, 1986).

Pedagogical Knowledge – Deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses, among other things, overall educational purposes, values, and aims (Shulman, 1986).

Pedagogical Content Knowledge – Knowledge of pedagogy that is applicable to the teaching of a specific content including knowing what teaching approaches fit the content and how elements of the content can be arranged for better teaching (Shulman, 1986).

Technology Integration – The incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources include computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communications, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods (Lawless & Pellegrino, 2007).

Technological Pedagogical Content Knowledge (TPCK) - A form of knowledge that is the basis of good teaching with technology and requires an understanding of how technology can play a role in using pedagogical techniques that use technology in constructive ways to teach content. This knowledge allows teachers to recognize difficult concepts of the content and apply sound technological approaches to their pedagogy that help address some of the problems students encounter (Mishra & Koehler, 2006).

CHAPTER II:

REVIEW OF RELATED LITERATURE

Introduction

This study focused on how elementary teachers were trained to use technology in their teacher preparation program at a university in southeastern Alabama and how they have been able to use this training to enhance learning by integrating technology in their classroom. Studies show that elementary teachers are more likely to use computers in the classroom as problem-solving tools than high school teachers (Barron, Kemker, Harmes, & Kalaydjian, 2003). The teachers who were selected would have received their teacher training during a time when a push for technology integration was being implemented in the institution as part of a Preparing Tomorrow's Teachers to use Technology (PT3) grant. This study also recorded the number of professional development hours that teachers have received through the schools concerning technology in an effort to better train teachers to integrate technology.

This review of literature examines the research on how technology has been implemented in the classroom through the years and what factors led to the success or failure of such implementation. By focusing on how technology has been integrated into different areas of education, we can see the benefits of such efforts in the ability of teachers to provide a differentiated curriculum. Training efforts that include teacher preparation programs as well as professional development programs will be examined to see how they relate to the overall perception of the abilities of teachers to integrate technology.

The review is divided into three parts and includes a brief history of the implementation of technology before the PT3 grant initiative, a composite look at the PT3 grant goals and objectives and how these were implemented and the efforts of many school systems to provide professional development in technology integration to its faculty.

Building the Information Superhighway

The building of the information superhighway has been a long and, at times, winding road. However, the task of connecting all schools to the Internet remained a priority of the federal government in the 1990s. Many leaders in our society have seen the Internet as a cure all for increasing student achievement (Goolsbee & Guryan, 2006; Trotter, 2007). While the quality and capacity of computer technology has been varied among school systems, the number of computers has been increasing over the past couple of decades. In 1995, there were 2.5 million computers in K-12 classrooms with a 1:14 ratio of computers to students. The number of computers reported was a 550% jump from the previous decade (Gilstrap, 1997). In 2001, the number of computers in the classroom had jumped to 10 million, and the number of computers to students was at 1:5.4 (Barron, Kemker, Harmes, & Kalaydjian 2003; Hernandez-Ramos, 2005). Data reported by the National Education Association in 2007 put the ratio at 1:3.8 (NCLB, 2007).

So, how was the information super highway constructed? One program that helped pave the way for the increase in the use of technology in the schools was the E-rate program. This program was part of the *Telecommunications Act* passed by Congress in 1996. This program gave discounts to schools to purchase equipment, wiring and services to connect all classrooms to the Internet. The discounts were based upon the schools ratio of students on the free and reduced lunch program and could mean substantial savings to schools where this ratio was high. By using this formula, schools that were in a high poverty area would receive higher discounts. After ten years, the program has provided more than 19 billion dollars to schools, and there are still up to 30,000 applications submitted annually (Trotter, 2007). One purpose of E-rate was to help close the gap of the digital divide. The digital divide was deemed to be a huge factor in implementing technology to enhance learning throughout all schools. While wealthier school districts could afford to purchase adequate amounts of technology for the classroom, poorer districts could not do so as easily. With the E-rate program providing more discounts to poorer school systems, the digital divide began to shrink as the years of funding continued. A study

conducted by Goolsbee and Guryan (2006) concluded that the E-rate program allowed poor school districts in California to connect classrooms to the Internet at a faster rate than they could have without the E-rate funding. A National Center for Education Statistics survey found in 1999 that 99% of the teachers reported that they either had the Internet available in their classroom or had it available somewhere in the school (U.S. Department of Education, 2000).

The E-rate program provided discounts for Internet connectivity but it did not provide funds for the purchase of computers. With the E-rate program, schools could provide as many Internet connections to the classroom as possible. Also, the schools could ensure that they had the best possible connectivity within the schools. This included fiber optic backbone, switches, routers, and servers to handle the connectivity and the contracting of services to provide the Internet access to the school. Other federal programs such as the Technology Innovation Challenge Grant (TICG) provided funding for computer hardware and software built around a school's developed plan to fully integrate technology into the curriculum (Peterman, 2003).

The Technology Innovation Challenge Grant was initiated during the Clinton administration. The goals of this initiative were to

1. ensure that all teachers had the training and support they needed to help students learn using computers and the information superhighway;
2. ensure all teachers and students had modern multimedia computers in the classroom;
3. ensure every classroom would be connected to the information superhighway; and
4. ensure that effective software and on-line learning resources will be an integral part of every school's curriculum (U.S. Department of Education, 2000).

Reports show that of the projects funded between 1995 and 2000, 46 projects referred to technology integration, technology infusion, embedded technology or technology rich curriculum as one of its main goals (Peterman, 2003). It is true that most school districts have spent millions of dollars over the years in capacity building of computers into the schools. However, many school districts failed to build into their technology budgets the "total cost of

ownership" (TCO) of technology into current or future budgets. Howard Mehlinger (1996) stated that schools must decide to add to and upgrade their technology every year and they should expect technology to be more integrated, interactive, and intelligent as they upgrade. In 1999, the Consortium of School Networking (CoSN) launched an initiative to educate school administrators on TCO. The consortium listed five items to consider, and among them were staff development and support. Staff development costs can include hiring professional trainers, training materials and the cost of hiring substitutes to give teachers adequate time to be trained during school hours. The CoSN estimates that 30% of a technology budget should be devoted to staff development (Fitzgerald, 2001). A report in 1995 showed that most school districts spent as little as 3% and no more than 15% of their budget on staff development (Staples, Pugach & Himes, 2005).

For over a decade, schools have been working to increase the number of computers in the classroom and connect these computers to the Internet. Federal grants and programs helped ease the financial burden on schools to invest in technology. However, research has shown that mere access to technology will not provide the increase in student achievement that all had hoped (Hernandez-Ramos, 2005; Trotter, 2007).

One study conducted by Goolsbee and Guryan (2006) on the E-rate program in California concluded that the access to connected classrooms provided no real gains in student achievement based on scores from standardized tests, even after two years of implementation. One of the problems associated with providing technology in the schools is that many times the technology goes unused. However, a more troubling problem is when the technology is misused. Like the integration of televisions into the classrooms in the 1960s, some classroom computers have become nothing more than babysitters for early finishers of the day's lesson. Studies have shown that computers in the classroom are more frequently used for non-instructional activities than instructional (Franklin, 2008). During the early stages of computer use in the classroom, there were no clear guidelines for what students should be expected to accomplish with this new technology (Barron, Kemker, Harmes, & Kalaydjian, 2003). Some students and teachers could

not make the connection between the lesson being taught and the technology that could be used to enhance the learning (Bernauer, 1996; Shuldman, 2004).

A 1999 National Center for Educational Statistics (NCES) survey found only 33% of current teachers felt well prepared to integrate technology into their classroom. The survey also reported that 66% of teachers used technology for instruction and that 41% of teachers assigned work that involved technology. Of particular interest in the survey was the fact that newer teachers and teachers with more professional development hours in technology were more likely to integrate technology in their classrooms. The results from this survey and the evidence of unsatisfactory gains in student test scores showed clearly that school administrators faced a bigger challenge than just finding the money in the budget to provide the infrastructure (Franklin, 2008; Shuldman, 2004).

The Apple Classrooms of Tomorrow (ACOT) project was an early effort to focus on the integration of technology in the classroom. The project was initiated in 1985 and provided an Apple computer to students and teachers for both home and school use. The goal of the project was to create an environment where teachers and students would begin using computers on a routine basis. From this project, a model was created to describe the five stages of technology integration which include

1. Entry – Learn the basics of using technology;
2. Adoption – Use new technology to support traditional instruction;
3. Adaptation – Integrate new technology into traditional classroom practice;
4. Appropriation – Focus on cooperative, project-based and interdisciplinary work, incorporating the technology as needed and as one of many tools; and
5. Invention – Discover new uses for technology tools. (Shuldman, 2004; Barron, Kemker, Harmes, & Kalaydjian, 2003)

These stages have been used to characterize the transformation that is made as a teacher begins to use technology in the classroom. Other models that have been developed include Roger's Theory on Innovation-Decision process, Concerns-Based Adoption Model (CBAM),

instructional transformation model and Sherry's learning/adoption trajectory (Adams, 2002; Brzycki & Dudt, 2005; Sherry & Gibson, 2002; Shuldman, 2004).

Another model that has been used as a self-assessment to categorize a teacher's ability to integrate technology is the Levels of Technology Implementation (LoTi) scale. This scale was developed by Christopher Moersch and has a high reliability in measuring classroom technology use. The LoTi scale ranges from 0-6 and includes the following progressive elements: non-use, awareness, exploration, infusion, integration, expansion, and refinement. This scale is in direct relation to activities that move toward a more student-centered approach in the classroom (Barron, Kemker, Harmes, & Kalaydjian, 2003; Middleton & Murray, 1999; Rakes, Fields, & Cox, 2006; Shuldman, 2004).

Student-centered learning involves utilizing higher order thinking skills and solving real-world problems. In this approach, teachers are no longer the sole holders of knowledge but become facilitators of knowledge and guide the student to his/her own understanding of the content. In order to successfully integrate technology in the classroom the teacher must move toward a more student-centered approach (Barron et al., 2003). There has been resistance where teachers cannot conceive or are unwilling to create an environment which fosters student-centered learning. Teachers are more comfortable using a teacher-centered approach which follows a more behaviorist approach to education (Park & Ertmer, 2007). Behaviorism is well rooted in traditional education practices. Standardized testing, drill and practice, and positive and negative reinforcements in the form of grades are just a few examples of behaviorism (Eisen, 2005).

In contrast, student-centered learning follows a more constructivist approach. Constructivism allows learners to construct knowledge based on past experiences that help bridge the new concept that is being taught. This scaffolding of knowledge helps learners move beyond basic knowledge that drill and practice often foster to an authentic, real world understanding of a concept (Andrews, 2007; Pringle, 2002). Constructivism promotes collaboration and exploration. Technology used to its fullest extent can make these concepts

much easier to accomplish. The incubator of student-centered learning begins in the teacher preparations methods courses. Faculty members need to model appropriate pedagogy and technology integration and then allow their students to practice what they have been shown (Mai, 2007; Pascarella, 2008; Rakes, Fields, & Cox, 2006).

Despite many efforts to integrate technology into the classroom since the ACOT study and President Clinton's initiative to get all classrooms connected to the Internet, most efforts have been lackluster at best (O' Bannon & Judge, 2004). The earlier initiatives focused on reducing the digital divide among poorer school districts. There is plenty of evidence to support that these programs were a huge success and provided computers, network infrastructure and the Internet to schools that might not been able to provide them otherwise. However, in focusing all of the resources to this one outcome, a new digital divide exists. There still remains a limited number of teachers who have the skills and abilities to adequately integrate these technologies into the curriculum. Thus, the demand for such technologically-aware teachers starts the new wave of a digital divide. It is not until all teacher preparation programs begin to adequately equip pre-service teachers with these needed skills that this divide will begin to decrease (Lawless & Pellegrino, 2007).

For now, the poorer districts often receive less qualified teachers and the turnover rate among these poorer districts is higher as teachers move to districts where they can receive higher pay with more professional development and more classroom time to integrate technology effectively. While e-rate evened the playing field in terms of access to technology, there still exists the lack of funds to properly train teachers to integrate technology in the poorer and often rural school districts (Rakes, Fields, & Cox, 2006).

The Great Fix for Technology Integration

Going on the premise that "teachers teach like they were taught," then work had to be done in changing the practices of the current teacher preparation programs as the 20th century was coming to a close. In fact, many wondered if technology would ever impact student learning the way they had hoped (Cohen, Pelligrino, Schmidt, & Schultz, 2007; Staples, Pugach, &

Himes, 2005). Difficulties existed in designing a curriculum that sufficiently exposed pre-service teachers to the appropriate methods of technology integration. Research has shown that pre-service teachers as well as in-service teachers feel disconnected between the lesson they are teaching and the technology they use within the lesson (Basham, Palla, & Pianfetti, 2005). A study conducted in 2001 in the State of Washington attempted to capture the perceptions of pre-service and in-service teachers concerning technology use in the classroom (Williams & Kingham, 2003). Participants were presented a set of statements concerning teachers' use of a variety of technology tools and resources and were asked to respond to their agreement or disagreement. The results of the survey suggested that there was a lack of technology integration within the school system (Williams & Kingham, 2003). This evidence indicated that teachers have not approached technology at a level to know what works, why it works, and how to sustain these efforts throughout the school year (Cohen, Pelligrino, Schmidt, & Schultz, 2007).

Prior to the implementation of the National Educational Technology Standards for Teachers (NETS-T) by ISTE, most teacher preparation programs taught technology along with math and science. There was little need to involve technology in any other subject (Barron, Kemker, Harmes, & Kalaydjian, 2003; Weinburgh, Collier, & Rivera, 2003). A survey prior to 1999 conducted by ISTE and the Milken Family Foundation concluded that teacher preparation programs did not provide rich experiences in technology integration. Also, it was found that the technology courses offered in most teacher preparation programs did not provide the skills to successfully integrate technology into the curriculum. The teaching and modeling of technology integration was, in most cases, sketchy, haphazard and with no real practical application (Fleming, Motamedi, & May, 2007; Jeffs & Banister, 2006; Koehler, Mishra, & Yahya, 2007). In the past, technology that was introduced within the classroom focused more on drill and practice programs and not so much on providing an interactive environment for technology integration. These practices emphasized the use of an application and did not fully integrate technology in the classroom to foster an environment that promoted higher order thinking skills. It has been concluded that appropriate technology integration focuses more on the teaching and

learning from the use of technology and not so much on the technology itself (Mills & Tincher, 2003). Therefore the technology courses taught during the teacher preparation program had to emphasize more than just how to use the technology.

In order to motivate states, schools and teacher preparation programs to integrate technology, ISTE published guidelines for students, teachers and administrators (Wright & Wilson, 2007). ISTE published the National Educational Technology Standards (NETS) for students in 1998 and teachers in 2000. These guidelines soon became the basis for many states technology standards. By 2003, 30 states had adapted their own technology standards for students and teachers based on the ISTE standards. It was at this time that teacher preparation programs had to revisit how they managed technology integration (Barron, Kemker, Harmes, & Kalaydjian, 2003; Bucci, Cherrup, Cunningham, & Petrosino, 2003).

Student experiences during the teacher preparation programs including experiences during methods courses and field experiences help shape the beliefs of these future teachers in classroom practices. Studies have indicated that if pre-service teachers are exposed to teaching methods that emphasize technology infusion, those teachers are more likely to infuse technology in their classrooms (Wright & Wilson, 2007). Also, it was found that if teaching methods are introduced but little time is spent in the practical use of the teaching method, then pre-service teachers will feel uncomfortable using those methods and will rely on more established methods (Park & Ertmer, 2007). A Presidential Committee of Advisors on Science and Technology found that pre-service teacher field experiences were a key component in technology preparation that furnished the opportunity to observe and practice appropriate methods for infusing technology. Therefore a key factor in retooling teacher preparation programs should be to increase the quality and quantity of field experiences that involved technology infusion (Chiero, Sherry, Bohlin, & Harris, 2003).

The identified barriers to technology use in teacher preparation programs include practices that do not support observation of exemplary peers or provide time to reflect on personal practices in teaching, lack of common vision and strong leadership, few incentives to

change teaching practices and a shortage of hardware and software to support technology integration (Brzycki & Dudt, 2005; Hall, Fisher, Musanti, & Halquist, 2006). Initiating a culture of change is needed to combat these barriers. Creating a team approach where all are onboard from the top down with technology integration is a key factor. Updating classroom and faculty computers to include systems that will support high technology use is another change that would prove beneficial. Often classroom computers were low-end and lacked adequate software (Levin & Wadmany, 2008; Vannatta, 2000).

These external barriers contribute to an inadequate technology experience for the pre-service teacher. However, more prevalent factors in determining the future use of technology in the classroom are the internal barriers such as the pre-service teacher's own beliefs about the usefulness of technology in the classroom, the preferred teaching style and the level of motivation to make changes. These internal barriers can be harder to identify and harder to overcome (Park & Ertmer, 2007). For example, all pre-service teachers have been influenced by their own experiences with technology prior to entering the program. Pre-service teachers also have preconceived ideas about how to teach and about how they will handle teaching situations, whether these ideas foster the best learning environment for their students or provide multiple learning opportunities (Cohen, Pelligrino, Schmidt, & Schultz, 2007; Levin & Wadmany, 2008). Even when teachers have technological resources available to successfully enhance learning, their own beliefs and past influences may prevent them from changing their current teaching practices (Persichitte, Caffacrella & Ferguson-Pabst, 2003). Teacher preparation programs must find ways to combat both the external and internal barriers to successfully integrate technology.

A key factor in establishing a firm foundation for technology integration within the teacher preparation programs is identifying the appropriate relationship between the three main components of teaching. These components are knowledge of content, knowledge of correct pedagogy and knowledge of technology. Mishra and Koehler (2006) argued that the reason behind the problem that teachers have in appropriately integrating technology is that the technology has been isolated in much the same way that content knowledge and pedagogy were

separated for many years. Teacher preparation programs have utilized many theories on how teachers should be trained. It was once believed that content knowledge was the most important, and teacher preparation programs focused on the mastery of content. At some point, the focus shifted to emphasizing appropriate pedagogical approaches. It was concluded that content knowledge was useless if it was taught haphazardly or in an unrealistic approach. Teacher preparation programs began blending the two theories so that students would be experts on content and would also know how to present content in an appropriate manner. Now the technology component is included within this framework, and it has, in most cases, become the isolated part of the relationship much like content and pedagogy were in the earlier years (Koehler, Mishra, & Yahya, 2007).

Students in teacher preparation programs cannot merely learn a particular technology but must be able to make the connection on why a certain technology can be used to enhance learning on a subject and be able to utilize the technology in the appropriate way to foster student learning. An emphasis should be placed on evaluating technology tools, so that the best possible choice can be made when using technology. This emphasis has become even more important since technology has a way of rapidly becoming obsolete. As new technologies become available it becomes less important on how to actually use the technology but more important in understanding the concept behind the use of the technology within the context of pedagogy and content (Watts-Taffe, Gwinn, Johnson & Horn, 2003). This knowledge is what Mishra and Koehler (2006) described as Technological Pedagogical Content Knowledge.

In 2008, the American Association of Colleges for Teacher Education (AACTE) produced a book entitled The Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators. This book emphasizes changes in teacher education programs as well as professional development plans to discontinue stand alone technology courses and training and move toward integrating technology in methods courses and training (Honowar, 2008). Having a good knowledge base concerning each of these components does not indicate a mastery of technology integration. However, identifying the multifaceted relationships needed for a

classroom environment that embraces technology integration helps to provide a curriculum that is technology rich and enhances learning (Koehler, Mishra, & Yahya, 2007).

Preparing Tomorrow's Teachers

During the latter years of the Clinton administration, a new federal initiative was introduced to help teacher preparation programs introduce technology integration in more of their courses and field experiences. The initiative was called Preparing Tomorrow's Teachers to use Technology, and its main goal was to increase the knowledge and ability of future teachers to use technology in improved teaching practices and student learning opportunities and to enhance the quality of teacher preparation programs. Under the initiative, partner schools could apply for three types of grants. These included capacity building grants for one year initial groundwork of teacher preparation reform, implementation grants that provided for three years of funding for implementing or expanding a program to improve pre-service teachers' technology proficiency, and catalyst grants to provide three years of funding for large scale improvement in preparing technology proficient teachers. The first year of funding was in 1999, and the initiative awarded 138 capacity building grants, 64 implementation grants and 24 catalyst grants (U.S Department of Education, 2001).

The PT3 initiative gave teacher preparation programs the needed funds to begin experimenting with new methods to prepare candidates for technology integration. The PT3 initiative ended after funding for the year 2003. Over the five years of the initiative it awarded 400 million dollars toward retooling teacher education programs (Honowar, 2008). Elements that were part of most PT3 projects included programs to bring faculty up-to-speed on technology, curriculum redesign, and creation of new tools to assess technology proficiency. Also included were learning communities that brought current teachers, pre-service teachers, faculty, and technology specialists together design best practices.

Many of the initiatives included plans to retrain the faculty to be more willing to demonstrate technology integration within their own method courses (Basham, Palla, & Pianfetti, 2005; U.S. Department of Education, 2001). Strategies used to accomplish this goal included

workshops, institutes, seminars and formal courses focused on skill building, online tutorials where needed, and mentoring projects when faculty members considered themselves novices at using technology. Workshops were typically only one day sessions; whereas, institutes or seminars spanned several days. In many cases, incentives were used to bolster attendance at these events. Incentives were typically stipends, mini-grants and additional or upgraded hardware for participants. However, more intangible incentives were used such as fulfilling tenure requirements or additions to vitas. In the case of mentoring, faculty members were paired up with in-service teachers or technology specialist to provide the necessary guidance to become familiar with current technologies (Basham, Palla, & Pianfetti, 2005; Duffield & Moore, 2006; Hall, Fisher, Musanti, & Halquist, 2006; Mims, Polly, Shepherd, & Inan, 2004).

Overall, 77% of the PT3 projects included some type of faculty technology literacy campaign. In providing these programs, the initiative sought not only to provide skills based lessons but to deepen the understanding of how technology fits within the overall goal of enhancing learning (Basham et al., 2005; U.S. Department of Education, 2001). Most programs resulted in better participation among faculty members when the training was directly related to the content; programs were also better attended when faculty members were provided content in ways that they normally would not have time or resources to accomplish (Brzycki & Dudt, 2005; Ludwig & Taymans, 2005).

During the PT3 initiatives, many tools were created to provide a better understanding of technology integration. Initiatives took advantage of the Internet to provide online tutorials for faculty members. One such program that had great success was the Teacherline Project initiated by the University of Dayton in partnership with the Public Broadcasting System (PBS). This initiative was part of a PT3 catalyst grant and provided 67 online modules that were aligned with NETS-T. The project included a six week training of faculty on the system, so that they could lead their students through completion of these modules (Rowley, Dysard, & Arnold, 2005).

The perceptions regarding the use of these online modules were overwhelmingly positive for both faculty and pre-service teachers. Among those that participated in the use of the online

modules, 84% responded that the Teacherline modules had great potential in helping students integrate technology in the classroom. Among the students, only 55% responded favorably to the Teacherline modules increasing personal technology skills. However, the positive and negative responses seemed to be tied to how fully engaged their instructors were in the use of the Teacherline module (Rowley, Dysard, & Arnold, 2005). This gives support to the idea that pre-service teachers need to observe their instructors using technology in positive ways throughout their program. Studies have shown that when pre-service teachers observe instructors using technology across their program, they are more likely to embrace the use of technology in their own classrooms (Fleming, Motamedi, & May, 2007).

During the PT3 project at Arizona State University it was found that only 22% of its current faculty used technology consistently during their lessons. A plan to reinforce technology use in the classroom was implemented that included workshops to emphasize using technology within the area of concentration, hiring of a technology specialist to work with the faculty, and commitment by the institution to hire only faculty members that had experience in technology integration. At the end of their grant, 100% of their faculty reported using technology consistently within their classrooms (Kelley, Wetzel, Padgett, Kim, Williams, & Odom, 2004).

Another PT3 catalyst grant was conducted by the University of Illinois at Urbana-Champaign to increase the technology skills of its pre-service teachers. The program called Technology Across Learning Environments for New Teachers (TALENT) included three online tutorials built in Flash and a live session for all students following the completion of the tutorial. Of the 24 special education pre-service teachers who participated, all reported a significant improvement in their skills and attitudes toward technology integration based on NETS-T (Basham, Palla, & Pianfetti, 2005).

Before the PT3 initiative, many teacher preparation programs provided only one or two stand-alone technology courses that focused on learning the technology. During the grant, institutions sought to redesign all methods courses to include a technology component. Instructors were asked to model appropriate technology use and to provide an in-class training

session on the technology. In return, students would demonstrate their understanding of the use of the technology in the classroom by completing a hands-on project (Basham, Palla, & Pianfetti, 2005; Collier, Weinburgh & Rivera, 2004).

Observation of the use of technology along with appropriate pedagogy demonstrated within methods classes is deemed necessary to improve student proficiency. However, observation is not enough. To be effective, the pre-service teacher must be able to practice these skills not only in the course but also in field experiences (Cohen, Pelligrino, Schmidt, & Schultz, 2007; Collier, Weinburgh, & Rivera, 2004; Mims, Polly, Shepherd, & Inan, 2004).

Most PT3 projects included an assessment of the current perceptions of ability to use and integrate technology. Assessments were given to various groups including current faculty within the teacher preparation program, pre-service teachers, first year teachers and in-service teachers. All groups were given assessments to record their current knowledge of technology, and faculty members were assessed to discover their current priorities and possible barriers toward utilizing technology. Many used pre and post assessments to gauge the effectiveness of the programs that were initiated during a PT3 project. Surveys were usually taken just after a workshop or other organized training to get the perception of the usefulness of the training by the participant. (Benson, Farnsworth, Bahr, Lewis, & Shaha, 2004; Bird & Rosaen, 2005; Collier et al., 2004; Ottenbreit-Leftwich & Cullen, 2006).

These surveys did very little to gauge the ability of the participant to actually implement the basis of the training into their classroom practice to impact learning. The results of the survey could only capture the participant's feelings on the possible success in implementation and whether the participant thought the training was worth his/her time. Data from these assessments were used in many cases to categorize the faculty members in one of the five stages of technology adoption that were developed during the ACOT studies conducted in the late 1980's. These stages ranged from entry stage to invention stage. Knowing this information would make it easier to provide the needed support to the faculty member (Barron, Kemker, Harmes, & Kalaydjian, 2003).

In order to find out if the training actually impacted the classroom by providing a richer environment to enhance student learning, both students and teachers would have to be surveyed and data on student outcomes would have to be collected (Lawless & Pelligrino, 2007; Ludwig & Taymans, 2005; Mims, Polly, Shepherd, & Inan, 2004). One study attempted to measure the level of technology integration by teachers. Results showed that only 29% of the Florida school district elementary teachers were consistently integrating technology in the classroom. Results were based on teachers' responses to the frequency they utilized technology based on the components of NETS-S (Barron, Kemker, Harmes, & Kalaydjian, 2003).

All PT3 projects that were implemented, whether regional, state or multi-state, had as the primary goal a change in teacher preparation programs across the country. PT3 organizers recognized that in order to do this, an emphasis had to be placed on changing the way faculty members taught within the classroom. A common thread throughout most PT3 initiatives was to build a partnership between teacher preparation faculty, current K-12 teachers and technology professionals. The collaboration of these groups was a milestone in bringing technology integration up to 21st century standards (Duffield & Moore, 2006; Hall, et al., 2006).

PT3 in the State of Alabama

The Alabama State Department of Education (ALSDE) was awarded a PT3 Catalyst grant in 1999. In addition to the primary goals of the PT3 initiative, the ALSDE sought to establish state technology standards. Through surveys and focus groups, the ALAPT3 staff began to prepare a draft of technology standards that were consistent with the national standards published by ISTE. Table 2 describes the major events of the PT3 catalyst grant that led to the development of the technology standards. After revisions were made from suggestions from the Alabama Association of Colleges for Teacher Education (ALACTE) and the deans of the teacher education programs, a final draft was sent to the State Board of Education. The board adopted the standards in 2002, and the standards were to be in place by 2003 (Alabama State Department of Education, 2001).

Table 2

Major Events in the Alabama PT3 Catalyst Grant

Year	Event
1999	State was awarded grant
2000	Pre-service, in-service and administrators were surveyed on technology competency
2002	State Board of Education adopts technology teacher standards
2002	Report reveals 80% implementation among undergraduate teacher preparation programs

The implementation team began by surveying a large group of education personnel that included teacher preparation faculty, pre-service teachers, cooperating teachers, first year teachers, veteran teachers and administrators. These surveys were to become the benchmarks for the continuing efforts to integrate technology into Alabama's education system. The surveys were used to measure the following areas:

1. teachers' perception of their technology competencies;
2. student teacher competencies in technology;
3. the extent to which teacher education faculty implement training in integrating technology within courses; and
4. education administrators' perception of their effectiveness in leading and supporting the integration of technology.

These surveys were good indicators of the perceptions of teachers and pre-service teachers on their achievement of implementing national technology standards (Alabama State Department of Education, 2001).

The results of the surveys were summarized into four areas of interest:

1. integrating technology;
2. teaching students to use technology;
3. managing technology; and
4. basic skills and applications of technology.

Within area one, integrating technology into classroom instruction, indicators revealed that more work needed to be done to train pre-service teachers and in-service teachers how to design and use learner-centered lessons and how to use technology for student assessment. Of particular notice was that in-service teachers perceived themselves as being very weak on developing and using criteria for evaluating technology based student products. Next, in area two, teaching students to use technology, indicators showed large weaknesses within the groups when it came to trying to show students about technology. These indicators revealed that all teachers were either uncomfortable or lacked the knowledge to guide students through the process of utilizing technology.

All participants perceived themselves to be strong or at least adequate in area three, managing technology and area four, basic skills and applications of technology. Overall the surveys revealed several areas that needed to be addressed to bring Alabama's teachers up-to-speed on making technology integration work in their classroom (Alabama State Department of Education, 2001).

In 2002, a survey was conducted to find out how far along the state institutions were in implementing the state mandated technology standards for teachers. The study looked at both undergraduate and graduate programs. The elementary programs reported the highest implementation with 80% of the standards being fully implemented. The standards that received the highest implementation across the undergraduate programs were using technology to enhance professional growth; use of technology tools for instruction, student assessment, management and reporting purposes for communication with parents; and modeling of safe, responsible, legal and ethical uses of technology. The standards with the lowest implementation among

undergraduate programs were identifying and evaluating technology resources and technical assistance; assessing advantages and limitations of current and emerging technologies to facilitate teaching and student learning; and developing and implementing a classroom management plan to ensure equitable and effective student access to available technologies (Nix, Snyder & Fritschi, 2002).

A consortium of 15 colleges and universities in the state of Alabama was awarded a PT3 implementation grant. The consortium used information gathered during the PT3 catalyst grant to make changes to the teacher preparation programs around the state. To achieve this mission the ALACTE challenged the consortium with these goals:

1. Ensure that the national standards that will be implemented focused specifically on the application of technology in instruction;
2. Ensure that instructors of methods courses integrate technology throughout the teacher preparation curriculum;
3. Develop a state-wide teacher preparation technology plan to ensure that all future teachers are effective teachers of and consumers of technology;
4. Ensure that faculty members serve effectively as professional models. Introduce faculty workload realignment to allow faculty members to be effectively involved in professional development activities designed to fulfill the statewide teacher preparation technology plan;
5. Establish web sites to disseminate all aspects of this project;
6. Ensure that teacher education majors, particularly pre-service teachers, will have more opportunities to apply technology during field experiences; and
7. Establish four program teams (General Studies, Professional Studies, Teaching Field, and Clinical Experiences) to implement the project's goals and objectives (University of South Alabama, 2004).

To achieve these goals, the consortium focused on training current teacher preparation faculty and pre-service teachers on technology use and how to integrate technology throughout the curriculum. The consortium institutions also redesigned methods courses to include more

technology integration (University of South Alabama, 2004). At the end of the ALAPT3 project, the consortium had accomplished most of the goals established by ALACTE. An indicator of this is the involvement by a large number of teacher preparation faculty; 28% of all teachers completed Intel certification (Hall, Fisher, Musanti, & Halquist, 2006).

The member institutions implemented an online assessment to gauge the effectiveness of the weekly training sessions in the transference of this training into the classroom. At the end of each semester, the faculty member was asked to fill out a self-assessment of the technology tools that were used during instruction. With the redesigning of the course to fit technology use, the instructor as well as the student should have seen an increase in the amount of technology that was used during the course. The results of the surveys were analyzed, and faculty members were placed in one of three stages of technology integration. These stages of entry, adaptation and transformation were introduced during the ACOT studies. An index was derived to record the amount of technology integration through three semesters. Overall, faculty members showed an increase in technology use over this period. The index increased from 19.58 to 24.26 between the first two semesters and then to 26.26 in the third semester. Reports claimed that the increases were due to the amount of training that was provided during this time.

Leaving Behind PT3

In November of 2000, George W. Bush was elected President and put a new education agenda to the forefront of society. It took only a year for a new education policy to be developed. The new focus of resources for American education resulted in the *No Child Left Behind Act.* The act stressed accountability for all schools and a goal of having only highly qualified teachers in the classroom. States and school districts had to report the number of highly qualified teachers they currently employed, and schools would be accessed as to their attainment of Adequate Yearly Progress (AYP). Those schools that did not make AYP would face stricter guidelines for providing instruction to students. Guidelines of NCLB were written to impact student outcomes and student achievement (NCLB Draft, 2007; Trotter, 2007).

NCLB contained a technology component. The *Enhancing Education Through Technology Act* (EETT) had as its primary goal to have all students technology literate by the eighth grade. In addition, the focus on technology shifted from training pre-service teachers to providing professional development within the school systems to train in-service teachers how to use technology to effectively impact student learning (Lawless & Pellegrino, 2007; Wright & Wilson, 2007). Schools that did not make AYP could apply for competitive grants to help improve instruction by providing professional development that could help impact student achievement. School districts were encouraged to spend technology budgets on software that could measure outcomes and maintain data on student achievement (Bush, 2005; Trotter, 2007).

With NCLB, professional development began to take on a new look. Workshops that only focused on how to use the technology did little to advance student achievement (Brooks-Young, 2007; Eib & Cox, 2003). The EETT grants specifically provided funds for professional development that gave teachers the opportunity to effectively integrate technology in their classrooms. Research has shown that quality professional development contains the following characteristics: longer in duration; provides access to new technologies for teaching and learning; engages teachers in meaningful and relevant activities in context; promotes peer collaboration and community building; and provides a clear vision for student achievement (Lawless & Pellegrino, 2007; Wright & Wilson, 2007). Also because of the focus on a data driven system, educators began looking for ways to measure the success of the professional development by measuring student outcomes. In the past, a teacher's perception of the effectiveness of the training was the only data collected. These data state nothing about the success of the teacher using the technology in his/her classroom to positively affect student outcomes.

One such program that has had success and has data to back up these claims is the Professional Development Portfolio (PDP) program. PDP contains four stages that culminate with a portfolio review to target student achievement. In the process, teachers attend a two-day seminar where they are exposed to best practices and new ways of presenting material in their classroom using technology. Time is spent by each teacher reflecting, collaborating and

designing a plan to provide instruction using technology that enhances learning. While many training sessions end there, this unique project continues to provide reflection and presentation on what worked and what did not and how student outcomes were affected (Eib & Cox, 2003).

Successful professional development plans seem to have some of the same elements as the PDP program. One element is to provide on-going training. Sternberg, Kaplan, and Borck (2007) stated that ongoing, embedded professional development is essential for all educators in creating a successful school literacy culture. Ongoing professional development can be achieved through follow-up sessions or through an online system that provides training at the individual's own pace and can provide a review at any time. The Mobile County School District adopted an online teacher training module to bring all of its 4000 teachers up-to-speed. The district chose online training because of the number of teachers and because of the large geographic area of the district. The online training was built to accommodate teachers who were novices in technology as well as those who were more advanced (Bush, 2005).

Collaboration is another common element in professional development plans. The online training provided in Mobile County provided a mentor, who took the training along with the classroom teacher. This was done so that all persons providing technology in the classroom would be aware of what was taking place and could easily help out in making the experience effective. The classroom resource person or mentor provided assistance to the teacher through email but also could help in face-to-face situations (Bush, 2005). An online learning community is a more complex version of the Mobile County situation. Online learning communities are developed so that all participants including classroom teachers, technology professionals and in some cases outside experts can all collaborate easily. The use of online learning portals allows this group to exchange ideas, discuss problems and allow mentoring to take place without having to meet at a central location (Sternberg et al., 2007).

Sebastian Elementary school in Florida established a professional learning community. The team consisted of two teachers, an administrator and a technology coordinator. The team was initially trained at a three-day seminar and worked with an online professional mentor.

Once trained, this team went back to the school system to begin to form other teams to expand the learning community. Project Lure (*Learn it. Use it. Run with it. Explain it.*) was a huge success. The teams initially met face-to-face but now conduct their sessions online. As a result, both teacher and student use of technology in the classroom has increased (Brooks-Young, 2007).

Summary

For just over two decades, computers and other technologies have been making an impact on education. Early on, computers were seen as the great equalizer in providing a quality education to the masses. There have been several different programs to make technology the learning tool that everyone hoped it would be. Each had its own successes. ACOT provided an initial framework for integrating technology; E-rate leveled the playing field among poorer school districts; PT3 brought about a change in how teacher preparation programs taught pre-service teachers; and NCLB is working to make sure that teachers are using technology to improve student achievement. With every program, the knowledge base expands to make certain that technology is put in proper perspective.

The last PT3 grants were awarded in 2003. Many online resources and faculty training sessions were abandoned (Honowar, 2008; Ottenbreit-Leftwich & Cullen, 2006). With the rapid change in technology, resources have to be maintained or they become obsolete. Training methods have to be tweaked to accommodate newer, faster hardware and software. Programs have to build upon each other. The continuous reinventing of the technology wheel is not effective. Without the funds to pay faculty and staff to invest their time in using technology and maintain online resources, the framework that was established begins to grow stale. Some teacher preparation programs have continued new ways of training and have pressed on despite the lack of funding. A report from the U.S. Department of Education (2001) indicated that 71% of the participating consortia in the PT3 grant program have in place a continuance of PT3 activities beyond the funding years. However, many others have struggled with how to continue to help their faculty and pre-service teachers with the technology factor (Honowar, 2008).

A report by the Alabama State Department of Education (2006) reported that while teachers are being adequately trained to use technology for personal productivity, they are lacking knowledge to assess students' technology proficiency. The report concluded that current professional development in technology did not seem to be contributing to increasing student achievement. This seems to be the case even though the computer ratio has been improved from past years. While the improved computer ratio is a positive one for the state of Alabama, it does not account for many schools with outdated computers. These computers are not able to perform the tasks that are needed in current classroom settings. Even today, there are still classrooms without computers (Alabama Department of Education, 2006).

The Alabama State Department of Education has tracked the perceptions of teachers toward technology use in the classroom since the beginning of the PT3 grant implementation. The initial survey revealed gaps in teachers' perceptions of being able to properly integrate technology into the curriculum (Alabama State Department of Education, 2001). The PT3 implementation grant was a massive effort to train teacher preparation faculty, pre-service teachers and in-service teachers to use technology in the classroom. State technology standards were established and mandated that teachers follow these standards within the curriculum. However, a state report in 2006 still concluded that teachers still lacked the ability to use technology to enhance student learning based upon the measurement of meeting of the state technology standards. More professional development was deemed necessary and needed to focus on training teachers to properly integrate technology into the curriculum (Alabama State Department of Education, 2006).

CHAPTER III:

METHODOLOGY

The purpose of this study was to record the perceptions of current teachers in the meeting of the state technology standards. The participants of the study were elementary teachers of schools within the service area of one southeastern university. As a result of the information gathered during the PT3 catalyst grant, revisions were made to the Alabama teacher standards and administrator standards concerning technology integration in the classroom. The PT3 implementation grant sought to include more authentic teaching practices in teacher preparation programs that infused technology into the curriculum. Faculty received training on using technology in the classroom so that they could then model best practices to pre-service teachers. Efforts were also made to place pre-service teachers in technology rich environments during their field experiences. The central questions in this study were as follows:

1. What are the perceptions of elementary teachers regarding their ability to meet the state technology standards for teachers during their classroom instruction;
2. What did the teachers perceive as current barriers in meeting the state technology standards and how have they been able to overcome the barriers; and
3. What are the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards?

Setting

The southeastern university was located in east Alabama and borders the Georgia state line. This campus was part of a large network of campuses that spans over 17 states and 11 countries. The Alabama campuses were located in four cities across the southern half of the state. In 2005, the university merged the administration and programs of each of its campuses and implemented its One Great University (OGU) program. The teacher preparation program in

elementary education at the campus studied has always been an extension of the main campus. The program primarily used three city school systems and three county school systems in the state of Alabama for field experiences placement for its teacher candidates. As a result, these school systems had a large population of teachers who had received their teaching degrees from the university. Each of these school systems represents a cross-section of demographic and socioeconomic factors.

The elementary education program at the university required 129 hours of coursework. These hours included 60 hours of general coursework and 69 hours of courses in education. A student could enroll in 15 hours of core education courses before being accepted into the teacher preparation program. All education courses required a minimum of 10 hours of field experiences, in which the student was engaged in the daily activities of a classroom.

The university required a three-hour course in technology that was part of the 15 hours of core education courses. The goals of this course were to expose students to the methods of integrating technology into the curriculum and to allow hands on experiences in using emerging technologies in the classroom. A student in this course would also take part in a minimum of 10 hours of field experiences where they would work with an in-service teacher to practice technology integration.

The research topic was of interest to me because, since 2006, I had been teaching the undergraduate technology course. In 2007, I became the sole instructor for this course and had taken a leadership position in directing the technology efforts of the education department. During the time I taught the technology course, I made an effort to emphasize the Alabama Teacher Technology standards. The students in this course had an opportunity to look over the technology standards and match them to appropriate uses of technology in the classroom. As a requirement of the course, students developed a lesson plan that involved technology and presented the lesson to the class. This study was beneficial in the future development of class exercises that better prepared the pre-service teachers to integrate technology in the classroom.

Background

This university was one of 15 participating universities in the ALAPT3 implementation project. Administrators of the college of education at the university implemented several projects that were intended to emphasize the use of technology within all education courses. The institution began by offering weekly one-hour training sessions on campus that dealt with issues such as basic computer skills and how to incorporate technology in the classroom as set forth by the national technology standards. Since these sessions were offered at various times, almost all education faculty had exposure to some, if not all, training. Overall, there were 160 hours of training offered during the first year. In addition, two faculty members were chosen to participate in Student Teachers Are Revitalizing Teaching Through Technology (START). Developed by a consortium of southern states, START was a PT3 project that exposed education faculty to tools they could use to teach their students how to use technology with their science lessons. Once trained, these faculty members trained the other faculty on how to implement these strategies.

The college of education sought to restructure many of the methods courses within the curriculum to include more technology experiences. During the first year, three faculty members worked to redesign three undergraduate courses and one graduate level education course. During the second year, the team was expanded to six members, and six courses were selected to be redesigned. The teams were split into two member groups with each taking two courses to redesign. In order to accomplish this task, the members had to adhere to several of the ALAPT3 project goals. For the first goal, adherence to national standards, team members restructured all courses to be in compliance with the national standards. For the next goal, technology integration throughout curriculum, team members redesigned instructional methods that included technology components throughout the curriculum and offered not only observance of technology use but mandated student use and a show of competency on the use of technology in the course.
For the next goal, faculty serve as models of professional teachers, team members were selected that had attended faculty training sessions and served in capacities that demonstrated their

competencies of technology use. The team members were to serve as mentors in the redesign of other education courses. The final goal, dissemination of information, required team members to report their accomplishments at faculty meetings and also post updates on the web.

Other projects that were implemented during PT3 included the Teacher Resources Online for You project and Blackboard online course management system. The Teachers Online for You project provided a central location of web resources divided into subject areas. These sites were researched for their reliability and usefulness in the classroom prior to being linked. Not only was the Blackboard system used to bring online content into the classroom, but it also was used as a collaboration tool to link all technology coordinators within the service district together. Collaboration was important to ensure success of the PT3 project goals.

As a result of the PT3 implementation grant, methods courses in the teacher preparation program of the university were modified to include more areas for technology integration. Instructors were trained on how to use technology and integrate it into their current teaching methods. Such methods included a broader use of the Internet to locate valuable teaching resources and articles on best practices. Online discussion boards were used to generate more interest in classroom topics. Training sessions were offered in one hour blocks throughout the course of a week to give instructors plenty of opportunities to attend. In addition, each course syllabus was modified to contain assignments that aligned not only with Alabama Course of Study for the subject matter but also aligned with the Alabama Technology Standards. Instructors were encouraged to use the Blackboard course management tool for their courses. This online course management system provided a way for instructors to communicate with their students during non-class hours. Instructors must be deemed Blackboard proficient by the university before attempting to use these online tools in their classroom.

Pre-service teachers were exposed to new teaching methods that included the use of technology. Students were also expected to demonstrate the use of this technology through in-class projects and interaction with other students as well as the instructor. The University implemented a program called Wimba and made it available to all instructors who used

Blackboard. Wimba tools allow an instructor to conduct synchronous and asynchronous classes remotely. These tools have made it possible for instructors to conduct audio discussion boards that allow students to post their thoughts in their own voice. When conducted in a live environment, audio discussion boards can promote some great classroom discussion. The Wimba classroom can be conducted using a webcam and a microphone. The instructor can present PowerPoint slides, as well as web content to the student. The student can give feedback through a chat program or by voicing a question. These types of experiences prepare pre-service teachers for what they might be experiencing within their own classroom of the future.

In 2005, Livetext was implemented throughout the college. Livetext was an online portfolio, lesson plan and assessment tool. Students were expected to submit assignments including lesson plans electronically through the Livetext portal. Instructors would record student outcomes through the online rubric and submit the score back to the student using Livetext. The Livetext portal was also used by students to compile an online portfolio that would be used not only during their internship but also as a way to show accomplishments and experience to future employers.

Students had an opportunity to observe and practice technology integration through their field experiences. The university put into place a technology matrix (see Appendix A) that all pre-service teachers must complete before finishing their internship. This matrix ensured that the student had been able to demonstrate competencies in these areas of technology integration. By giving the pre-service teachers more exposure and practice on the use of technology in the classroom, it was hoped that they would be more likely to use technology to enhance learning in their own teaching experiences.

Permission Procedures

Permission for this study was acquired by the Institutional Review Board (IRB) of The University of Alabama (see Appendix B). A formal letter was sent to the principals and/or superintendents of each school system seeking approval to conduct research. The letters were distributed by email and in person. A follow-up call or visit was made to obtain the permission in

writing. Several principals responded immediately to the request and agreed to allow the research at their school. Some schools were experiencing problems with their email system at the time of the study and a visit had to be made to obtain the permission of the principal. Superintendents were contacted where all schools in the system participated in the study. A total of six principals and two superintendents responded with their permission to conduct the research. Potential participants came from the faculty lists of each local elementary school. Potential participants were contacted by an email or seen in person to seek their voluntary participation. Participants were made aware of the research study procedures and their rights while participating. A consent form was obtained by all participants in the study.

Research Design and Instrumentation

This study used descriptive statistics and correlation analysis to answer the research questions. The primary research tool of this study was a teacher survey (see Appendix C). The teacher survey instructions were delivered to each participant by email using Profiler Pro. This online mechanism for delivering surveys has been used by many school districts to collect initial information on technology competency during the PT3 grant projects. Results of the online survey were compiled in a database as a service of the online survey tool. A printed survey and answer sheet were used as a backup procedure in case participants incurred a problem accessing the online survey. Survey instructions were sent out to 477 teachers at 16 elementary schools. The survey instrument was similar to the one used in the 2006 report on technology use in the state of Alabama schools conducted by the State Department of Education. The first 31 questions of the teacher survey used in the 2006 report are the same. This teacher survey was one of several surveys used to gather data for the 2006 report. Permission was received by the Director of Technology Initiatives of the State Department of Education to use the survey in this study. The Profiler Pro Teacher Survey was designed to measure the Alabama Technology Standards based upon the levels of technology integration in five categories (Alabama State Department of Education, 2006):

1. General Instruction Integration;
2. Teaching Students to Use Technology;
3. Managing Technology Resources;
4. General Technology Skills; and
5. Essential Conditions.

The survey instrument has been deemed a good indicator of technology integration using multivariate analysis of variance set at a .05 level of significance as well as a discriminate function analysis. Content validity was established by having the survey reviewed by a panel of experts (Alabama State Department of Education, 2006).

Table 3 summarizes the relationship of the survey question sets with the research questions. Questions 1-31 of the survey answer the first research question of this study. These questions were broken down into four areas and measure the level of technology use in the classroom to achieve the state technology standards. Questions 1-10 deal with the teacher's experience in general technology integration. Questions 11-18 deal with a teacher's ability to teach students to use technology effectively. These questions show whether a teacher feels confident enough about technology integration to be able to properly engage students in utilizing the available technology components. Questions 19-25 deal with a teacher's ability to manage technology resources. Questions 26-31 deal with a teacher's general technology skills. A three-point Likert scale was used to record each participant's responses. Possible responses for questions 1-31 were never, occasionally or routinely.

Questions 32-39 deal with the support system within each school that the teacher can rely upon in dealing with technology. These questions revealed some of the barriers to technology use that have been identified and answer the research question concerning barriers to technology use with the school. A three-point Likert scale with possible responses of no, somewhat or yes along with two open-ended questions was used for this section. Table 3 displays the category and question sets from the survey which answer the research questions of this study.

Table 3

Relationship of Survey Question Sets to the Research Topic

Survey Question Set	Survey Category	Research Topic
Questions 1 – 10 Questions 11 – 18 Questions 19 – 25 Questions 26 – 31	General Instruction Integration Teaching Students to Use Technology Managing Technology Resources General Technology Skills	Teachers' perception of meeting state technology standards
Questions 32 – 38	Essential conditions	Teachers' perceptions of barriers to technology integration
Questions 39 – 40	Essential conditions	Teachers' perception of the quality of professional development in the school

The survey also recorded some vital pieces of information such as the grade level taught, the number of years the participant had been a teacher, the number of professional development hours received during the current school year, the level of education of the participant and if the participant received his/her degree from the southeastern university. This information was used to determine if there were any significant relationships in the perceptions of the participants when these variables are considered. The number of professional development hours recorded along with the participant's perception of the professional development received answers the research question on the role professional development has played in the achievement of the state technology standards.

Previous Study

In 2006, the Alabama Department of Education released a report entitled *Technology in Alabama Public Schools*. The study used four survey tools to gauge the amount of technology use by students, teachers and administrators. The data reported were from the 2004 - 2005 school year. This information was gathered as a result of a state technology initiative called IMPACT (Indicators for Measuring Progress in Advancing Classroom Technology). The goal of IMPACT was to improve learning through the use of technology (Alabama State Department of

Education, 2006). The survey tool for teachers was administered using an online survey tool called Profiler Pro. Data were received by 43,140 teachers in the state of Alabama. The survey measured the level of technology integration along five categories that have been tied to the Alabama Technology Standards (Alabama State Department of Education, 2006).

The report revealed several strengths and weaknesses concerning technology integration in the classroom. Among the strengths was the ability of teachers to use technology to analyze student achievement data and to use technology for personal productivity. Teachers reported that they were receiving adequate technology support with the school system (Alabama State Department of Education, 2006). However, the report also revealed that teachers did not formally assess students' use of technology to learn and communicate information and that teachers did not seem to be receiving professional development that resulted in greater use of technology by the student to increase learning (Alabama State Department of Education, 2006). The study concluded that teachers were reluctant to use technology to increase student achievement and that professional development should focus on training the teachers to use technology in a way that would increase student learning (Alabama State Department of Education, 2006).

Data Collection and Analysis

Participants for this study came from three school systems that the southeastern university uses for its field placements and that have a high concentration of the university graduates as teachers. Qualified participants were all teachers within these school systems. Since the Alabama Teacher Technology Standards were not fully in place until 2003, comparisons were made from the perceptions of teachers who received their teaching degree before the technology standards were implemented to those that received the degree after the technology standards were in place.

A sample from each school system was sought in order to minimize the possibility of contamination of results due to a skewed sample size. Participants were emailed the link to the survey after a signed consent form was obtained. Profiler Pro was used to administer the survey

and store the data. Descriptive statistics and frequency charts were used to report the results of the study. A Pearson chi square test of significant relationships was used to determine if the data reported were significant between the variables listed on the survey instrument. These variables include the participation in professional development concerning technology, receiving initial certification before or after 2003 and if the participant received degrees from the southeastern university.

The qualitative part of the study consisted of open-ended questions on the survey instrument. The data from these questions were analyzed to find the most common themes regarding barriers to technology integration within the schools and how the teachers have coped with these barriers, and the perception of how professional development in technology has helped integrate technology.

CHAPTER IV:

RESULTS OF STUDY

Introduction

The purpose of this study was to examine how elementary teachers, employed at schools within the service area of one southeastern university perceived their meeting of the state technology standards as mandated by the state. The southeastern university in this study provides a large portion of the needed teachers in the area. By using the Alabama Teacher Technology Standards as a benchmark, teachers who participated in this study were asked questions that gauged their use of technology in the classroom. In addition, the teachers were asked to reflect on barriers to technology integration within the school and what measures, if any, were taken to overcome these barriers. This study also recorded the perceptions of the effectiveness of current professional development efforts by the school.

The Alabama Teacher Technology Standards were developed from the information gathered from 1999 to 2003 during the PT3 catalyst grant concerning technology integration in the classroom. The Alabama Teacher Technology Standards were implemented by the state in 2003 and the teacher preparation programs began exposing pre-service teachers to these standards during that year. Also, the PT3 implementation grant sought to include more authentic teaching practices in teacher preparation programs that infused technology into the curriculum. Faculty received training on using technology in the classroom so that they could then model best practices to pre-service teachers. Efforts were also made to place pre-service teachers in technology rich environments, during their field experiences, at the southeastern university.

The southeastern university in the study was part of a consortium of fifteen universities that participated in the PT3 implementation grant. During the grant, the university redesigned courses to include more technology use and demonstration and restructured field experiences that exposed pre-service teachers to technology rich lessons.

This chapter reports the results of a survey of teachers' perceptions of how they are meeting the Alabama Technology Standards, perceived barriers and the adequacy of professional development concerning technology use. In 2006, the Alabama Department of Education conducted a study to see if teachers across the state were meeting the state technology standards. In the 2006 study, 43,140 teachers completed the online survey. The first 31 questions of the 2006 teacher survey are the same as the questions answered by participants in this current study. The research questions explored in this study were:

1. What are the perceptions of elementary teachers regarding their ability to meet the state technology standards for teachers during their classroom instruction;

2. What do the teachers perceive as current barriers in meeting the state technology standards and how have the teachers been able to overcome the barriers; and

3. What are the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards?

Research Process

Data were collected from16 schools representing three school systems within the southeastern university's service area. There were a total of 477 elementary teachers at these 16 schools. Upon IRB approval, this study sought permission from the principals of the 16 elementary schools to administer the survey. Permission was received by the principals of the schools or the superintendents of the school districts. Invitations to participate in the survey,

along with the participant consent forms, were emailed to the 477 elementary teachers. Consent to participate was received by 124 teachers. Instructions on how to complete the survey were initially sent out through email to the 124 participants, with follow up reminders delivered to the teachers' school mailboxes. The online survey was developed on a professional website designed to collect and store data from the survey responses. In order to prevent duplication, the survey was made available to the participants after they created an account on the survey website and then joined the survey group. Participants began completing the survey in April 2009.

Demographic Data

The 124 elementary school teachers who completed the online survey represented 26% of the total population. The participants taught classes in kindergarten through sixth grade. Twenty-five percent of the participants received their initial certification before 2003. These participants would not have been exposed to the Alabama Teacher Technology Standards during their teacher preparation program. Among the participants, 66% held only a bachelors degree; 34% held a masters degree. Eighty percent of the participants received their initial teacher certification from the southeastern university. Eighty-one percent of the participants who held masters degrees received the degrees from the southeastern university. Table 4 shows a summary of the participants' demographic data.

Table 4

Demographic Data

Professional Development	%	n
0 hours	27.4	34
1-5 hours	38.7	48
6-10 hours	16.1	20
11-15 hours	6.5	8
16-20 hours	6.5	8
21 or more hours	4.8	6
Initial Certification		
Before 2003	25.0	31
On or after 2003	75.0	93
Place of Certification		
University in Study	79.8	99
Other	20.2	25
Master's degree		
Yes, at university in study	27.4	34
Yes, at other place	6.5	8
No	66.1	82
Masters degree before 2003		
Yes	11.3	14
No	88.7	110

Research Question One

What are the perceptions of elementary teachers regarding their ability to meet the state technology standards for teachers during their classroom instruction? This research question was answered through participants' responses to survey questions 1-31. These questions attempted to gauge the extent to which teachers are involved in daily activities concerning technology integration and general technology use. Possible responses to the questions were *never*, *occasionally* or *routinely*. The survey responses were coded 1, 2, and 3 respectively for purposes of analysis. The questions were divided into the categories *General Instruction Integration, Teaching Students to use Technology, Managing Technical Resources,* and *General Technology Skills*.

General Instruction Integration

The first section of the survey instrument included ten questions in the *general instruction integration* category. The responses to these ten questions recorded the perceptions of the extent of technology integration within the general curriculum by recording the frequency with which teachers plan, design, implement and manage technology in their daily lessons. Participants in the study responded that they are evaluating, designing and implementing lessons that involve students in the use of technology and encourage use of higher order thinking skills. This is indicated by the frequency of responses to questions 5 through 8 of the survey (see Table 5). For question 5, 47.7% (n = 60) of participants responded that they *routinely* plan and implement technology-based learning activities that promote student engagement in higher-level thinking and creation of original products. For question 6, 40.9% (n = 50) of participants responded that they *routinely* design, manage, and facilitate learning experiences using technology that is sensitive to the diversity of learners. Question 7 asked participants to respond to how frequently they identify, evaluate, and select specific technology resources to support a coherent lesson sequence. This question received the highest percentage of responses in the *routinely* category with 52.3% (n = 65) of participants indicating that they were involved in this activity. For question 8, 40.9% (n = 50) of participants responded that they *routinely* organize learning activities so that students work together using the tools of technology.

Questions 1, 2 and 9 received the fewest number of responses of *routinely* in this category (see table 5). Question 1 asked participants to respond to how frequently they develop and use criteria for evaluation of technology-based student products and the processes used to create those products. This question received a 25% response rate of *routinely* being involved in this activity. Question 2 asked participants how frequently they use various strategies to

determine students' technology proficiency in content area learning and received a *routinely* response rate of 15.9%. Question 9 queried teachers about recognizing students' talents in technology use and providing them with opportunities to share their expertise with teachers, peers and others. This question received a 22.7% response rate of *routinely* being involved in this activity. Table 5 displays the frequency of responses for all questions in this category.

Table 5

Summary Statistics of Responses for Category 1: General Instruction Integration

Question (n = 124)	Never (1)	Occasionally (2)	Routinely (3)
1. I develop and use criteria for evaluation of technology-based student products and the processes used to create those products	38.6%	36.4%	25.0%
2. I use various strategies to determine students' technology proficiency in content area learning.	25.0%	59.1%	15.9%
3. I design and implement learning experiences that use assistive technologies to meet the special physical needs of students.	34.1%	34.1%	31.8%
4. I design, implement, and assess learner-centered lessons that are based on effective practices in teaching and learning with technology.	9.1%	56.8%	34.1%
5. I plan and implement technology-based learning activities that promote student engagement in higher-level thinking and creation of original products.	13.6%	38.6%	47.7%
6. I design, manage, and facilitate learning experiences using technology that is sensitive to the diversity of learners.	13.6%	45.5%	40.9%
7. I identify, evaluate, and select specific technology resources to support a coherent lesson sequence.	6.8%	40.9%	52.3%
8. I organize learning activities so that students work together using the tools of technology.	11.4%	47.7%	40.9%
9. I recognize students' talents in the use of technology and provide them with opportunities to share their expertise with their teachers, peers, and others.	27.3%	50.0%	22.7%
10. I apply technology productivity tools for student assessment and reporting purposes	25.0%	36.4%	38.6%

Teaching Students to Use Technology

The next section of the survey instrument contained eight questions. The category for these questions was labeled *teaching students to use technology*. These questions explored the teachers' perception of the extent to which they are teaching students to use technology in the classroom. Participants' responses to these questions show weaknesses in applying the technology standards associated with this category. Table 6 displays the questions for this category and the response rate for each question. Question 16 received the highest number of responses of *routinely* with only 20% (n = 25) of the participants reporting that they are involved in teaching students to use computers, printers and other peripheral devices. Teaching students to participate in online collaboration (question 15) received the highest response of *never* with 68% (n = 84) indicating that they are not involved in this activity. Teachers also responded to question 12 that they *never* (59%, n = 73) teach students to troubleshoot hardware and software problems. Question 13 asked participants how often they teach students to select and apply suitable productivity tools to complete tasks. Fifty percent of participants (n = 62) responded that they are *never* involved in this activity. Question 14 asked participants how often they taught students to use technology resources to prepare publications and presentations. This question received a 38.6% (n = 47) response rate of *never* being involved in this activity. Question 17 asked participants how often they taught students to use technology tools to process data and report results. Fifty percent of participants (n = 62) responded that they were *never* involved in this activity. Table 6 shows the frequency of responses for this category.

Table 6

Summary Statistics of Responses for Category 2: Teaching Students to Use Technology

Question (n = 124)	Never (1)	Occasionally (2)	Routinely (3)
11. I teach students to use technology resources in collaborative ways to solve authentic problems in the subject areas(s).	27.3%	52.3%	20.5%
12. I teach students to troubleshoot routine hardware and software problems.	59.1%	29.5%	11.4%
13. I teach students to select and apply suitable productivity tools (e.g., word processing, databases, spreadsheets, communication tools, graphics programs) to complete personal and educational tasks.	50.0%	43.2%	6.8%
14. I teach students to use technology tools and resources for preparing publications and presentations, managing information, and interacting with various audiences.	38.6%	47.7%	13.6%
15. I teach students to participate in online collaboration or discussion as part of learning experiences.	68.2%	22.7%	9.1%
16. I teach students to use computers, printers, and other peripheral devices (e.g., scanners, digital cameras).	22.7%	56.8%	20.5%
17. I teach students to use technology tools to process data and report results.	50.0%	40.9%	9.1%
18. I teach students to use technology to locate, evaluate, and collect information from a variety of sources.	25.0%	63.6%	11.4%

Managing Technology Resources

The next section of the survey instrument contained seven questions. These questions were associated with the category labeled *managing technology resources*. Participants responded to how well they identified, planned, modeled, implemented and improved technology resources and policies of the classroom, school and district. Table 7 displays all questions in this

category and the response rate of the participants. Question 20 asked the participants' perception of how well they modeled safe and responsible uses of technology and implemented school and district acceptable use policies and data security plans. A large number of participants (65.9%, n = 82) indicated that they were *routinely* involved in this activity. However, only 18.2% (n = 22) of participants responded in question 24 that they are *routinely* involved in evaluating emerging technology (see Table 7).

Table 7

Summary Statistics of Responses for Category 3: Managing Technology Resources

Question (n = 124)	Never (1)	Occasionally (2)	Routinely (3)
19. I identify technology resources and technical assistance available within the school and district.	15.9%	40.9%	43.2%
20. I model safe and responsible use of technology and implement school and district technology acceptable use policies and data security plans.	13.6%	20.5%	65.9%
21. I manage available technology resources to provide equitable access for all students.	9.1%	31.8%	59.1%
22. I plan and implement learning activities that use technology to enhance student academic achievement and technology proficiency.	4.5%	40.9%	54.5%
23. I evaluate and improve instructional technology practices in the classroom using information from student feedback, observations, student assessment data, etc.	20.5%	45.5%	34.1%
24. I assess current and emerging technologies with the potential for facilitating teaching and student learning.	20.5%	61.4%	18.2%
25. I participate in online professional collaboration (email, listserv, chat rooms) with peers and experts to enhance technology expertise.	20.5%	36.4%	43.2%

General Technology Skills

The next section of the survey instrument contained six questions. These questions were associated with the category labeled general technology skills. These questions gauged the perceptions of the participants on their use of technology not only in the classroom but for personal and administrative tasks. Table 8 displays all questions in this category and the response rate of the participants. Participants responded overwhelmingly that they *routinely* were involved in using technology for these purposes. On question 26 participants were asked how often they use computers, printers and other devices. As shown in Table 8, 95.5% (n = 118) of participants responded that they *routinely* use these devices. On question 27, 88.6% (n = 110) reported *routinely* using technology tools to locate and collect information. On question 28 participants were asked how often they used productivity tools such as word processors, databases and spreadsheets to complete personal and professional tasks. Over 93% (n = 115) responded that they *routinely* use these tools. On question 29 over 68% (n = 84) responded that they *routinely* use technology tools to prepare presentations. On question 31, 56.8% (n = 70) of participants responded that they use technology to facilitate communication with parents or guardians of their students. Question 30 asked participants to record how often they troubleshoot hardware and software problems. In this category, this question received the least number of responses of *routinely* being involved in this activity with only 38.6% responding as such (n = 48).

Table 8

Summary Statistics of Responses for Category 4: General Technology Skills

Question (n = 124)	Never (1)	Occasionally (2)	Routinely (3)
26. I use computers, printers and other peripheral devices (e.g., scanners, digital cameras).	0.0%	4.5%	95.5%
27. I use technology to locate, evaluate and collect information from a variety of sources.	0.0%	11.4%	88.6%
28. I use suitable productivity tools (e.g., word processing, databases, spreadsheets, communication tools, graphics programs) to complete personal, educational, and professional tasks.	0.0%	6.8%	93.2%
29. I use technology tools and resources for preparing publications and presentations, managing information, and interacting with various audiences.	2.3%	29.5%	68.2%
30. I troubleshoot routine hardware and software problems that occur in the classroom.	18.2%	43.2%	38.6%
31. I use technology to facilitate communication with parents/guardians of students.	4.5%	38.6%	56.8%

Essential Conditions

The last set of questions in this part of the study explored the teachers' perceptions of the essential conditions necessary to integrate technology in the classroom. Results of these questions could point to some possible barriers that teachers are experiencing in integrating technology. Possible responses to these questions were *no, somewhat*, or *yes*. The responses were coded 1, 2 and 3 respectively for analysis purposes. Table 9 shows that most participants responded that they felt they had adequate resources and support to successfully integrate technology. Questions 32 and 33 asked participants if they perceived they had adequate hardware and software available to integrate technology. As shown in Table 9, 52.3% (n = 65) responded

yes to these two questions. Fifty percent of participants (n = 62) indicated they perceived they had adequate technology support to integrate technology, while 56.8% (n = 70) indicated they had adequate instructional support to successfully integrate technology. In question 36, participants were asked if they felt their principal supported their use of technology in the classroom. Responses of *yes* to this question were reported by 86.4% (n = 107) of the participants. Finally, 54.5% (n = 68) of participants responded in question 37, that they had adequate professional development to successfully integrate technology. Table 9 summarizes participants' responses to this question set.

Table 9

Summary Statistics of Responses for Category 5: Essential Conditions

Question (n = 124)	No (1)	Somewhat (2)	Yes (3)
32. I have sufficient hardware to successfully integrate technology in my teaching.	13.6%	34.1%	52.3%
33. I have sufficient software to successfully integrate technology in my teaching.	9.1%	38.6%	52.3%
34. I have sufficient technology support to successfully integrate technology in my teaching.	18.2%	31.8%	50.0%
35. I have sufficient instructional support to successfully integrate technology in my teaching.	13.6%	29.5%	56.8%
36. My principal supports the integration of technology in teaching and learning.	13.6%	29.5%	56.8%
37. I have sufficient professional development to allow me to successfully integrate technology in my teaching.	13.7%	31.8%	54.5%

Grouped Data

Participants in the study were grouped according to the answers to several demographic questions. Participants were grouped either as having professional development or not having professional development, obtaining initial certification before 2003 or in or after 2003, obtaining initial certification at the southeastern university in the study or obtaining certification at any other university, and obtaining an advanced degree from the southeastern university in the study or obtaining an advanced degree at any other university.

The results of the 37 quantitative questions were then reanalyzed according to the groups. The responses of *never, occasionally* and *routinely* for questions 1-31 and *no, somewhat* and *yes* to questions 32-37 were given points values of 1, 2 and 3 respectively. The responses of the 124 participants on each question were totaled according to the point values stated above. The totals for each possible response were then divided into the five question sets of *general instruction integration, teaching students to use technology, managing technology resources, general technology skills* and *essential conditions*. A contingency table displaying the results of these groupings was built and a Pearson chi square analysis was used to determine if there was a statistical difference in the responses among these groups. Tables 10-20 display the results of the contingencies and chi square analyses. The level of significance was set at the .05 level for all analyses.

Professional Development Groups

Table 10 displays the contingencies for the professional development group across all five question categories. The chi square analysis indicates significance ($\alpha = .05$, $p < .05$) among teachers who participated in technology related professional development versus those that did not participate in technology related professional development in all five categories. The p value

was found to be equal to zero in the categories of *general technology integration* and *teaching students to use technology*. This analysis presents evidence that there is a relationship between participating in technology related professional development and the frequency of participating in the technology related activities mentioned in the survey. Table 11 displays the results of the chi square analysis for the professional development grouping.

Table 10

Contingency Table of Survey Responses Grouped by Technology Related Professional Development

Group	n	Never	Occasionally	Routinely	Total
			General Instruction Integration		
Without Professional Development	32	108	116	86	310
With Professional Development	92	136	440	354	930
Total	124	244	556	440	1240
			Teaching Students to Use Technology		
Without Professional Development	32	150	64	34	244
With Professional Development	92	270	386	88	744
Total	124	420	450	122	992
			Managing Technology Resources		
Without Professional Development	32	41	75	101	217
With Professional Development	92	78	271	302	651
Total	124	119	346	403	868
			General Technology Skills		
Without Professional Development	32	18	33	135	186
With Professional Development	92	16	124	418	558
Total	124	34	157	553	744
			Essential Conditions		
Without Professional Development	32	14	68	104	186
With Professional Development	92	73	149	336	558
Total	124	84	217	440	744

Table 11

Chi square Analysis of Survey Data for Professional Development

$X^2 = 5.991, \alpha = .05$	X^2	df	p value
General Instructional Integration	60.340	2	0
Teaching Students to Use Technology	54.128	2	0
Managing Technology Resources	7.712	2	0.021152
General Technology Skills	15.586	2	0.000413
Essential Conditions	8.765	2	0.012494

Teachers who reported participating in technology related professional development had a mean score of 2.23 (n = 92) on the questions in the *general instruction integration* category compared to 1.93 (n = 32) for teachers with no professional development. For the questions in the *teaching students to use technology* category, the mean score for teachers with professional development was 1.76 (n = 92) compared to 1.53 (n = 32) for those with no professional development. Table 12 illustrates the mean scores for all categories in the professional development grouping.

Table 12

Mean Scores of Survey Data for Professional Development

	Professional Development (n = 92)	No professional development (n = 32)
General instruction integration	2.23	1.93
Teaching students to use technology	1.76	1.53
Managing technology resources	2.28	2.34
General technology skills	2.63	2.72
Essential conditions	2.48	2.47

Initial Certification Year Groups

Grouping two was divided between teachers who received their initial certification before 2003 and those that received certification in or after 2003. The year was chosen because teachers who received their certification before 2003 would not have been exposed to the Alabama Technology Standards in their teacher certification programs. Table 13 displays the contingencies for the initial certification group. The chi square analysis indicates significance ($\alpha = .05$, $p < .05$) in the responses of the participants in the *teaching students to use technology* and *managing technology resources* categories. Responses from participants in the *managing technology resources* categories shows significance with $p = 0$. This analysis would indicate that there is a relationship between teachers receiving initial certification before 2003 and their involvement in activities associated with teaching students how to use technology and managing the technical resources of the school. Table 14 shows the results of the chi square analysis.

Table 13

Contingency Table of Survey Responses Grouped by Initial Certification Year

Group	n	Never	Occasionally	Routinely	Total
			General Instruction Integration		
Certification Before 2003	29	55	117	108	280
Certification On or After 2003	95	189	439	332	960
Total	124	244	556	440	1420
			Teaching Students to Use Technology		
Certification Before 2003	29	73	107	44	224
Certification On or After 2003	95	347	343	78	768
Total	124	420	450	122	992
			Managing Technology Resources		
Certification Before 2003	29	23	39	134	196
Certification On or After 2003	95	96	307	269	672
Total	124	119	346	403	868
			General Technology Skills		
Certification Before 2003	29	3	38	127	168
Certification On or After 2003	95	31	119	426	576
Total	124	34	157	553	744
			Essential Conditions		
Certification Before 2003	29	15	41	112	168
Certification On or After 2003	95	72	176	328	576
Total	124	87	217	440	744

Table 14

Chi square Analysis of Survey Data for Certification 2003

$X^2 = 5.991$, $\alpha = .05$	X^2	df	p value
General Instructional Integration	1.724	2	0.422317
Teaching Students to Use Technology	19.555	2	0.000567
Managing Technology Resources	52.278	2	0
General Technology Skills	3.964	2	0.137793
Essential Conditions	5.185	2	0.748330

The mean score for participants in the teaching students to use technology category was 1.87 (n = 29) for those teachers who received their initial certification before 2003 and 1.65 (n = 95) for those that received certification in or after 2003. The mean score for participants in the managing technology resources was 2.57 (n = 29) for teachers who were certified before 2003 compared to 2.26 (n = 95) for those that received certification in or after 2003. Table 15 shows the mean scores for all categories in the initial certification grouping.

Table 15

Mean Scores of Survey Data for Initial Certification

	Certification before 2003	Certification in/after 2003
General instruction integration	2.19	2.15
Teaching students to use technology	1.87	1.65
Managing technology resources	2.57	2.26
General technology skills	2.74	2.69
Essential conditions	2.58	2.44

Certification from Southeastern University Group

Grouping three consists of those teachers who received their teacher certification from the southeastern university and those that received their teaching certificate from other universities. Table 16 displays the contingencies for certification at the southeastern university group. The chi square analysis indicates significance in the responses of participants in the general instruction integration, teaching student to use technology and essential conditions categories. This analysis shows evidence that there is a relationship between receiving initial certification at the southeastern university and the frequency of technology related activities associated with the general instruction integration, teaching students to use technology and the essential conditions categories of the survey. Table 17 shows the results of the chi square analysis for this group.

Table 16

Contingency Table of Survey Responses Grouped by Certification at University in Study

Group	n	Never	Occasionally	Routinely	Total
			General Instruction Integration		
Certification Received at University	98	162	438	380	980
Certification Not Received at University	26	82	118	60	260
Total	124	244	556	440	1420
			Teaching Students to Use Technology		
Certification Received at University	95	320	376	88	784
Certification Not Received at University	26	100	74	34	208
Total	124	420	450	122	992
			Managing Technology Resources		
Certification Received at University	98	89	282	315	686
Certification Not Received at University	26	30	64	88	182
Total	124	119	346	403	868
			General Technology Skills		
Certification Received at University	98	30	115	443	588
Certification Not Received at University	26	4	42	110	156
Total	124	34	157	553	744
			Essential Conditions		
Certification Received at University	98	55	171	362	588
Certification Not Received at University	26	32	46	78	156
Total	124	87	217	440	744

Table 17

Chi square Analysis of Survey Data for Certification at Studied University

$X^2 = 5.991$, $\alpha = .05$	X^2	df	p value
General Instructional Integration	37.814	2	0.00000001
Teaching Students to Use Technology	11.109	2	0.00387000
Managing Technology Resources	2.75	2	0.25239600
General Technology Skills	5.294	2	0.07086350
Essential Conditions	15.924	2	0.00034850

Table 18 shows the mean scores of the participants from each group in the categories listed. The mean score for teachers who received their certification from the southeastern university in the study was 2.22 (n = 98) in the general instruction integration category compared to 1.92 (n = 26) for those that received their certification from another university. The mean score for teachers who received their certification at the southeastern university in the study was 1.70 (n = 98) in the teaching students to use technology category compared to 1.68 (n = 26) for those that received their certification from another university. In the essential conditions category the mean score was 2.52 (n = 98) for those that received their certification from the southeastern university in the study compared to 2.29 (n = 26) for those that received their certification from another university.

Table 18

Mean Scores of Survey Data for Certification at Studied University

	Certified at southeastern university	Not certified at southeastern university
General Instruction Integration	2.22	1.92
Teaching Students to Use Technology	1.70	1.68
Managing Technology Resources	2.33	2.32
General Technology Skills	2.70	2.68
Essential Conditions	2.52	2.29

Advanced Certification at Southeastern University Groups

The final groups for the analysis are those teachers who received their bachelors and masters degrees from the university in the study and those that did not. Table 19 displays the contingencies for this group. The chi square analysis showed significance in the responses of participants in all but the general technology skills category. Responses in the general technology integration, teaching students to use technology and the managing of technology resources were significant with a p value = 0. This analysis indicates there is a relationship between receiving an advanced degree from the southeastern university and the frequency of technology related activities associated with all categories of the survey except in the general technology skills category. Table 20 shows the results of the chi square analysis.

Table 19

Contingency Table Survey Responses Grouped by Advanced Certification at University in Study

Group	n	Never	Occasionally	Routinely	Total
		General Instruction Integration			
Bachelor's/master's degree at University	28	23	122	135	280
Bachelor's/master's degree not at University	96	221	434	305	960
Total	124	244	556	440	1240
		Teaching Students to Use Technology			
Bachelor's/master's degree at University	28	38	152	34	224
Bachelor's/master's degree not at University	96	382	298	88	768
Total	124	420	450	122	992
		Managing Technology Resources			
Bachelor's/master's degree at University	28	10	45	141	196
Bachelor's/master's degree not at University	96	109	301	262	672
Total	124	119	346	403	868
		General Technology Skills			
Bachelor's/master's degree at University	28	5	26	137	168
Bachelor's/master's degree not at University	96	29	131	416	576
Total	124	34	157	553	744
		Essential Conditions			
Bachelor's/master's degree at University	28	9	44	113	166
Bachelor's/master's degree not at University	96	76	173	327	576
Total	124	87	217	440	744

Table 20

Chi square Analysis of Survey Data for Advanced Certification at University Studied

$X^2 = 5.991$, $\alpha = .05$	X^2	df	p value
General Instructional Integration	40.799	2	0
Teaching Students to Use Technology	78.225	2	0
Managing Technology Resources	67.312	2	0
General Technology Skills	5.983	2	0.0502121
Essential Conditions	10.12	2	0.0063456

Table 21 shows the mean scores of the participants from each group in the categories listed. For the general instruction integration category the mean score for teachers who received both bachelors and masters from the southeastern university in the study was 2.40 (n = 28) compared to 2.09 (n = 96) for those that did not receive both degrees from the southeastern university. The mean score for the teachers who received both degrees from the southeastern university in the study was 1.98 (n = 28) for the teaching students to use technology category compared to 1.62 (n = 96) for those that did not receive both degrees from the southeastern university. The mean score for the teachers who received both degrees from the southeastern university in the study was 2.67 (n = 28) for the managing technology resources category compared to 2.23 (n = 96) for those that did not receive both degrees from the southeastern university. The mean score for the teachers who received both degrees from the southeastern university in the study was 2.79 (n = 28) for the general technology resources category compared to 2.67 (n = 96) for those that did not receive both degrees from the southeastern university. The mean score for the teachers who received both degrees from the southeastern university in the

study was 2.61 (n = 28) for the essential conditions category compared to 2.44 (n = 96) for those that did not receive both degrees from the southeastern university.

Table 21

Mean Scores of Survey Data for Advanced Certification at University Studied

	Bachelors/Masters at southeastern university	No Masters at southeastern university
General instruction integration	2.40	2.09
Teaching students to use technology	1.98	1.62
Managing technology resources	2.67	2.23
General technology skills	2.79	2.67
Essential conditions	2.61	2.44

Research Question Two

What do the teachers perceive as current barriers in meeting the state technology standards and how have the teachers been able to overcome the barriers? In the first part of the survey, teachers were asked to respond to how frequently they were involved in technology based activities that were divided into the five categories of the Alabama Teacher Technology Standards. Question 38 of the survey asked participants to record what they perceived as barriers to meeting these state standards and what they had done, if anything, to overcome these barriers. Participants' comments were compiled and analyzed to find common themes among all participants. The themes were then listed according to the number of responses by participants to find the most common themes.

Teachers in this study responded that the availability of technology resources was the most common barrier to technology integration, followed by lack of technology related quality

professional development, lack of time and finally lack of or poor support of technology. A few teachers responded that they perceived no barriers to technology at their school. Table 22 summarizes the frequency of responses by the participants in this study.

Participants in this study also commented on how they overcame some of these barriers. Participants most often cited using trial and error to combat a lack of knowledge or lack of professional development concerning the technology they were using. One participant commented that she was expected to learn the new student grading program on her own time. Participants also mentioned working in groups to combat the lack of sufficient technology resources. Several participants mentioned that they only had one or two computers in their classroom and managing how all students could utilize these computers was a concern. Creating 'teachable moments' in combating the lack of time to properly integrate technology in the classroom was a common theme in dealing with this barrier. One participant stated that when students are using technology there has to be ample time to show students how to use the technology.

Table 22

Barriers to Integrating Technology in the Classroom

Barrier	n	%
Availability of Resources	36	29
Professional Development	30	24
Time	18	14
Funding	10	8
Technical Support	7	6
None	5	4

Research Question Three

What are the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards? As pre-service teachers, participants were exposed to some degree of technology integration. However, because of the pace at which technology changes and the need for teachers to be trained on specific technology resources of the school, technology related professional development is one of the key factors in determining technology use in the classroom (O'Bannon & Judge, 2005; Weinburgh, Collier & Rivera, 2003). Question 39 asked participants to make comments on how the quality of professional development concerning technology they had received from their current school system impacted their ability to integrate technology.

As shown in table 23, 58% of participants responded that the professional development in technology they had received was adequate and was of high quality. These teachers commented that their use of technology in the classroom had increased because of the professional development they had received. Many believed the professional development had given them more confidence to use the technology resources that were available in the classroom. Sixteen percent of the participants responded that they had negative experiences with professional development. Several teachers commented that they were overwhelmed with the amount of training held at one time. "Too much instruction at one time to let it sink in" was one comment by a participant. One teacher said the instruction was adequate for first time teachers but was not advanced enough for veteran teachers. A few commented that the training did not take into consideration the teachers' time constraints in the classroom. Also, even though some teachers did not have a problem with the professional development that they attended, they did feel like it was wasted time because they did not have the resources to apply their knowledge. Twenty-six

percent of respondents either did not respond or responded that they had not attended any professional development concerning technology. See Table 23 for a summary of these findings.

Table 23

Impact of Technology Related Professional Development on Integrating Technology

Impact	n	%
Positive impact	72	58
Negative impact	20	16
No impact	32	26

Summary

This chapter presents the findings of the survey administered to 124 elementary school teachers in 16 schools. The data from the survey were used to answer the three research questions of this study. Questions 1-37 were divided into five categories mirroring the categories of the Alabama Technology Standards for Teachers who were implemented in 2003. The data from these 37 questions were used to answer the first research question that dealt with the teachers' perception of their ability to meet the state technology standards for teachers during their classroom instruction.

The responses to question 38 were used to answer research question two of the study on the perceptions of teachers concerning the barriers to integrating technology in their classroom and what they have done, if anything to overcome these barriers. Responses to question 39 of the survey were used to answer research question three of the survey on the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards.

Using the demographic data from the remaining questions of the survey, participants were grouped and the data were reanalyzed to see if any variable affected the perceptions of the teachers. The variables that were analyzed included: amount of technology related professional development, initial teacher certification year, place of certification and place of advanced certification.

CHAPTER V:

FINDINGS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

This study surveyed elementary teachers in sixteen schools which were within the service area of a southeastern university's teacher education program. This university graduates a large portion of the teachers in the area under study. The request to participate in the study was sent to the 477 elementary teachers in the service area. One hundred and twenty-four teachers agreed to participate in the study, signed a consent form, and completed the online survey. The results of the survey instrument were analyzed and used to answer the three research questions of the study. This chapter discusses the findings and limitations of the study and provides recommendations for future research.

Purpose of Study

The purpose of this study was to examine how elementary teachers perceived that they met the mandated state technology standards. By using the Alabama Teacher Technology Standards as a benchmark, teachers were asked questions that gauged their perceptions of the use of technology in the classroom. The teachers were also asked to comment on perceived barriers to technology integration within the school and what measures, if any, they have taken to overcome those barriers. In addition, this study also recorded the perceptions of the effectiveness of current technology related professional development efforts by the schools.

Research Questions

This study sought to answer the following research questions:

1. What are the perceptions of elementary teachers on the meeting of the state technology standards for teachers during their classroom instruction;

2. What do the teachers perceive as current barriers within the schools studied that hamper the infusion of technology into the curriculum to meet the state technology standards and how have they been able to overcome the barriers; and

3. What are the perceptions of elementary teachers on the professional development received by the school in meeting the state technology standards?

Research Methodology

To answer the first research question participants were asked to respond to 37 questions on the survey that were divided into five categories that correspond to the major divisions of the Alabama Teacher Technology Standards. The participants were asked to respond either *never*, *occasionally*, or *routinely* to questions 1-31 and *no*, *somewhat*, or *yes* to questions 32-37. The frequency of responses was recorded and analyzed to draw conclusions on the use of technology in the classroom. Next, the responses were grouped based on variables determined by the participants' answers to several demographic questions. The responses were then reanalyzed according to the variables and a Pearson chi-square analysis was conducted to see if there was any significance in the responses among these groups.

To answer research questions two and three of the study, participants were asked two open-ended questions. The responses to these questions were analyzed to find common themes among the participants. The frequencies of these themes were recorded to gauge the perceptions

of the teachers regarding barriers to technology integration and quality of professional development concerning technology they have received.

Research Question One

Research question one dealt with the perceptions of teachers in their meeting of the State Teacher Technology Standards. The state technology standards are divided into five categories. This study analyzed participants' responses to questions in each category to see if they perceived themselves meeting the standards in that category.

Category One: General Instruction Integration

For category one, *general instruction integration*, participants responded that they are planning, designing, and implementing lessons that include technology. Responses from the question set revealed that teachers seem to be doing an adequate job of locating technology based resources and incorporating those resources into their lessons. Participants indicated they are *routinely* providing students with technology resources that allow students to engage in higher level thinking skills and creating student-centered lessons. Providing learner-centered lessons was an essential condition of providing an environment that promotes the use of technology as stated by ISTE (O'Bannon & Judge, 2005; Weinburgh, Collier, & Rivera, 2003).

Most teachers reported that they do not *routinely* assess student technology proficiency, evaluate technology based student products, or allow students to share technology expertise with their teachers or peers. However, many participants reported that they are *occasionally* involved in these activities. Research has found that in order to successfully integrate technology teachers must move toward a more student-centered approach to teaching (Barron, Kemker, Harmes, & Kalaydjian, 2003; Middleton & Murray, 1999; Rakes, Fields, & Cox, 2006; Shuldman, 2004).

The data analyzed in this part of the survey show evidence that teachers are adhering to the technology standards associated with the general technology integration. However, evidence also supports that many teachers have not completely fostered an environment that promotes student-centered learning. Using the five stages of technology integration that were developed during the ACOT study that began in 1985, most participants would be considered between levels two and three. Level two, *adaptation*, is when teachers integrate new technology into traditional classroom practices and level three, *appropriation*, is when learning is focused on cooperative, project based work and interdisciplinary work that integrates technology as needed along with many other tools (Barron, Kemker, Harmes, & Kalaydjian, 2003; Shuldman, 2004).

Category Two: Teaching Students to Use Technology

For questions in the *teaching students to use technology* category, participants overwhelmingly responded *occasionally* or *never* when asked about being involved in teaching students to use or apply suitable technology products for learning. The highest percentage of responses of *routinely* was for questions that dealt with teaching students how to collaborate and how to use computers and printers. According to Rakes, Fields, and Cox (2006), evidence of these activities not being performed routinely in the classroom points to the lack of student-centered learning opportunities.

Participants in the study who responded that they had received technology professional development actually responded more frequently that they were teaching students how to apply and use technology products. Professional development was found to be one of the ten essential conditions to promote the use of technology in the classroom according to ISTE (O'Bannon & Judge, 2005; Weinburgh, Collier, & Rivera, 2003).

The data demonstrates that teachers in this study are not meeting the state technology standards in the teaching students to use technology category. Classifying teachers in this study as adapters, according to the five levels of technology integration would support this analysis. Teachers who are routinely involved in activities in the teaching students to use technology category would more likely be classified at the levels of appropriation or invention (Barron, Kemker, Harmes, & Kalaydjian, 2003; Shuldman, 2004).

Category Three: Managing Technology Resources

In category three, *managing technology resources*, participants responded that they do an adequate job of managing the resources that are provided by the school system. While the numbers of responses of *routinely* were high the most notable element of these responses was the low percentage of *never* responses. Since the beginning of the e-rate program in the late 1990's, teachers are being exposed to more technology (Peterman, 2003; U.S. Department of Education, 2000). In 2007, the computer to student ratio was 1:3.8 nationally (NCLB, 2007). In 2005 the Alabama education system student to computer ratio was 1:4.3 for Internet connected computers and 93% of all classrooms had at least one computer in the classroom with Internet access (Alabama State Department of Education, 2006). However, research has shown that exposure to technology alone will not ensure correct use of technology or that technology use will increase student achievement (Goolsbee & Guryan, 2006; Hernandez-Ramos, 2005; Trotter, 2007). Many times the technology is not being used for instructional purposes (Bernauer, 1996; Franklin, 2008; Shuldman, 2004).

The data presented for the *managing technology resource* category shows evidence that participants are meeting the state technology standards in this category. Applying the five levels of technology integration, participants would most likely fall between the appropriation and

invention stages. In the invention stage, teachers discover new uses of technology tools (Barron, Kemker, Harmes, & Kalaydjian, 2003; Shuldman, 2004). There is evidence in this study that participants would not be categorized at the invention level by the responses to question 24 of the survey. In this question participants were asked to respond to their frequency of assessing current and emerging technologies with the potential for facilitating teaching and student learning. Only 18% of participants in the study responded that they *routinely* were involved in this activity. Teachers in the invention stage would be more likely to be involved in this activity.

Category Four: General Technology Skills

In category four, *general technology skills*, participants reported overwhelmingly that they *routinely* use technology tools for administrative tasks. There were no participants in the study who indicated that they did not use computer, printers and other technical devices. The data also indicates that all teachers in the study are using technology productivity tools such as word processors, spreadsheets and databases. The data, for this category, indicates that participants in this study are meeting the state technology standards in this category.

Category Five: Essential Conditions

The data from category five, *essential conditions* reveals that most teachers believe they have adequate resources and support from their school systems to integrate technology. Teachers were asked if they thought their principal supported the use of technology in the classroom and the teachers responded that they thought principals did support the use of technology. Although all questions received a majority of favorable responses, the question regarding their perception of the adequacy of the technology support received the lowest marks compared to the other questions. This would seem to indicate that although teachers have technology resources

available, there is a lack of support to keep the technology resources updated and in working condition.

In 2005, 42% of all computers in Alabama classrooms were at least 36 months old (Alabama State Department of Education, 2006). The total cost of ownership for technology has been a problem for school districts through the years. School districts fail to provide funds for technology upgrades on a yearly basis (Staples, Pugach & Himes, 2005). This creates a situation where classrooms are equipped with low-end computers that do not support the needed software (Levin & Wadmany, 2008; Vannatta, 2000). It has been suggested that school districts build into their budgets the total cost of ownership for the technology and upgrade their technology yearly as technology continues to be more innovative and interactive (Fitzgerald, 2001; Mehlinger, 1996). The problem of outdated, broken computers and lack of technical support for these computers was also validated by comments by participants in the qualitative part of this study.

Participants in this study responded favorably to all questions in the *essential conditions* category. These questions do not directly access how teachers in the study are meeting the state technology standards but show the environment in which teachers attempt to integrate technology. The responses to questions in this category would indicate that conditions are favorable for teachers to meet the state technology standards.

Grouped Data

The following groups showed significance in the responses for the questions in the *general instruction integration* category: *participating in professional development, receiving initial certification from the southeastern university in the study, and receiving advanced certification from the southeastern university in the study*. Participants in these groups more frequently answered *routinely* to questions in the *general instruction integration* category.

Previous studies have concluded that teachers with more technology related professional development tend to integrate technology in the classroom more frequently than those with little or no technology related professional development (Franklin, 2008; Shuldman, 2004; U.S. Department of Education, 2000).

The significance in the groups that received their initial certification and advanced certification from the southeastern university in the study would also support earlier studies that suggest that exposure to quality teaching methods in teacher preparation programs will foster more technology integration within the classroom (Chiero, Sherry, Bohlin & Harris, 2003; Park & Ertmer, 2007; Wright & Wilson, 2007). The southeastern university in the study was part of the ALAPT3 initiative that emphasized more exposure to technology integration in the teacher preparation program. By providing the three components of content knowledge, pedagogy and technology integration in the teacher preparation program, Participants who graduated from the southeastern university in the study may have obtained what Mishra and Koehler (2006) described as Technological Pedagogical Content Knowledge.

The following groups showed significance for the category of *teaching students to use technology*: participating in technology related professional development, receiving initial certification before 2003, receiving certification from the southeastern university in the study, and receiving an advanced degree from the southeastern university in the study. Participants in these groups tended to respond more frequently that they were involved in teaching students to use technology.

Quality professional development has been established as a key factor in integrating technology and fostering an environment that promotes technology use by the student (Lawless & Pellegrino, 2007; Wright & Wilson, 2007). Evidence was found that those teachers who

participated in technology related professional development responded more frequently to *routinely* being involved in the activities associated with questions in the teaching students to use technology category. Participants in the study commented that the technology related professional development had given them the confidence to increase their technology use in the classroom and be able to guide their students to use technology.

Participants who received their initial certification before 2003 also responded to *routinely* being involved in the activities associated with questions in the *teaching students to use technology* category. The year 2003 was chosen for this grouping because 2003 was the year that the Alabama Teacher Technology standards were implemented. However, the significance found in the study with this grouping does not seem to be associated with the timeliness of the implementation of the standards but more with the length of service of the participant. Teachers with more years of service could have participated in more technology related professional development and could be more confident in teaching students to use technology. This would somewhat contrast a study conducted in 1999 that concluded that newer teachers and teachers with more professional development are more likely to integrate technology in the classroom (Franklin, 2008). The data in this study would suggest that the ongoing emphasis on technology integration in the teacher preparation program and in the schools with technology related professional development has leveled the playing field among all teachers.

For the *managing technical resources category*, the analysis of the groupings found significance in all groups except for the *receiving initial certification at the southeastern university in the study*. The highest significance was found in the *initial certification before 2003* group. As stated in an earlier discussion, it is believed that the significance has more to do with the level of experience of the participants in this group than actually receiving certification

before 2003. Participants who received their initial certification before 2003 answered more frequently that they were *routinely* involved in the activities surrounding this category. The data from these findings would conclude that teachers not only need professional development to sufficiently manage technology resources but also need time to learn what methods of utilizing technology resources works best for their classroom situation. Earlier studies concluded that teachers were not at a point in their skill level to know what technology is best for a certain subject and how to sustain technology use throughout the school year (Cohen, Pelligrino, Schmidt, & Schultz., 2007; Shuldman, 2004; Williams & Kingham, 2003). Teachers who received their bachelors and masters from the southeastern university would have more experience in dealing with technology resources because of their time within the teacher education program and the possibility of more exposure to technology resources within their schools.

For the *general technology skills* category, the only grouping that was significant was the *technology related professional development* group. This finding would support that teachers will only be comfortable with increasing their use of technology for personal productivity when quality professional development is provided. Teachers would be able to master their technology skills in using productivity software by attending quality technology related professional development. Quality professional development has been characterized as one that is longer in duration, provides access to new technologies for teaching and learning, engages teachers in meaningful and relevant activities in context, and promotes peer collaboration and team building (Lawless & Pellegrino, 2007)

In the *essential conditions* category, all groups showed significance except for the *certification before 2003* group. Since this category takes a snapshot of how well the school is

supporting the teacher in the use of technology, the findings in the groupings would suggest that teachers who participate in quality professional development would be able to understand how the technology that is available in the schools can be utilized to provide student-centered lessons that are rich in technology. The increase in knowledge, of correct approaches to technology integration, would also allow teachers to more easily overcome barriers that exist in the school. Participants who graduated from the southeastern university would have been exposed to technology integration throughout their program. This could have fostered a positive attitude toward the use of technology in the classroom and the support that is needed within the school.

Research Question Two

Research question two dealt with the participants perceived barriers to technology integration and the meeting of the state technology standards. The barrier that was most frequently mentioned by participants in the study was that of availability of resources. This seems to contradict the finding in the *essential conditions* category, where teachers responded that they have sufficient hardware and software to successfully integrate technology. However, the comments seem to reveal that although teachers have some technology resources available that there are problems with the number, age, and reliability of the technology. This is validated in the participants' responses to the question of sufficient technology support earlier in the survey. This question received the least amount of responses of having sufficient technology support. Several teachers stated that they only had one or two computers in the classroom. The teachers have allowed the students to work in groups but realize that there is not enough time for all students to complete their work. One teacher stated that there were plenty of technology integration opportunities in the reading curriculum but they lacked sufficient amounts of

technology to use in the classroom. Others commented that when technology did not work that it took too long for support staff to fix the technology.

Another barrier that was mentioned quite frequently was that of professional development. Participants' responses to questions in the essential conditions section of the survey revealed that most teachers believed they had sufficient technology related professional development. However, several comments by teachers seem to reveal that a portion of the teachers in the area are not getting sufficient, if any, technology related professional development to integrate technology. One teacher commented that they had been asked to learn the new student administration software on their own time. Other teachers responded that they had no professional development opportunities this year. The survey revealed that 26% of the teachers did not participate in professional development concerning technology during the previous school year. Some that had received professional development commented there was not sufficient time to cover the topic adequately. These comments seem to back up the research that quality professional development is one that is longer in duration and is related to the actual content being taught and will impact student outcomes (Lawless & Pellegrino, 2007; Shuldman, 2004; Vannatta, 2000;Wright & Wilson, 2007). The data in this section shows evidence that some schools may not be considering the total cost of ownership of the technology this is provided in the classroom. It has been suggested that school districts should upgrade their technology yearly and devote 30% of the technology budget to providing technology related staff development (Fitzgerald, 2001; Mehlinger, 1996). An earlier study found that school districts only spent between 3% and 15% of their technology budget on professional development (Staples, Pugach & Himes, 2005).

Research Question Three

Research question three asked how elementary teachers perceived the technology related professional development received by the school in meeting the state technology standards. Fifty-eight percent of participants responded that the professional development they received was of high quality and was beneficial to increasing their use of technology in the classroom. However, 16% of participants commented that they received poor quality professional development and another 26% reported that they did not participate in any technology related professional development.

Providing quality professional development seems to be the key to providing an environment that promotes technology integration. In fact, ISTE listed it as one of its ten essential conditions in order to foster technology use in the classroom (O'Bannon & Judge, 2005; Weinburgh, Collier, & Rivera, 2003). Quality professional development was defined in Lawless and Pellegrino (2007) as one that is longer in duration, provides access to new technologies for teaching and learning, engages teachers in meaningful and relevant activities in context, promotes peer collaboration and community building, and provides a clear vision for student achievement. Professional development has not always contained these elements. An emphasis was placed on providing quality professional development during the PT3 initiatives. During this time technology related professional development was structured as ongoing training instead of one time sessions and focused on student outcomes and not solely on the technology (Chiero, Sherry, Bohlin & Harris, 2003; Eib & Cox, 2003).

Previous Study

In 2006, the Alabama State Department of Education conducted a study to gauge the extent of technology integration within its schools. The study included responses from 43,140

teachers across the state. The state reported that teachers perceived themselves as strong in using technology for administrative or personal productivity purposes. Teachers also reported that they perceived that they had adequate technology resources and support and the leadership supported the use of technology in the classroom. Weaknesses were found in developing and using criteria for evaluating technology based student products and formally assess students' technology proficiency, or students' use of technology to learn and communicate information. The weaknesses were attributed to professional development that did not focus on the students' use of technology that promoted student achievement (Alabama State Department of Education, 2006).

Although the sample size of the current study is much smaller than the state study completed in 2006, similarities exist with the findings of both studies. The findings of the current study imply that weaknesses may still exist in the quality or focus of technology related professional development that is being offered to teachers.

Limitations

The survey instrument used in the study can only look at the perceptions of the participants in meeting the state teacher technology standards. A complete understanding of how each participant integrates technology can only be achieved by observing the participant in the classroom. The study also relied on the participants understanding the activities associated with each survey question. The study also relied on the participants making comments on the two open-ended questions that correctly reflected their attitudes toward the barriers to technology integration and the quality of professional development.

Implications

The state teacher technology standards mandate that teachers utilize technology in the classroom to enhance learning. This study shows evidence that teachers are using technology in

the classroom. Many years of federal programs, which have provided funding for technology resources and technology related professional development, seems to have paid off. However, this study has provided evidence that barriers to technology integration still exist. Some schools do not provide adequate technology to allow teachers to provide student-centered lessons. Teachers, in these schools, will not be able to meet the technology standards that deal with these activities. This study showed evidence that teachers do not feel they are adequately meeting these standards. School districts can provide an atmosphere that promotes technology integration by providing updated technical resources to the teachers.

Ongoing technology related professional development has been a key to successful technology integration in the classroom. This study shows evidence that teachers may not be receiving the type of professional development needed to be able to teach students to use technology to the point of allowing them to complete lessons that require high level thinking skills. Teachers will begin to revert back to traditional teaching methods if proper professional development is not maintained. School districts can work with technology consultants to provide proper training for their teachers.

Teacher education programs have a responsibility to give pre-service teachers a good foundation in technology integration by demonstrating correct teaching methods utilizing technology. However, these skills have to be put into practice in the early stages of a teacher's career or the skills will be wasted. Collaborative efforts between the schools and the teacher education program could provide the incoming teachers with additional support. Personnel, within the teacher education program, could assist the incoming teacher by continuing to provide guidance in implementing technology integration in the classroom.

Recommendations

More research is needed to find out how technology integration affects student outcomes. When technology was first introduced into the classroom, studies indicated that there was no impact on student achievement (Barron, Kemker, Harmes, & Kalaydjian, 2003; Bernauer, 1996; Goolsbee & Guryan, 2006). However, investments have been made over many years to increase the quantity and quality of technology resources in the classroom (Hernandez-Ramos, 2005; Trotter, 2007). Several federal initiatives such as the ACOT study, The Technology Innovation Challenge Grant and PT3 grants sought to equip teachers with the knowledge and understanding of how to successfully integrate technology (Barron, Kemker, Harmes, & Kalaydjian, 2003; Basham, Palla, & Pianfetti, 2005; Honowar, 2008; Shuldman, 2006). In order to gauge the effect technology has played on student outcomes, more data needs to be collected and interviews conducted with students to see if there is a gain in student achievement.

Research needs to be conducted on the new revised state technology standards for teachers. In 2008, the State Board of Education adopted a new set of technology standards for teachers. Full implementation of these standards is scheduled for the 2009-2010 school year. As these standards are put into place and technology related professional development begins to reflect these standards, research will be needed to see if increases in technology integration occur.

Summary

This study attempted to answer three research questions by surveying elementary teachers at 16 schools included in the service area of one southeastern university. This southeastern university was a participant in the ALAPT3 initiative conducted by the state in the years from 1999 to 2003. Among the goals of the PT3 initiatives was to expose pre-service

teachers to more technology integration within their methods classes and to give them field experiences rich in technology integration. As a result of the information gathered during the ALAPT3 initiative the state implemented the Alabama Teacher Technology Standards in 2003.

The first research question attempted to find out the perceptions of elementary teachers on their meeting of the state technology standards within their classroom instruction. The results of the survey showed evidence that the participants perceived they were meeting the state technology standards in all but one category. Participants perceived themselves to be very weak in the category of teaching students to use technology.

Results of the survey were grouped to determine if there was any significant relationship between the participants' responses and the groups. Participants were grouped either as having professional development or not having professional development, obtaining initial certification before 2003 or in or after 2003, obtaining initial certification at the southeastern university in the study or obtaining certification at any other university, and obtaining an advanced degree from the southeastern university in the study or obtaining advanced degree at any other university. Professional development was found to be significant across all categories of the state technology standards. Those teachers who reported having participated in technology related professional development responded more frequently to *routinely* being involved in the activities mentioned in the survey than those that did not participate in technology related professional development. The importance of quality professional development has been identified in previous studies as being essential in increasing technology integration in the classroom (Franklin, 2008; O'Bannon & Judge, 2005; Shuldman, 2004; Weinburgh, Collier & Rivera, 2003).

The results of the analysis of the initial *certification before 2003* group showed significance in the answers to questions in the *general instruction integration, teaching students to use technology, and managing technology resources* category. As discussed in this chapter, the significance is believed to be attributed more with the years of experience of the participant and not that they received their initial certification before or after 2003. Teachers in the study who had more experience by reporting that they received their initial certification before 2003 reported more frequently that they were *routinely* involved in the activities of these categories.

The results of the analysis of the *received their initial certification at the southeastern university used in the study* group showed significance in the answers to questions in the *general instruction integration, teaching students to use technology* and the *essential conditions* categories. Participants in this group answered more frequently that they were *routinely* involved in the activities associated with these categories. Teachers who received their initial certification at the southeastern university used in the study would have been exposed to teaching methods that included a demonstration of technology integration. When faculty demonstrate the correct use of technology integration within the courses of the teacher education program, pre-service teachers are more likely to use technology in their own classrooms (Basham, Palla, & Pianfetti, 2005; Rowley, Dysard, & Arnold, 2005).

Participants in the group that received both initial certification and advanced certification at the southeastern university used in the study answered *routinely* to questions in all categories except the *general technology skills*. Teachers in this group would have been exposed to the same demonstration of technology integration as those in the previous group. The addition of significance in the *managing technology resources* category demonstrates that teachers in this group may also have been familiar with the technology resources of the schools by being

exposed to field experiences that included technology integration during their initial certification and also during their advanced certification. Providing field experiences that were rich in technology integration was found to be a key factor in providing a quality teacher education program (Chiero, Sherry, Bohlin, & Harris, 2003; Honowar, 2008).

The second research question attempted to identify the perceived barriers to technology integration of participants in the study and what they had done, if anything, to combat these barriers. The two main barriers that were mentioned were lack of technology resources and lack of professional development. Comments made by the participants suggested that the technology resources that are available are not sufficient either in number or quality to provide the needed technology to the students. The lack of professional development indicates that some schools are not providing their teachers the proper training to successful integrate technology in the classroom. This can be further substantiated by the information gathered to answer research question three.

The third research question attempted to indentify how elementary teachers perceived the technology related professional development received by the school in meeting the state technology standards. Many of the participants commented that they had received quality technology related professional development that had given them the confidence to integrate technology in their own classroom. However, a large number of participants indicated that they had received either poor quality or no technology related professional development. Research has found that quality technology related professional development is key to increasing technology integration in the classroom (Franklin, 2008; O'Bannon & Judge, 2005; Shuldman, 2004; Weinburgh, Collier, & Rivera, 2003).

This study has reported evidence that teachers who participated in the survey perceived that they were doing an adequate job of integrating technology in the classroom and are meeting most of the Alabama Teacher Technology Standards. Weaknesses were found in activities associated with teaching students to use the technology available. Teachers also reported that the availability of technology resources in the classroom and the lack of quality technology related professional development were barriers to integrating technology. Many teachers reported that they either had not participated in or received poor quality technology related professional development.

This study indicates that more technology related professional development is needed to increase the confidence of the teachers and allow them to increase the amount of student-centered lessons. Now that the state has implemented a new set of teacher technology standards, the schools in the study may need to change the way they offer technology related professional development, so that the teachers are receiving the training they need. The schools may also need to look at the amount of technology available in the schools as well as the condition of the current technology. Providing teachers with sufficient amounts of technology and making sure the technology is working can be important factors in the integration of technology in the classroom.

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APPENDIX A

COLLEGE OF EDUCATION

TECHNOLOGY PROFICIENCY MATRIX

COLLEGE OF EDUCATION

Technology Proficiency Matrix

Intern _____ Date _____

Technology Standard Date Completed _____ Teacher's Signature _____

Technology Standard	**Date Completed**	**Teacher's Signature**
(i) l. Identify technology resources and technical assistance available both on-line and on-site within a school and district setting.		
(i) 2. Evaluate technology resources and technical assistance available both on-line and on-site within a school and district setting.		
(iii) 1. Develop a classroom management plan to ensure equitable and effective student access to available technology resources.		
(iii) 2. Implement a classroom management plan to ensure equitable and effective student access to available technology resources.		
(iv) 1.Model safe, responsible, legal and ethical use of technology.		
(iv) 2. Implement school and district acceptable use policies including fair-use and copyright guidelines and Internet user protection policies.		
(v) 1. Design learner-centered lessons and units that use appropriate and effective practices in teaching and learning with technology.		
(v) 2. Implement learner-centered lessons and units that use appropriate and effective practices in teaching and learning with technology.		
(v) 3. Assess learner-centered lessons and units that use appropriate and effective practices in teaching and learning with technology.		
(vi) 1. Use technology tools for instruction		
(vi) 2. Use technology tools for student assessment.		
(vi) 3. Use technology tools for management.		
(vi) 4. Use technology tools for reporting purposes.		
(vi) 5. Use technology tools for communication with parents/guardians of students.		
(vi) 6. Evidence of all listed tools including but not limited to spreadsheets, web page development, digital video, the Internet, and email.		

(vii) 1. Facilitate students' use of technologies to locate, collect, create, produce, communicate, and present information.		
(vii) 2. Facilitate students' individual and collaborative use of technologies		
(vii) 3. Evidence of all listed tools including but not limited to spreadsheets, web page development, digital video, the Internet and email.		
(viii) 1. Design learning experiences incorporating technologies that were responsive to diversity of learners including, but not limited to special education, ESL, learning style, and levels of ability.		
(viii) 2. Manage and facilitate learning experiences incorporating technologies that were responsive to diversity of learners.		
(ix) 1. Evaluate students' technology use within curricular areas.		
(x) 1. Use technology to enhance		

APPENDIX B

IRB APPROVAL

Office for Research

Office of the Chair,
Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
RESEARCH

January 21, 2009

Brian Endfinger
Educational Leadership, Policy & Technology Studies
College of Education

Re: IRB # 07-OR-217-R2 "Life after PT#: Preparing Tomorrow's Teachers in Technology at Troy University"

Dear Mr. Endfinger:

The University of Alabama Institutional Review Board has granted your renewal application approval.

Your renewal application has been given expedited approval according to 45 CFR part 46. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Please use reproductions of the IRB approved informed consent form to obtain consent from your participants.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office for Research Compliance
The University of Alabama

152 Rose Administration Building
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Tuscaloosa, Alabama 35487-0104
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APPENDIX C

TEACHER SURVEY

Teacher's Technology Integration Evaluation

Answer the following questions based on the scale below.

A. Never B. Occasionally C. Routinely

Category 1: General Instructional Integration

1. I develop and use criteria for evaluation of technology-based student products and the processes used to create those products.

2. I use various strategies to determine students' technology proficiency in content area learning.

3. I design and implement learning experiences that use assistive technologies to meet the special physical needs of students.

4. I design, implement, and assess learner-centered lessons that are based on effective practices in teaching and learning with technology.

5. I plan and implement technology-based learning activities that promote student engagement in higher-level thinking and creation of original products.

6. I design, manage, and facilitate learning experiences using technology that is sensitive to the diversity of learners.

7. I identify, evaluate, and select specific technology resources to support a coherent lesson sequence.

8. I organize learning activities so that students work together using the tools of technology.

9. I recognize students' talents in the use of technology and provide them with opportunities to share their expertise with their teachers, peers, and others.

10. I apply technology productivity tools for student assessment and reporting purposes.

Category 2: Teaching Students to Use Technology

11. I teach students to use technology resources in collaborative ways to solve authentic problems in the subject areas(s).

12. I teach students to troubleshoot routine hardware and software problems.

13. I teach students to select and apply suitable productivity tools (e.g., word processing, databases, spreadsheets, communication tools, graphics programs) to complete personal and educational tasks.

14. I teach students to use technology tools and resources for preparing publications and presentations, managing information, and interacting with various audiences.

15. I teach students to participate in online collaboration or discussion as part of learning experiences.

16. I teach students to use computers, printers, and other peripheral devices (e.g., scanners, digital cameras).

17. I teach students to use technology tools to process data and report results.

18. I teach students to use technology to locate, evaluate, and collect information from a variety of sources.

Category 3: Managing Technology Resources

19. I identify technology resources and technical assistance available within the school and district.

20. I model safe and responsible use of technology and implement school and district technology acceptable use policies and data security plans.

21. I manage available technology resources to provide equitable access for all students.

22. I plan and implement learning activities that use technology to enhance student academic achievement and technology proficiency.

23. I evaluate and improve instructional technology practices in the classroom using information from student feedback, observations, student assessment data, etc.

24. I assess current and emerging technologies with the potential for facilitating teaching and student learning.

25. I participate in online professional collaboration (email, listserv, chat rooms) with peers and experts to enhance technology expertise.

Category 4: General Technology Skills

26. I use computers, printers and other peripheral devices (e.g., scanners, digital cameras).

27. I use technology to locate, evaluate and collect information from a variety of sources.

28. I use suitable productivity tools (e.g., word processing, databases, spreadsheets, communication tools, graphics programs) to complete personal, educational, and professional tasks.

29. I use technology tools and resources for preparing publications and presentations, managing information, and interacting with various audiences.

30. I troubleshoot routine hardware and software problems that occur in the classroom.

31. I use technology to facilitate communication with parents/guardians of students.

Answer the following questions based on the scale below.
A. No B. Somewhat C. Yes

Category 5: Essential Conditions

32. I have sufficient hardware to successfully integrate technology in my teaching.

33. I have sufficient software to successfully integrate technology in my teaching.

34. I have sufficient technology support to successfully integrate technology in my teaching.

35. I have sufficient instructional support to successfully integrate technology in my teaching.

36. My principal supports the integration of technology in teaching and learning.

37. I have sufficient professional development to allow me to successfully integrate technology in the classroom.

Please make comments on the following questions:

38. What do you consider to be the barriers to integrating technology in your classroom and what have you done to overcome those barriers?

39. How has the quality of professional development concerning technology you have received from your current school system impacted your ability to integrate technology?

Please indicate the following information:

40. Number of Professional Development hours concerning technology during this school year:

A. 0 B. 1-5 C. 6-10 D. 11-15 E. 16-20 F. 21 or more

41. Where did you receive your initial teacher certification?

A. Researched University B. Other university or college

42. Was your initial certification prior to 2003? A. Yes B. No

43. Did you receive a master's degree in elementary education?

A. Yes, received from Researched University B. Yes, received from another university or college C. No, I do not hold a masters degree

44. Was the master's degree received prior to 2003? A. Yes B. No C. NA

45. Do you receive a specialist degree in elementary education?

A. Yes, received from Researched University B. Yes, received from another university or college C. No, I do not hold a specialist degree

46. Was the specialist degree received prior to 2003? A. Yes B. No C. NA

47. First year of teaching: A. 2008 B. 2007 C. 2006 D. 2005 E. 2004 F. 2003 G. 2002 or earlier

48. Grade Level taught: A. K B. 1st C. 2nd D. 3rd E. 4th F. 5th G. 6th