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Factors Influencing Teachers' Technology Self-Efficacy

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Abstract

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This mixed-method research study was designed to expand the knowledge of teachers' technology self-efficacy as it relates to integrating technology in the classroom. This study examined teachers' levels of technology self-efficacy, identified specific factors affecting their current level, and examined the role and impact professional learning opportunities have on levels of technology self-efficacy.

The researcher utilized the Computer Technology Integration Survey to identify technology self-efficacy levels of teachers at two middle schools and one high school. Participants were then selected to participate in personal interviews and/or focus groups. Interviews and focus groups were coded using open coding. Results were triangulated with a document analysis.

The common themes that emerged from this study were based on 21 interviews and three focus groups. Research revealed that identified factors could be categorized into two major groups, internal work-related factors and external personal factors. Internal work-related factors that support the teachers' integration of technology included school and district staff and school culture. Peer teachers emerged as a support and barrier. Connectivity and technical glitches were identified as barriers. External personal factors included people, social media, smartphones, and reading. All were identified as supports. The themes that emerged can be impacted by professional learning opportunities which may lead to enhanced student outcomes.

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Chapter 1: Introduction

Introduction and Nature of the Problem

In 1996, President Bill Clinton announced the Technology Literacy Challenge. His challenge outlined four goals to transform education. First, all teachers would receive modern computers, and computers would be available to all teachers and students. Second, all teachers would be provided the training and support needed to help students learn. Third, all classrooms would be connected to the internet. Fourth, high-quality and engaging software and online learning resources that are directly related to the school's curriculum would be an integral part of school (U.S. Department of Education, 1996). However, the issue of high-quality technology integration is something schools have struggled with since the first students died of dysentery in the 1985 game Oregon Trail (Moeller & Reitzes, 2011). This struggle continues today even as students are often issued their own laptops and are often never without a smart phone.

The Office of the President continued to push for computers to improve academic achievement with the introduction of Enhancing Education Through Technology (EETT) as a part of the No Child Left Behind Act (NCLB). George W. Bush signed the act into law on January 8, 2002. The primary goal of EETT was to improve student academic achievement through the use of technology in elementary and secondary schools. Additional goals included ensuring all students were technologically literate upon completing the eighth grade regardless of background or socioeconomic status and to encourage effective technology integration through training and curriculum development (NCLB, 2001). North Carolina was awarded a substantial amount of money as part of the EETT grant process. As a result, the North Carolina State Board of Education released IMPACT Guidelines for North Carolina Media and Technology Programs in

2000. The goal was to have an impact, specifically to impact teaching, learning, motivation, and student achievement.

The vision of IMPACT was to provide schools with step-by-step directions for school library media and technology programs to meet the new challenges facing North Carolina Schools. As a result of following the guidelines, a school's library media and technology program would focus on student achievement, involve the entire staff in collaborative planning of authentic and engaging instructional programs, be enriched with high-quality resources, and utilize current technology and effective models of integration (North Carolina Department of Public Instruction [NCDPI], 2006).

Despite the increased availability of computers in schools, few teachers have changed the way they teach and fully integrate computers into their classroom (Becker, 2000; Edutopia, 2008; Marcinkiewicz, 1996). The National Center for Educational Statistics (NCES, 1999) conducted a survey of schools and reported that fewer than 20% of teachers felt they were prepared to integrate computer technology into classroom instruction. Schools have invested large amounts of time and capital to put the computer hardware and software into place; but Becker (1998) suggested, "students still spend most of their school day as if these tools and information resources had never been invented" (p. 24). Furthermore, "the mere existence of these technological resources does not assure that teachers can or will adapt their practices to make use of them" (p. 24). A 2011 survey found that despite the increase in technology available in schools, only 8% of teachers fully integrate technology into the classroom (Moeller & Reitzes, 2011). A Pew Research Center (2010) survey found 86% of teenagers were banned from bringing a cellphone to school or banned from using a cellphone in class (Lenhart, Ling, Campbell, & Purcell, 2010).

The first step in the IMPACT model was to create school-level building support. This involved forming a media and technology advisory committee and the hiring of an instructional technology facilitator (NCDPI, 2006). IMPACT defined the role of an instructional technology facilitator "as a specialist for the selection of online and other technology resources" (NCDPI, 2006, p. 130). This role was previously carried out by innovative, tech-savvy teachers; but with the increase of technology and other responsibilities, teachers had difficulty meeting their own teaching obligations to support an entire building (Hofner, Chamberlin, & Scot, 2004). Researchers and educators have shown that planning for technology integration is difficult for teachers (Mishra & Koehler, 2006; Pierson, 2001). The goal of the instructional technology facilitator is to develop new forms of instruction via technology (Means, 2001), motivate students by creating an environment that involves students more directly than traditional teaching methods (Schacter, 1999), and utilize technology to individualize instruction for students (Lou & MacGregor, 2001). The instructional technology facilitators "are a somewhat disruptive force in the normal way of teaching in the school: they are change agents" (Hofner et al., 2004, p. 34). In the end, the instructional technology facilitators can be seen much like a coach. "Coaching becomes a more effective model for today's educator because it builds a distinct level of mutual respect and trust with the individual being coached, translating into a more effective learning environment" (Beglau et al., 2011, p. 6).

Adding computers to the classroom in order to create digital learning environments continues to be a driving force in transforming education (Scherer & Cator, 2011). The ratio of students to computers has grown steadily closer to one computer to one student over the past 30 years. In 1981, there was one computer for every 125 students. That ratio was trimmed to one computer for every 18 students in 1991 and one computer for every five students in 2000 (Christensen, Horn, & Johnson, 2008). Schools have now been pushed to provide ubiquitous, or one-to-one (1:1), computing for all students. The expected outcomes for 1:1 are high reaching. These outcomes include improving the in-class educational experience, providing universal internet access, and building stronger connections between teachers and parents, as well as between school and community (Mitchell Institute, 2004). America's Digital Schools 2006: A Five Year Forecast examined preliminary studies of large-scale 1:1 computer environments and reported improvements in student attendance, reduced student attrition, increased teacher enthusiasm, increased teacher retention, and positive changes in the teaching and learning environment (Greaves & Hayes, 2006).

As a result of the increased computer and technology initiatives in schools, the International Society for Technology in Education (ISTE, 2009) developed ISTE's Essential Conditions. These 14 conditions are necessary elements for teachers and school administrators to meet to effectively leverage technology for learning. The Essential Conditions include a shared vision, empowered leaders, implementation planning, consistent and adequate funding, equitable access, skilled personnel, ongoing professional learning, technical support, curriculum framework, student-centered learning, assessment and evaluation, engaged communities, support policies, and a supportive external context (ISTE, 2009; McLeod & Richardson, 2013). ISTE also released the 2014 Essential Conditions Inventory. The inventory consists of 144 Likert-type questions that assess the degree to which respondents meet expectations in the Essential Conditions. The inventory has been found valid and reliable (Kennedy, 2014).

One must examine why 21st century teachers still use roughly the same tools as the previous generation of teachers (Cuban, 2003). In February 2012, the Bill and Melinda Gates Foundation published a report titled Innovation in Education: Technology & Effective Teaching in the U.S. More than 400 teachers in Grades 6-12 were surveyed. The key findings included eight barriers to technology use in the classroom. Teachers expressed access to computers, personal comfort level, time for planning, student access at home, lack of training, knowledge of effective software programs, student abilities, and union/school rules as the biggest barriers to incorporating technology into their teaching. The survey also found that teachers aged 45 and older are slightly less likely to use technology on a regular basis (Bill & Melinda Gates Foundation., 2012).

Table 1

Biggest Barriers to Incorporating Technology in the Classroom According to Teachers

Barrier	%
Access to computers	69
Personal comfort level	62
Time for planning	52
Students' access at home	49
Lack of Training	48
Knowledge of effective software programs	48
Student's abilities	35
Union and school rules	27

The barriers that prevent technology integration can be separated into extrinsic barriers and intrinsic barriers. Extrinsic barriers are outside the teacher's control and may include lack of technology and lack of time (Means & Olsen, 1997). It was once assumed that once adequate technology was purchased, technology integration would follow (Kerr, 1996). There are numerous extrinsic barriers that have frustrated and continue to frustrate teachers. Adequate technology is a budgetary issue and has been addressed according to the increased ratio of students to computers (Ertmer, 1999). New technology has also been quickly adopted by schools including iPads, netbooks, and Chromebooks (Nagel, 2010; Pierce, 2014). Technology continues to evolve and each change brings new challenges. Many schools do not have adequate wireless internet to meet today's instructional needs (Cohen & Livingston, 2013). President Obama has also addressed the lack of adequate wifi in schools through his ConnectEd Initiative and his call on the Federal Communications Commission to modernize E-rate, federal funding available to schools (Whitehouse, 2013). Once the extrinsic barriers are overcome, intrinsic barriers begin to surface. Intrinsic barriers are barriers that interfere with or stall change internally (Ertmer, 1999). Apple Classrooms of Tomorrow noted that once the extrinsic barriers were removed and classrooms were infused with technology, "experienced teachers found themselves facing first-year-teacher problems: discipline, resource management, and personal frustration" (Sandholtz, Ringstaff, & Dwyer, 1991, p 5). Current literature suggests that intrinsic barriers are common among today's educators (Boss, 2008; Ertmer, 1999; Kerr, 1996; Norris & Soloway, 2011). Intrinsic barriers are often less concrete than extrinsic barriers and more personal and deeply rooted (Ertmer, 1999). According to Ritchie and Wiburg (1994), "traditional perceptions of what teaching, learning, and knowledge should look like are major limiting factors to integrating technology" (p. 152).

As the number of schools adopting a 1:1 environment increases, teachers have adequate access to technology; however, teachers are not capitalizing on this opportunity to effectively integrate technology. There is mounting evidence that suggests teachers' own beliefs in their capacity to effectively integrate technology are a significant factor in determining technology use in the classroom (Albion, 1999; Kellenberger & Hendricks, 2003).

Wang, Ertmer, and Newby (2004) also concluded, “self-efficacy beliefs do not automatically translate into the actual use of technology among teachers, they are a necessary condition for technology integration” (p. 242). Studies have identified technology self-efficacy as a barrier to technology integration, but the relationship of a teacher’s self-efficacy beliefs and classroom technology integration requires further investigation (Ertmer, 2005). Additionally, “it is necessary to move beyond examining usage patterns and general attitudes toward technology in education and toward a better understanding of how self-efficacy beliefs emerge and what factors will influence these beliefs (Abbitt & Klett, 2007, p. 36).

Technology becomes increasingly important for educators to engage today’s students (U.S. Department of Education, 2010), and teachers must become fluent in technology if students are to successfully develop 21st century skills (Abbitt & Klett, 2007). Teachers who took part in a study by Schrum, Shelley, and Miller (2008) felt their students were more engaged and more creative in completing assignments. These teachers reported being motivated to use technology because it increased their own self-efficacy. Finally, these teachers believed they were better teachers as the technology allowed them to be more creative and improve their teaching (Schrum et al., 2008). Bandura (1995) defined self-efficacy as “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (p. 2). Bandura (2004) further described self-efficacy beliefs as behavioral determinants of how people think, behave, and feel. Self-efficacy is developed through mastery experiences, social modeling, social persuasion, and psychology responses. Performing a task successfully strengthens self-efficacy beliefs and is the most effective way to develop a strong self-efficacy. Self-efficacy is a useful indicator to predict the effectiveness of technology integration initiatives (Albion, 1999), yet simply identifying teacher self-efficacy may not provide the information needed for policymakers and school administrators to make decisions that increase student learning and positively impact education (Henson 2002). Examining teacher technology self-efficacy with regard to technology integration in addition to the presence of a school-based instructional technology facilitator is significant. Teachers with high self-efficacy beliefs "are most inclined to accept change and choose the best option" (Moersch, 1995, p. 40). According to Teo (2009), "it is possible that teachers, who are surrounded by effective support structures that provide them with experiences in technology, would develop more positive judgments about their ability to use technology for teaching" (p. 14). Since technology is not static, teachers must be able to use the technology available today and be prepared to handle the technology of the future (Hunt, 1997).

Statement of the Problem

The problem studied is the teachers' technology self-efficacy as it applies to classroom technology integration and the role the professional development and learning opportunities play in teachers' technology self-efficacy.

Deficiencies in the Literature

There are a few identified deficiencies in the literature. Abbit and Klett (2007) stated that research needs to move from general attitudes of technology usage to understanding how teachers' self-efficacy beliefs are formed and what can influence these beliefs. Schools today are making huge investments in technology purchases and are expecting immediate results in both improved teaching practices and student achievement. While technology can make good schools better, it can also make bad schools worse. Additionally, technology in school is often associated with failures (Toyama, 2011). With more and more schools issuing laptops to students, this can be a very expensive failure. As the Chief Technology Officer for a school system in the midst of a 1:1 initiative, the researcher is very much interested in improving the project.

Purpose of the Study

The purpose of this study was to expand the knowledge on teachers' technology self-efficacy as it relates to integrating technology in the classroom. This study examined teachers' levels of technology self-efficacy, identified specific factors affecting their current level, and examined the role and impact professional learning opportunities have on levels of technology self-efficacy.

Setting

The participants for this research were full-time, certified teachers from one high school and two middle schools from a single school district located in a rural area of the southern United States. There are approximately 1,700 students at the high school and 700 students at each of the middle schools. The racial/ethnic makeup of the high school students consists of approximately 81% Caucasian, 9% Hispanic, 4% African American, 5% two or more races, and 1% Asian. Additionally, approximately 53% of the students receive free or reduced-price lunches. The racial/ethnic makeup in the first middle school consists of approximately 81% Caucasian, 10% Hispanic, 3% African American, 3% two or more races, 2% Asian, and 1% American Indian. Additionally, approximately 64% of the students receive free or reduced-price lunches. The racial/ethnic makeup of the second middle school consists of approximately 84% Caucasian, 9% Hispanic, 3% African American, and 3% two or more races. Additionally, approximately 61% of the students receive free or reduced-price lunches.

The high school employs approximately 100 certified teachers, and each middle school employs 50 certified teachers. The schools were purposely chosen in order to gather participants from schools employing an instructional technology facilitator. School administrators from each school granted permission for the study to take place.

Audience

North Carolina teachers, under the recently adopted North Carolina Teacher Evaluation Process, were directly evaluated based on their ability to facilitate learning for their students. Section IV specifically required, "teachers know when and how to use technology to maximize student learning. Teachers help students use technology to learn content, think critically, solve problems, discern reliability, use information, communicate, innovate, and collaborate" (NCDPI, 2009b, p. 10). Additionally, students want teachers to use technology in the classroom (Lepi, 2012). A recent study conducted by Eden Dahlstrom with EDUCAUSE Center for Applied Research concluded that two thirds of students agree that technology continues to be a means of engagement that helps them feel connected to their institutions, teachers, and other students. Two thirds of students also agree that technology elevates the level of teaching. Finally, students who bring their own personal technology device programs have continued to grow in schools (Hart, 2015). The trend of bringing your own technology has been gaining acceptance in an increasing number of K-12 schools (Johnson, 2012). Nearly all technology initiatives, from 1:1 to bring your own device, stress that effective professional development must be offered for the initiative to succeed (Dahlstrom 2012; Johnson, 2012; Lepi, 2012). Possibly, these findings can be added to the body of knowledge on technology integration and the role professional learning opportunities can play in making technology integration produce better academic results. Specifically, this could aid administrators in identifying effective classroom technology, evaluating teachers, and implementing successful professional development. Additionally, this research could help school and district administrators with planning for technology projects including budgeting, hiring, and support.

Research Questions

The research questions to be answered in this study were

1. What factors affect teachers' levels of technology self-efficacy?
2. What similarities and differences exist between and among teachers of varying technology self-efficacy levels?
3. In what ways could identified factors affecting teachers' levels of technology self-efficacy be impacted by professional learning opportunities?

Role of the Researcher

The researcher is the Chief Technology Officer for a rural school district in western North Carolina. All three institutions in the district that were a part of the study have principals and technology facilitators with over 10 years of education experience. Because of the researcher's position, there was access to the students, teachers, and instructional technology facilitators; their demographic information; and the ability to research the components of the problem.

The researcher was interested in researching the topic as a result of implementing instructional technology as a teacher, assisting other teachers in implementing instructional technology as an instructional technology facilitator, and overseeing the instructional technology program for an entire school district. Many classrooms observed have been resistant to new technologies, and teachers have a negative attitude towards implementing instructional technology. These classrooms often had low levels of student engagement and low levels of student learning. Other classrooms observed have embraced technology, and instructional technology is a part of the daily lessons. Typically, these classrooms have a higher level of student engagement and higher levels of student learning.

Definitions of Major Concepts and Terms

The following terms are used throughout this research and are defined for purposes of the study.

External barriers. External barriers may include the lack of technology resources, poor or inadequate training, lack of technical support, and insufficient time to plan and/or implement (Ertmer, 1999).

Intrinsic barriers. Intrinsic barriers may include the teachers' underlying beliefs and visions concerning technology and learning (Ertmer, 1999).

Instructional technology. Instructional technology is a combination of technological, pedagogical, and content knowledge: TPACK (Koehler, 2013). The essential features are (a) the use of appropriate technology, (b) in a particular content area, (c) as part of a pedagogical strategy, (d) within a given educational context, and (e) to develop student knowledge of a particular topic or meet an educational objective or student need (Cox & Graham, 2009).

One-to-one. A one-to-one (1:1) program refers to students in a school who are provided with their own laptop, netbook, tablet, or other mobile computing device. One-to-one refers to the ratio of one device to one student (Abbott, 2013).

Self-efficacy. An individual's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Bandura, 2004).

Instructional technology facilitator. A school-based specialist position whose primary concern is empowering teachers to harness the power of technology integration for student learning (Hofner et al., 2004).

Technology integration. Technology use to deepen and enhance the learning process across the curriculum (Edutopia, 2008). According to Means and Olson (1997), this includes "promoting student learning through collaborative involvement in authentic, challenging, multidisciplinary tasks by providing realistic complex environments for student inquiry, furnishing information and tools to support investigation (collecting, analyzing, displaying, and communicating information), and linking classrooms for joint investigations" (pp. 17-18).

Summary

Sixteen years into the 21st century, schools are still talking about implementing 21st century skills. Technology and 21st century skills go hand-in-hand as our students live in a technology- and media-abundant environment (The Partnership for 21st Century Skills [P21], 2015). Schools began purchasing technology to help with this transformation of education. While technology does have the potential to transform education, often schools see little to no measurable impact (Richtel, 2011).

In order for technology to live up to its full potential, it must be integrated by a capable teacher. There are many barriers to prevent a teacher from effective technology integration, both intrinsic and extrinsic. However, a teachers' own beliefs in their capacity to effectively integrate technology are a significant factor in determining technology use in the classroom and warrants more study (Albion, 1999; Kellenberger & Hendricks, 2003). This study was designed to answer questions about the factors affecting teachers' levels of technology self-efficacy, the similarities and differences that exist between and among teachers of varying technology self-efficacy levels, and how identified factors are impacted by professional learning opportunities.

In Chapter 2, a review of related literature is presented in the areas of technology use and its importance in schools, teacher confidence with technology and effective teaching, methods for improving teacher confidence with technology, and effective personal learning. Chapter 3 outlines the methodology used in the research process. Chapter 4 presents the results of the CTIS, personal interviews, and focus groups. Chapter 5 offers discussion and recommendations.

Chapter 2: Literature Review

Introduction

A recent YouTube video by Veritasium (2014) claimed, "no prediction has been made as often or as incorrectly as [This will revolutionize education]." The motion picture, radio, educational television, and computers have all been heralded as revolutionary (Veritasium, 2014). While motion pictures, radio, and television are important, they have not had the impact that computers have on our daily lives. Today's students have grown up with technology that has changed the way the Millennial generation reads, learns, processes information, and solves problems (Howe & Nadler, 2010). Much of this digital age of work, education, and entertainment takes place on the web. This is a commonplace activity for today's teens; in 2012, 95% of all teens (ages 12-17) were online (Pew Research Center, 2012).

Education must harness the power of this technology. While schools have made strides to keep up with changing technology and acknowledge its importance, they have not truly made technology transformative. State and federal governments have pushed for larger roles of technology in the classroom; but administrators, schools, and districts must make effective technology integration a priority. Recognizing that teachers play a pivotal role in student success, educators must have the confidence to implement effective technology integration in their classroom. Educators must be equipped with the 21st century technological skills, an effective support system, and professional development that build on their confidence.

This literature review presents current research in six specific areas. The first area of research includes the history of major education legislation with technology components with a focus on North Carolina. The second and third sections focus on the history of teaching with technology and teacher and student views of technology. Teacher self-efficacy is examined in the fourth section. The fifth section examines methods for improving teacher confidence with technology. The final section examines effective professional development. This overview is important to understand the expectations and realities teacher face when integrating technology and how it impacts their self-efficacy.

History of Legislation and Guidelines for Technology Integration in North Carolina

Classroom computers continue to be a driving force in transforming education. The ratio of students to computers has steadily increased over the past 30 years. In 1981, there was one computer for every 125 students. That ratio was trimmed to one computer for every 18 students in 1991 and one computer for every five students in 2000 (Christensen et al., 2008). As the world makes the move from analog to digital, technology has practically become a necessity to nearly everyone and everything. Technology now plays an essential role in education today.

NCLB was signed into law by George W. Bush in 2001 and brought sweeping changes to public schools across the country. The goal of NCLB was to ultimately improve student achievement, and it identified technology integration as a method of achieving this goal. NCLB specifically required every student to be technologically literate by eighth grade. The U.S. Department of Education and ISTE developed the standards that students must meet. These standards were designed to be met through technology integration, building access, accessibility, and parental involvement; not a separate, stand-alone class (Learning Point, 2007).

In June 2007, ISTE revised the standards and renamed them the ISTE Standards for Students (ISTE Standards•S). The original standards focused more on using and understanding computers and technology. The revision shifted the focus to evaluating the skills students need to be productive in a global and digital world. The new set of standards focus on (1) creativity and innovation; (2) communication and collaboration; (3) research and information fluency; (4) critical thinking, problem solving, and decision making; (5) digital citizenship; and (6) technology operations and concepts. Each of the standards contains specific skills and knowledge that students need to gain to contribute to an increasingly global and digital world (ISTE, 2007).

NCLB set key standards and accountability elements for school districts to demonstrate the impact teaching practices have on student learning (U.S. Department of Education, 2002). As a part of NCLB, the federal government included EETT. The purpose of EETT was to improve student achievement through the use of technology in elementary and secondary schools. The U.S. Department of Education provided grants to state educational agencies. State agencies were allowed to retain up to 5% of the monies and distribute the remaining to local educational agencies and local entities.

The North Carolina State Board of Education released IMPACT, Guidelines for North Carolina Media and Technology Programs in 2000 as a result of NCLB and EETT. The ultimate goal was to impact teaching, impact learning, impact motivation, and impact student achievement. The document was revised in 2005. The vision of IMPACT was to provide schools with step-by-step directions for a school's library media and technology program specialist to implement and follow. IMPACT schools were ones that focused on student achievement, involved the entire staff in collaborative planning of authentic and engaging instructional programs, were enriched by high-quality resources, and utilized current technology and effective models of integration (NCDPI, 2006). In addition to the guidelines, NCDPI awarded grants to North Carolina public schools to help implement the IMPACT model in one middle or high school (NCDPI, 2003). Eleven schools were awarded the first round of grants in 2003 (NCDPI, Communications and Information, 2003). The U.S. Department of Education posted Requests for Proposals to fund evaluation studies of state-level instructional technology initiatives (Corn, 2007). The Instructional Technology Division of NCDPI responded and was one of 10 states to be awarded the funding. This funding was utilized to form Looking at North Carolina Educational Technology (LANCET). LANCET partnered with The William and Ida Friday Institute for Educational Innovation at North Carolina State University and the South East Initiative Regional Technology Consortium at SERVE (NCDPI, Communications and Information, 2003).

The SERVE Center at the University of North Carolina at Greensboro was a primary collaborator with NCDPI to provide professional development and technical assistance to the IMPACT schools on formative evaluation and has developed and validated instruments for formative evaluation. The School Technology Needs Assessment (STNA) was one tool that came into existence due to this collaboration. The goal of STNA was to assist school-level planners to have the data needed to analyze the implementation of the North Carolina IMPACT technology integration model (Corn, 2007).

STNA has been revised three times, with STNA v.3.0 being released in December of 2006. STNA aims to collect the perceptive data in four areas of technology implementation at the school level through 78 five-point Likert scale items (Corn, 2007). The first area measures the degree to which environmental factors support technology use; second, whether professional development opportunities are offered and if they are taken advantage of; third, if technology is used to support teaching and learning activities; and finally, the impact technology has on teaching practices and student outcomes. Data from these four areas are to be analyzed by school administrators, technology and media specialists, and school planning team members to help drive purchasing decisions, allocate resources, and other decisions surrounding technology. STNA should not be used to determine an individual's skills, understanding, or attitudes about technology. Additionally, STNA should not be used to compare schools or school staff.

In February 2009, President Obama introduced Race to the Top (RttT) as a competitive grant initiative to spur systemic education reform to specifically improve teaching and learning in American schools. One of the four priorities of RttT was competitive preference emphasis on science, technology, engineering, and mathematics (U.S. Department of Education, 2009). Schools were to prepare more students for advanced study and careers in sciences, technology, engineering and mathematics. Schools were also instructed to address the underrepresented groups of women and girls in these fields. In addition to teaching and preparing students in technology fields, schools were to incorporate technology into high quality assessments. Finally, schools were to use technology based tools to provide teachers, principals, and other staff with support and data to manage continuous instructional improvement (U.S. Department of Education, 2009).

In 2009, the U.S. Department of Education initiated a National Educational Technology Plan (NETP) called Transforming American Education Learning: Powered by Technology. The previous plan was finalized in 2004 and the U.S. Department of Education desired to update the technology plan to include technological advancements and new research on learning. NETP sought for transformations to be revolutionary rather than simply evolutionary changes. NETP called for all education systems "to be clear about the outcomes we seek; collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility; continually monitor and measure our performance; and hold ourselves accountable for progress and results every step of the way" (U.S. Department of Education, 2010, p. 7). The plan recognized that technology was now a part of everyday life and that we must leverage technology to provide engaging, authentic, and meaningful learning experiences. The revolutionary transformation is to occur through a model of learning powered by technology, with recommendations in five core areas: learning, assessment, teaching, infrastructure, and productivity. The model of learning called for our education system to leverage technology to create engaging, relevant, and personal learning experiences for all students that mirror their daily lives and their futures. To accomplish this goal, NETP called to abandon teacher-centered classrooms and put the students at the center of learning, empowering them to take control of their own learning. The model of assessment called for technology assessments to have dual roles: first as a formative assessment system that can diagnose and modify the conditions of learning and instructional practices; and second as the assessments that can help determine what the student has learned for grading and accountability. The model of teaching called for educators to switch to a model of connected teaching:

> In a connected teaching model, classroom educators are fully connected to learning data and tools for using the data; to content, resources, and systems that empower them to create, manage, and assess engaging and relevant learning experiences; and directly to their students in support of learning both in and out of

school. (U.S. Department of Education, 2010, p. 10)

NETP acknowledged that many educators might not have the understanding or the comfort with using technology. The same is true for the school administrators, education leaders, and policymakers, which influences the curriculum, funding, professional development, and technology purchases. This deficit prevents technology from being revolutionary in improving teaching and learning. The model called for a comprehensive infrastructure for learning that is not limited to the school day or school building but open to students, educators, and administrators anywhere and anytime. This always-on network is not just to access information but also to allow students and educators to connect and collaborate with other people and participate in professional learning communities (PLCs) or networks. The final core area was productivity, which called for redesign and transformation of America's schools. The model called for education systems to reexamine basic assumptions such as seat-time, grouping students in grades based on their age, and organizing learning that all students in a class receive the same content and the same pace. NETP hoped to create some radically redesigned schools that improve learning outcomes (U.S. Department of Education, 2010).

North Carolina law GS115C-102.6 has mandated that North Carolina develop a State School Technology Plan. The purpose of this plan is to provide cost-effective flexible technology, infrastructure, and expert staffing to promote substantial gains in student achievement. North Carolina's technology plan sets five specific strategic priorities and goals that the state aims to accomplish by 2013:

1. A statewide shared services model.
2. Universal access to personal teaching and learning devices.
3. Statewide access to digital teaching and learning resources, including digital

textbooks.

4. A statewide model of technology-enabled professional development.
5. 21st century leadership for all schools and districts (NCDPI, 2011).

P21 is a national organization that advocates for 21st century readiness for every student. The aim of P21 and its members is to provide tools and resources that can help the U.S. education system compete in a global economy. P21 created a framework for 21st century learning that combines a focus on 21st century student outcomes with innovative support systems to help students master the abilities required of them in the 21st century. These outcomes are blending of specific skills, content knowledge, expertise, and literacies. Outcomes are included in life and career skills; learning and innovation skills; information, media, and technology skills; and the core subjects and 21st century themes. Additionally, to ensure students master these 21st century skills, a support system supports the framework: The support system includes standards and assessment, curriculum and instruction, professional development, and learning environments. P21 feels schools and districts that use the entire framework with support systems have more engaged students and students graduate better prepared to succeed in today's global economy (P21, 2011).

State and federal agencies have embraced the transformative role that technology can play in schools. The federal government passed laws specifically requiring students to be technology literate by a certain age (EETT, 2001) and provided grant funding to help make this a reality. North Carolina was awarded one of those grants and developed guidelines to help schools and districts effectively integrate technology. Additionally, federal and state agencies crafted technology plans outlining what they were doing to facilitate the integration of technology. ISTE created standards for administrators, teachers, and students that guided schools in this transformation. All of these laws, guidelines, plans, and standards fall to the teacher. Ultimately, teachers must have the technology and the confidence to teach with the technology for effective technology integration to work.

Teaching with Technology

In the mid-1980s, the push began to add computers to the classroom; and by 2003, the average public school in the United States had 136 computers available to support instruction. There was an average of four students to every computer with internet access. However, there was no evidence that adding computers to the classroom impacted achievement (Christensen et al., 2008). Over the years, the role of the computer has changed. At first, the computer was mainly used as an administrative productivity tool. Teachers used computers to take attendance; maintain grades; and communicate with peers, students, and parents (Rother 2005). A computer may have been in the classroom, but it was not being used for instruction. Often, computers were placed in a central lab where teachers and students would visit sporadically. When students did visit the lab, it was often to learn basic computer skills or programming. Computers were a separate curriculum instead of being integrated into the content area curriculum (Wenglinsky, 2006). Computer-assisted instruction (CAI) has also been used in the education setting. CAI programs often included drill and practice, which is often the easiest area to integrate into the classroom (Brock, 1994). Drilling practice, both analog and now digital, has a place in education; the overall gains have been incremental (Barshay, 2014; Norris & Soloway, 2015).

The era of using of computers in education is less than 60 years old. PLATO, a computer-based education system was designed in 1959 at the University of Illinois and was the first large-scale project for the use of computers in education (Molnar, 1997). A PLATO system was designed as a large central computer that connects to many terminal systems and was designed for students to interact with the computer using conventional and multimedia learning aids. The interaction was dependent on how the instructional material was written. Generally, the interaction had the following characteristics:

- The student got immediate response from the computer whenever the student asks or answers a question.
- The computer adjusted its lesson to meet the particular needs and abilities of the individual student at that moment.
- The computer kept track of what the student had already learned.
- The student worked in private without fear of exposing his weakness to other people.
- The student used the computer to assist him in visualizing ideas through graphics, computations, examples, and simulations. (Gibbons, 1982, p. 129)

By 1981, there were 18 PLATO systems, with nine in the U.S. or Canada and 10 outside of North America (Gibbons, 1982).

Nearly all of the computers in education programs in the late 1950s and early 1960s were focused on scientific research. However, at Dartmouth in 1963, John Kemeny and Thomas Kurtz transformed the role of computers in education to an academic one. They adopted a time-shared system that allowed many students to interact directly with the computer. The system was eventually expanded into regional computing centers for colleges and schools. Additionally, they developed a new, easy-to-use computer language, BASIC (Molnar, 1997; Trustees of Dartmouth College, 2010).

In 1963, Patrick Suppes and Richard Atkinson, while at Stanford University, researched and developed a computer-based instruction program for mathematics and reading. Their goal was for students to be able to abandon the lock-step process of group instruction. Instead, students would have individualized instructional strategies that gave rapid feedback, allowing students to correct their responses (Taylor, 1982).

The computer language LOGO became the language behind the computer literacy movement in elementary school. Seymour Papert developed LOGO in the early 1970s at the Massachusetts Institute of Technology. Papert set out to develop a new and different approach to computers in education, one that encouraged rigorous thinking about mathematics. Papert (1993) used LOGO to teach mathematics in micro world environments like music and physics, insisting that schools should teach children to be mathematicians and not just teach math. LOGO was later expanded to work with LEGO construction kits in a constructivist approach to learning. The construction kits were computer driven with a hands-on aspect that helped students solve real word meaningful projects. Students learned to define a problem and the implied practical problem-solving skills needed to solve the problem (Harel & Papert, 1991). LEGO Mindstorms are kits that contain software and hardware to create small, customizable, and programmable robots that are used in education today and are named after Papert's book *Mindstorms: Children, Computers, and Powerful Ideas* (Bumgardner, 2007).

In 1967, the National Academy of Sciences established the President's Science Advisory Committee (PSAC) to study the use of computers in higher education. The committee, chaired by John R. Pierce of Bell Laboratories, concluded that an undergraduate education without computers was no different than an undergraduate education without an adequate library. The value of computers used in precollege education was also acknowledged. Because of PSAC's reports, President Lyndon Johnson directed the National Science Foundation to collaborate with the U.S. Office of Education and established an experimental program to develop the potential of computers in education. The Office of Computing Activities was founded as a result and provided federal leadership in the use of computers for research and education (Molnar, 1997).

The origins of the internet are founded in communication, when a message was sent from a computer in the Network Measurement Center at UCLA to another computer at the Stanford Research Institute (Opfer, 1999). Early in education, the internet was also used in schools to increase communication between schools and families (Bouffard, 2008). In 2000, research by the National School Board Association found increased interest in utilizing email and websites for communications. This trend has shown no sign of slowing down as more schools and local education agencies continue to evolve and use social media for communication. According to a survey by the Reform Support Network (2013), schools are adopting tools like Facebook, Twitter, and YouTube with 96% of the respondents claiming that parents were their key audience.

As the internet became a more integral part of our daily lives, it also became more prevalent in the classroom and impacted teaching and learning. Teachers noted that students became more engaged when completing assignments using the internet by offering a certain degree of choice, increasing their level of interest, and providing opportunities relatable to their own experiences. The vast amount of information available on the internet has also given rise to increased opportunities for students to teach the teachers. Students are likely to be energized as they report information not formerly known by the teacher (Green, 2002).

In June 2013, President Obama visited Mooresville Middle School in North

Carolina to announce ConnectEd, an initiative to connect all schools to the digital age. ConnectEd aims to improve bandwidth to connect 99% of students with broadband speeds of at least 100 Mbps and provide high-speed wireless in schools within 5 years. The plan also hopes to provide educators with support and training in using educational technology to improve student learning and foster development of new resources for teachers, which would include interactive demonstrations, lessons from experts, and building online communities for teachers to collaborate with others across the world (Meyer, 2013; Slack, 2013). A survey of middle and high school principals conducted by the National Association of Secondary School Principals found that 75% of principals felt the improved broadband in their schools would increase student engagement in more powerful learning activities (National Association of Secondary School Principals, 2013).

Teacher and Student Views of Technology

The main function of a school is to educate students; therefore, student beliefs about technology should not be ignored. Teachers are responsible for the teaching and learning that takes place in their classrooms with the ultimate goal of students becoming productive and contributing members of society. Student perceptions of technology's role inside of school and their life outside of school can affect their engagement and interest levels. Effective teachers are in tune with their students' interests and values. Understanding a student's interest regarding technology and what role it plays in their daily life is an important aspect of which teachers should be aware.

Li (2007) published the results of a survey that examined both student and teacher views about technology. The survey was conducted in two urban and two rural schools in Canada. The results of the survey showed that 87.3% of the students surveyed enjoyed using technology and believed it could be effective in learning. Analysis was done on the students' comments on using technology effectively in their learning; and four narratives emerged: (1) increased efficiency and the need for change, (2) pedagogy, (3) future preparation, and (4) increased motivation and confidence. Students felt technology use increased efficiency because it allowed for easier access to information and the latest research and simply made learning easier. With regard to pedagogy, students felt the use of technology allowed multiple and diverse approaches to teaching and learning in ways that could not be replicated by traditional textbook based methods. Students also recognized that the world has become technologically oriented; and in order to be prepared for their future, they need to understand technology to be able to function in the workplace. Finally, students claimed technology increased their enjoyment of learning and confidence in their ability. Students often cited the use of games and other fun uses of technology including virtual reality, simulations, and the internet.

Li's (2007) study also surveyed 15 teachers from the same four schools to measure what they thought about using technology for teaching and learning. All teachers recognized that students liked technology. Yet 10 of the teachers felt that technology should only be used when necessary. None of the teachers felt that technology could increase student confidence, and nine teachers said they would only use technology for the strong students. "Weak students needed to focus on the practice of basic skills rather than wasting time on technology integration" (Li, 2007, p. 389). Several of the teachers said they would forego the technology-supported learning for the traditional textbook approach for their weaker students. Li found, "no one considered that since those weak students had failed in traditional textbook-based learning, trying innovative approaches such as integrating technology might actually help . . . nobody considered using technology to enhance weak students' understanding" (p. 389). Further, teacher readiness to integrate technology was connected with their comfort level in teaching, in technology, in the students, and in subject matter. The findings show teachers and students hold different views on the integration of technology in teaching and learning (Li. 2007).

Technology in education has seen drastic changes over the last 60 years. Both the original version of PLATO and LOGO were displayed at a single workstation with a green and black screen with no internet access. In the 1990s, the internet became available in schools. At that time it was something you specifically set out to visit and not the ubiquitous, always-on internet that we expect today. Through these years, computers have gotten smaller and more abundant in schools. As barriers of lack of technology and internet access have declined, teacher self-efficacy remains a crucial element to the effective integration of technology.

Teacher Self-Efficacy and Technology Use

Self-efficacy is grounded in social cognitive theory and was developed by Albert Bandura. Bandura (1995) defined self-efficacy as “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (p. 2). Bandura (1995) further described self-efficacy beliefs as behavioral determinants of how people think, behave, and feel. Self-efficacy is developed through mastery experiences, social modeling, social persuasion, and psychology responses. Performing a task successfully strengthens our self-efficacy beliefs and is the most effective way to develop a strong self-efficacy. However, failing the task or challenge can weaken self-efficacy (Bandura, 2004).

In education, a teacher’s self-efficacy can be defined as “judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Hoy, 2001, p. 783). Research has suggested that a teacher's belief in his or her own ability to have a positive impact on student learning is critical in the actual success or failure of his or her own teaching behavior (Henson, 2002). Woolfolk and Hoy (1990) noted, "Researchers have found few consistent relationships between characteristics of teachers and the behavior of learning of students. Teachers' sense of efficacy . . . is an exception to this general rule" (p. 81). Teacher self-efficacy can be linked to many variables that influence student achievement (Cakiroglu, Capa-Aydin, & Woolfolk Hoy, 2012; Henson, 2002; Woolfolk & Hoy, 1990). Preservice teacher beliefs about one's own abilities are likely to influence their success for technology integration as they begin careers as educators (Abbitt, 2011). Teachers with a greater amount of self-efficacy adopt more innovative methods of teaching (Bull, 2009; Guskey, 1988). Teacher self-efficacy was predictive of student achievement on both the Iowa Test of Basic Skills (Moore & Esselman, 1992) and the Canadian Achievement Tests (Anderson, 1988).

Bandura (1977) proposed four major sources of self-efficacy which include mastery experiences, social modeling, social persuasion, and psychological responses. Individual self-efficacy beliefs are formed by how they interpret inputs from these four sources. In education however, according to Henson (2002),

> prior conceptualizations of teacher efficacy have all but ignored these sources of information and their relationship to efficacy and ultimate behavior. If efficacy is a powerful influence on behavior, then investigation of factors, that might influence efficacy are certainly warranted. (p. 140).

By increasing teacher self-efficacy, teachers are more motivated to adopt certain behaviors or new skills to perform a specific task. Schools investing in developing a teacher's self-efficacy would help produce the desired results in the classroom.

Bauer and Kenton (2005) completed a mixed-method study to examine the classroom practices of 30 teachers identified as tech savvy through their use of technology in their instruction. They studied how much the teachers used technology, the obstacles they had to overcome to succeed in its use, and their general issues and concerns regarding technology. The participants were identified through personal referrals. Two elementary schools, one middle school, and one high school were also chosen because they represent a broad, K-12 mix. Three sources of data were collected. The participants first completed a survey questionnaire after they agreed to participate. Second, the participants were observed in the classroom. Each participant was observed once for 30-45 minutes. Finally, each participant was informally interviewed as soon as possible after the observed lesson.

Bauer and Kenton (2005) observed, "true integration of computer technology into the target schools has not happened" (p. 535). Four major external barriers were identified. First was hardware. The participants had computers; but they were old, slow, incompatible with new educational software, and lacked proper networking. Additionally, the sites did not have technicians. Troubleshooting was done by a person on staff with the most technical knowledge. Second was the concern for the amount of time to prepare integrated lessons. Participants reported a dramatic increase in the amount of time needed to prepare a technology-integrated lesson. Since the hardware was not dependable, the participants also had to create backup lesson plans. Participants also noted that classes often took 10 additional minutes to get started. The students were often in computer labs where computers needed to be started, logged in, and the correct application launched. Student computer skill level was the third obstacle faced by the participants. Students often had difficulty keyboarding and negotiating the menu systems: “The teachers reported that their teaching was affected by the degree to which they contended with students whose skill level was deficient” (Bauer & Kenton, 2005, p. 537). In a technology-integrated lesson, “it becomes a possibility that lack of skill might interfere with content learning” (Bauer & Kenton, 2005, p. 537). Finally, all participants praised the internet but also shared concerns. They referred to the internet as a mixed blessing; there was an equal amount of useful and worthless information. To overcome this, participants prepared for lessons by selecting websites in advance and carefully monitoring student work (Bauer & Kenton, 2005).

Over time and with the proper support, the external barriers can be mitigated. However, Bauer and Kenton (2005) also identified an important intrinsic barrier of self-efficacy. All participants of the study saw themselves as tech-savvy and more likely to integrate technology than their peers. Seventeen percent of the participants felt their own lack of expertise was a barrier that they needed to overcome before they could succeed with technology integration. The participants were asked for their confidence level with technology and their skill level with technology. The participants who rated themselves highly confident (14) versus those who rated them themselves highly skilled (9) produced interesting statistics. Bauer and Kenton concluded, “this suggests that some teachers considered themselves more confident than skilled with technology and that confidence is a key factor in learning to teach with computer technology” (p. 523).

Many different scales and surveys have been researched and developed over the years to measure self-efficacy. This includes scales for general self-efficacy and scales for specific technology or computer self-efficacy beliefs. Technology self-efficacy is an important trait impacting a teacher’s decision to use technology, ultimately determining if a technology project or implementation is successful (Compeau & Higgins, 1995). "The existence of a reliable and valid measure of self-efficacy makes assessment possible and should have implication for organizational support, training, and implementation" (Compeau & Higgins, 1995, p. 189).

In 1989, the Computer Self-Efficacy Scale (CSES) was developed and validated. The CSES included 32 items in a 5-point Likert style response. The scale measures perceptions of capacity in specific computer-related knowledge and skills. To construct the validity of the scale, data were gathered from 414 individuals engaged in learning to use computers in three separate settings (Murphy, Coover, & Owen, 1989). Compeau and Higgins (1995) developed a Likert scale survey that measures individual self-efficacy beliefs in technology integration. The original survey included 10 items and assessed teacher confidence toward using a software package to complete their job (Compeau & Higgins, 1995). The scale was validated in a longitudinal study on individual reactions to computing technology. The instrument was used with 394 individuals over 1 year (Compeau, Higgins, & Huff, 1999).

In 2004, Wang et al. developed the Computer Technology Integration Survey (CTIS). The Likert-style survey was developed to determine how teachers feel about integrating technology into classroom teaching and was used as pre and postsurvey measures. Through factor analysis and Cronbach alpha coefficients, the survey was found to be both a valid and reliable instrument (Wang et al., 2004)).

Teacher self-efficacy is a significant factor if effective technology integration is to occur. For years, the schools have purchased more computers; but computers alone have not led to increases in student achievement. There must be a teacher who feels that he/she has the capability to utilize technology for instruction. Tools such as the CSES and the CTIS have been developed to help researches determine how teachers feel about integrating technology. Global education technology spending is expected to reach $19 billion by 2018 (Futuresource Consulting, 2014). Teachers have the expectation to utilize technology for student instruction. Schools must investigate ways to improve teacher self-efficacy with technology in order to have an impact on student achievement.

Methods for Improving Teacher Confidence with Technology

Teacher access to computers and technology training has increased in schools, but that alone has not helped technology make the leap to lead the powerful student-centered instruction. Teachers play a crucial role in leading instruction and enhancing student skills. It is essential that teachers are furnished with the technology and 21st century skills to carry out their jobs, but we must also instill a confidence within them to be a change agent.

First and foremost, teachers need to see the need for technology integration. Better student results require better teaching, and integrating technology into the curriculum improves students' learning processes. Teachers who use technology as a problem-solving tool change the way they teach from a behavioral approach to a more constructivist approach. Technology is instrumental to successful project-based learning where students are engaged, enabled to solve real-world problems, and become creators of content (Gahala, 2001; Shaffner, 2007). Schools must refrain from using technology for technology's sake and develop a vision of how technology can improve teaching and learning (Gahala, 2001). Teachers must see the need for technology integration and not technology as disconnected from the curriculum. "A disconnect means that teachers see no relevance between what the students need to know and what they can construct, find or ponder with computer technology" (Morehead & LaBeau, 2005, p. 121). Carney

(1998) examined a teacher development program, named the Shortline Teacher Development Centre (STCD), aimed at integrating technology into the constructivist classroom. One of the four elements deemed crucial for effective teacher learning was challenging the teachers' frames of reference. In order to generate new learning, teachers must be placed in situations of uncertainty. Three forces helped create the uncertain conditions: technology, new teaching contexts, and converging reforms. The need to integrate technology is the most powerful in challenging familiar practice and knowledge (Carney, 1998). Another study centered on elementary teacher computer use found when principals believe technology is important for teaching and learning, they need to impart those beliefs to their teachers. In order to set up an environment that supports technology integration, principals need to provide time and access to technology for the teachers. However, the most important factor in success was teacher preparation and training. The teachers with preparation focusing on integrating technology into the curriculum and instruction used technology more frequently and in more diverse ways than the majority of other elementary teachers (Franklin, 2008).

Today's teachers must accept the changing role of an educator. Gone are the days of a sage on the stage. Instead, educators must accept technology as an integral part of educating the students of the 21st century (Morehead & LaBeau, 2005). Integrating technology no longer means dropping off a class of students at the computer lab to learn basic word processing. Technology can help flip the stereotypical classroom roles. Students gain the responsibility for their own learning outcomes and desires. Teachers become more of a guide and facilitator. Technology is the main tool that assists in this transformation into student-centered learning and, when used effectively, improving student performance on achievement tests (Kulik, 2003;

Wenglinsky, 2006). While it is easy to assume technology as the agent of change, it must actually be the teachers who assume this role (Fisher, 2006).

Placing technology in the classroom does not guarantee that it will be used to support student-centered instruction (Cuban, Kirkpatrick, & Peck, 2001). Schools must meet the immediate needs of the teachers and provide them opportunities to learn, rather than simply offering technical training (Kanaya, Light, & Culp, 2005). A survey conducted in 2000 demonstrated that teachers who sought out professional development opportunities or who led professional development for their peers were more likely to be experienced users of educational technology. The survey further suggested that these were the teachers who found relevant connections between educational technology and their own professional growth (Riel & Becker, 2006). The new knowledge that will most likely be learned and applied in the classroom will come if it is situated in relevant contexts. It does little good to share the 21st century virtues of ubiquitous technology and student-centered learning if teachers cannot see how it is relevant and what it means to students (Carney, 1998).

A powerful strategy to help teachers gain self-efficacy to integrate technology into their classroom is to provide opportunities for them to observe, collaborate, reflect, and share with their peers (Ertmer, Ottenbreit-Leftwich, & York, 2006; Mumtaz, 2000). Often, teachers have not seen proper examples of technology integration; but allowing them to observe others can give them the needed knowledge about what successful technology integration looks like in the classroom (Ertmer & Ottenbreit-Leftwich, 2010). Technology practices are more effective if teachers have had the opportunity to observe and interact with positive role models. Alternative observations, such as video cases and web-based scenarios, can be used for meeting some of these needs (Albion &

Ertmer, 2002). Teacher individual learning is not likely to result in changed practices without long-term collegial interaction (Carney, 1998). Apple Classrooms of Tomorrow Research pointed out the relationship between technological innovative teaching and collegial interaction. "The innovative, high-access-to-technology classrooms drove teachers to more collegial interaction and instructional sharing. But teachers who already enjoyed a high level of collegial interaction embraced technological innovation and implemented new instructional strategies more quickly" (Sandholtz et al., 1991, p. 11).

Effective Professional Development

Professional development programs vary widely from district to district and even school to school, but research has shown there are key structural and activity features that are prevalent in successful programs (Guskey, 2000). The five key structural characteristics include prolonged contact, model type, association of attending educators, availability of follow-up, and continuous evaluation. There are also four important characteristics of an effective professional development activity. These include content-specific material, inquiry-based learning, collaborative grouping, and establishing learning communities (Lieberman & Mace, 2008; Maldonado, 2002; Stoll & Louis, 2007).

All too often, professional development has been thought of as a "one-shot" deal. Teachers come to the computer lab, learn from an expert, and are expected to fully implement in their classroom. "Conventional approaches to professional development have little impact on teachers' instructional practice and students' learning" (Moon, Ben-Peretz, & Brown, 2000, p. 749). Additionally, Garet et al. (2008) found that large-scale professional development that included many conventional professional development practices did lead to significant increases in teacher knowledge but failed to enhance student achievement significantly. An effective program has ample contact hours with teachers, and the total contact hours and the span of time which the professional development program takes place are indicative of a successful program (Guskey, 2000; Maldonado, 2002; Quick, Holtzman, & Chaney, 2009). Teachers should be given adequate time to develop, absorb, discuss, and practice new knowledge (Loucks-Horsley, Stiles, & Hewson, 1996; Wang, 2013). When sufficient time is given, it solidifies to teachers that the professional development is an ongoing activity and an integral part to the process of teaching effectively (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Gulamhussein, 2013; Guskey, 2000).

Major models of professional development include training, observer/assessment, and individual guided models. Each model includes its own advantages and disadvantages (Guskey, 2000; Maldonado, 2002; Vega, 2013). Combining the positive factors and combining the models themselves can be highly effective for both individual and school-wide improvements (Guskey, 2000; Hawley & Valli, 1999). The training model typically involves a team of presenters who are considered experts in their fields and can demonstrate skills that would be directly successful in the classroom. The observer/assessment model allows teachers to receive feedback on classroom performance. This can lead to reflections on personal instruction styles, strengths, and weaknesses (Lewis, Perry, Hurd, & O'Connell, 2006; Maldonado, 2002). This model increases the chances of reflection and changes in teaching styles (Guskey, 2000). The individually guided model calls for teachers to design their own learning experiences and decision making in the classroom and encourages teachers to pursue their own effective teaching strategies. This model tends to ensure that teachers are fully invested in the professional development and builds a sense of self-efficacy (Hawley & Valli, 1999; Ingersoll & Strong, 2011; Maldonado, 2002).

The association of attending educators, or the similarity between educators, is another key component in the structure of an effective professional development program (Gallimore, Ermeling, Saunders, & Goldenberg, 2009; Maldonado, 2002). Programs work best when geared for educators from the same school, department, or grade level. This type of professional development encourages strong communication among teachers, which helps bring change to classroom teaching practices (Garet, Porter, Desimone, Birman, & Yoon, 2001; Quick et al., 2009). Also created are teacher leaders, who act as "change agents" for their schools (Loucks-Horsley et al., 1996).

A final component of an effective professional development program includes consistent follow-up and support (Killion, 2013; Maldonado, 2002). The professional development cannot simply end when teachers leave the workshop with the expectation to implement what they have just learned. Follow-up and support is needed to assist teachers as they face new issues or problems as they implement learned practices in their classroom (Hawley & Valli, 1999). Without the opportunity for follow-up on questions that may be occurring, professional development may not be fruitful (Guskey, 2000). Educators who receive support also gain self-efficacy, giving them the confidence to change their classroom practices and have a positive influence on student learning (Ashton, 1984; Brinkerhoff, 2006).

Often, schools define all professional development as good; but in today's times of accountability, this is not enough. Today we must evaluate professional development. Guskey (2000) defined evaluation as the systematic investigation of merit or worth and further defined five critical levels of professional development evaluation. Level 1 refers to participant reactions. Information on participant reactions is generally gathered through a questionnaire at the end of the activity. The questions typically include whether or not participants liked the workshop, whether the materials made sense, and was the instructor knowledgeable. Additionally, you will find questions about the refreshments provided, the temperature of the room, and the comfort of the chairs. Typically these questions are generic enough that districts can use the same questionnaire for all professional development workshops. Information from these questions can help improve the design and delivery of workshops in a number of valid ways and are usually a prerequisite to higher-level evaluation results. Level 2 focuses on participant learning by measuring the knowledge, skill, and attitudes the participants gained. These can be measured in a number of different ways including paper assessments, simulation, skill demonstration, oral or written reflections, or portfolios. Participant learning can seldom be collected in a standardized form, and indicators of successful learning must be outlined before beginning the workshop. Collection of this information assists in improving the content, format, and organization of the workshop. Level 3 shifts the focus to information on organization support and change. Measuring results on organization support and change is more complicated than the previous levels. Instruments typically used include district and school records, minutes from follow-up meetings, questionnaires, structured interviews with participants and administrators, and participant portfolios. This information is used to document and improve organization support and to inform future change initiatives. Level 4 focuses on whether participants are using their new knowledge and skills on the job by answering a question such as "Did what participants learn make a difference in their professional practice?" Depending on the goals of the workshop, instruments may include questionnaires, structured interviews with participants and administrators, reflections, portfolios, direct observations, and audio or video. This information is used to document and improve the implementation of the program or change initiative. Level 4 information cannot be gathered at the completion of a professional development workshop. Instead, sufficient time must pass to allow participants to adapt what they have learned into their classroom. The fifth and final level examines student-learning outcomes, or how the workshop or activity benefits the students in any way. Measures of student benefit typically include student performance and achievements from assessments, grades, and standardized tests. However, it is also important to include affective (attitudes and disposition) indicators and psychomotor outcomes (skills and behaviors). In addition to assessment results, instruments may include student self-concepts, study habits, attendance, homework completion rates, and classroom behavior. School-wide measures of student benefit may include advanced placement enrollment, honor society memberships, discipline rates, and retention rates. Information gathered at this level can be used to improve all aspects of program design, implementation, and follow-up. Additionally, this information is used to determine the overall effectiveness of professional development. Individual schools determine to what extent professional development is evaluated. However, tracking of only a single level tells you nothing about the next level. Each level is important, but the bulk of professional development is typically only evaluated at Level 1 or 2 (Cody & Guskey, 1997; Guskey, 2000).

Recent trends in education have schools creating PLCs with the aim of improving instruction. A PLC is designed to use data to drive school improvement. This school improvement comes from the strength of teacher collaborative teams to improve student outcomes (DuFour & Eaker, 1998; Stoll & Louis, 2007). Teachers and administrators are to work to continuously seek improvement and share learning. Staff acts on that learning to enhance their effectiveness and ultimately benefit students (Hord, 1997; Vescio, Ross, & Adams, 2008).

In 2011, Learning Forward published the third revision of standards that define the characteristics of effective professional learning. The standards serve as a guide to help all facets of professional learning, including planning; organization; implementation; and evaluation. The standards should be used systematically as a template for organizing professional learning. Teachers can also use the standards as a description of what they should expect from their professional learning. The seven standards include learning communities, leadership, resources, data, learning designs, implementation, and outcomes. The goal for each standard is to increase educator effectiveness and results for all students. The standards are designed to work with one another. Focusing on certain standards instead of a holistic view may contribute to poor professional learning (Killion & Crow, 2011).

While a PLC is school-based, the explosion of social media and Web 2.0 has led educators to expand their sharing and learning with educators from around the world in the form of a personal learning network (PLN). A PLN can be defined as a group of people who interact by sharing and learning from others who have the same values and goals (Nelson, 2002). Collaboration from other educators greatly increases the likelihood that changes will be carried over to the classroom (Graham, 2007). A PLC allows for collaboration within the school building and a PLN expands the collaboration throughout the world.

Summary

From the 1870 Magic Lantern slide projectors to the first computers in the 1960s to the iPads and Chromebooks of today, technology has been a part of the American education system (Dunn, 2011). Recently, technology even has been called to save education (Morella, 2014). The federal and state governments have also made technology in education a priority, with both passing legislation to ensure our students have technology integration skills. Schools have purchased increasing quantities of educational technology with many schools choosing to give each student a laptop. Today's tweens and teens are spending more time with media and technology than any other activity (Rideout, Foehr, & Roberts, 2010). The effectiveness of technology in education remains predicated on the teacher. Today's students have grown up with the technology and have technology as a badge of generational identity (Pew Research Center, 2010). Many teachers have not had this luxury and often lack the confidence to teach with technology. For effective technology integration to occur, schools must focus on methods to improve teacher technology self-efficacy through learning opportunities and professional development.

In Chapter 3, the methodology of the research study is presented, including the selection of participants; demographic data; the instruments utilized; and procedures used to conduct the study.

Chapter 3: Methodology

Introduction

The purpose of this study was to identify and examine the factors influencing teachers' technology self-efficacy. This study used data taken from a quantitative survey with the purpose of selecting participants to participate in the research. The research questions were answered with qualitative methods. A qualitative approach was used in order to explore the experiences of teachers in an authentic setting and to try to understand how they make sense of their everyday lives (Hatch, 2002). This study was carried out using a case study design. In applied fields such as education, case studies offer an attractive design (Merriam & Tisdell, 2014). Readers can take the narrative descriptions and by proxy form their own experiences and naturalistic generalizations (Stake, 1995). Additionally, the educational processes, problems, and programs can all be examined in a comprehensive view that can improve the craft (Merriam & Tisdell, 2014). Furthermore, "case study has proven particularly useful for studying educational innovations, evaluating programs, and informing policy" (Merriam & Tisdell, 2014, p. 51).

The research questions answered in this study were

1. What factors affect teachers' levels of technology self-efficacy?
2. What similarities and differences exist between and among teachers of varying technology self-efficacy levels?
3. In what ways could identified factors affecting teachers' levels of technology self-efficacy be impacted by professional learning opportunities?

Participants

The participants for this case study were full-time, certified teachers from one high school and two middle schools from a single school district located in a rural area of the southern United States. At the time of data collection, there were approximately 1,700 students at the high school and 700 students at each of the middle schools. The high school employs approximately 100 certified teachers, and each middle school employs 50 certified teachers. The schools were purposely chosen in order to gather participants from schools employing an instructional technology facilitator. School administrators from each school granted permission for the study to take place.

Instruments

The survey selected for use in this study was the CTIS developed by Wang et al. (2004). The survey was used to select the teachers to participate in the research. Permission to use the survey is available in Appendix A. The survey is available in Appendix B. The instrument is composed of 21 statements regarding the participant's confidence for technology use in the classroom. The statements all begin with the phrase, "I feel confident that . . . ." Participants were asked to state their agreement with each statement on a 5-point Likert-style scale. The scale ranges from strongly disagree to strongly agree. The CTIS was developed to be used as a pre and postsurvey measure and was used in a study to measure preservice teachers' self-efficacy beliefs for technology integration (Wang et al., 2004).

The CTIS was reviewed for content and construct validity. Due to content validity being judgmental in nature, a panel of six self-efficacy content experts was established. Each of the experts individually reviewed the materials and provided comments and suggestions. Pertinent revisions were made to the instrument. Based on these revisions, "it was believed that the content validity of the instrument was convincing" (Wang et al., 2004, p. 235). The empirical nature of the construct validity led to a factor analysis being performed on both presurvey and postsurvey data to identify subsets of items that could be grouped together to form factors. The factor analysis was just exploratory. In order to determine reliability, Cronbach alpha coefficients were calculated on presurvey and postsurvey data. The Alpha coefficients of .94 for presurvey and .96 for postsurvey combined with the factor analysis suggest the instrument "exhibited construct validity," was "highly reliable," and "holds promise for its use in further research" (Wang et al., 2004, p. 236).

In qualitative research, interviews are often utilized to help understand meaning of the central themes of a subject's lived world and to gain access to their personal experiences (Kvale, 2008). Interviews in this study were conducted to gather opinions, beliefs, personal feelings, and experiences with regard to their classroom technology integration. The interviews consisted of 20 questions developed by the researcher (Appendix C). Bandura (1995) identified four factors affecting self-efficacy: experience, vicarious experience, social persuasion, and physiological factors. Knowing this, several of the interview questions were asked to address these factors. Additionally, the interview questions were peer reviewed by the dissertation committee. The interview questions were also field tested to remove ambiguity from the questions. Information gained from the interviews was used to respond to all three research questions.

Focus groups were conducted for a deeper exploration of the themes that emerged from the one-on-one interviews. The purpose of the focus groups was to help the participants clarify and further explore their beliefs. Focus groups utilized a group setting, and participants were encouraged to talk among themselves. This included asking other participants questions, sharing stories and experiences, and commenting on each other's points of view (Kitzinger, 1995). The focus-group questions were used to help answer the second and third research questions (Appendix D). The focus-group questions were peer reviewed by the dissertation committee.

A document analysis, a systematic review of both printed and electronic material, was conducted to provide a second source of evidence (Bowen, 2009). The primary focus of the document analysis was to examine what technology self-efficacy factors could be impacted by professional development and learning opportunities. The document analysis was used to help answer the third research question.

Procedures

In order to identify the participants from each school, the CTIS developed by Wang et al. (2004) was administered to all full-time certified teachers. Results from the survey were quantified to aid in identifying the teachers who became part of the study. Once teachers completed the survey, the interquartile range was calculated. Six teachers were selected at each of the middle schools, and nine teachers were selected from the high school. An equal amount of teachers were selected from each of the calculated technology self-efficacy quartiles. No other factors were used to help aid the selection of teachers; this includes gender, age, and years of experience.

The CTIS was sent via the school district's email system to all full-time certified teachers' school email addresses after a faculty meeting. The meeting and email included an overview and purpose of the study and survey. The survey was included as a link. Teachers were asked to attach their name to the survey to aid in contacting them should they wish to be invited to participate. Teachers had approximately two weeks to complete the survey. Teachers were also notified of their right to not participate.

Upon completion of the CTIS, the results were examined to eliminate any incomplete or invalid surveys. The remaining valid surveys were quantified into the interquartile range and categorized into three separate levels: low technology self-efficacy, medium technology self-efficacy, and high technology self-efficacy. The levels of technology self-efficacy were determined by the total score on the individual teacher surveys. Data from the survey were not used directly to answer the research questions but instead provide the capacity to identify participants to continue in the study.

The results of the survey were quantified and aided in identifying the teachers who became a part of the study. The study encompassed multiple sites and multiple subjects. This helped provide a wider range of data and more meaningful results. Additionally, multiple forms of data collection were used throughout the study, including interviews and focus groups. Combining these sources of data provided a more comprehensive picture of classrooms and factors influencing a teacher's technology self-efficacy. Lists of names were compiled of potential participants at each level. The list was randomized, and the first person in each level was contacted via email. Participation in this study was strictly voluntary. If a teacher declined to participate, the next teacher on the list was asked. This process repeated until each school had three willing participants with one participant in each technology self-efficacy level group.

Once the 21 participants were identified and agreed to participate, interviews were scheduled. These interviews were face-to-face and conducted after normal working hours. The participants selected a location that was convenient for them. The interviews lasted no more than 1 hour. The interviews flowed through a set of predetermined systematic questions. The questions were framed as open-ended questions that allowed the participants the opportunity to share their personal experiences with integration of educational technology, self-efficacy, and professional learning opportunities. Written notes were taken, and audio from all interviews was digitally recorded and professionally transcribed.

Upon completion of the face-to-face interviews, three separate focus groups were convened, one at each school. This allowed additional participants at each school to exchange their views on educational technology. The focus groups took place after normal working hours at a location that was convenient for all group members. Written notes were taken, and audio from all focus groups were digitally recorded and professionally transcribed.

A document analysis was necessary to better understand the role professional development and professional learning plays in the participants' levels of technology self-efficacy. Professional development materials and school improvement plans were collected from each of the three schools. The documents were analyzed using Dedoose qualitative research analysis software to ascertain the characteristics of the technology professional development the participants have attended. The document analysis aided in answering the third research question.

Data Analysis

A variety of methods were employed to examine and interpret all data collected. According to Suter (2012),

> qualitative research, in all of its complex designs and methods of data analysis, is guided by the philosophical assumptions of qualitative inquiry: To understand a complex phenomenon, you must consider the multiple "realities" experienced by the participants themselves—the "insider" perspectives. (p. 344)

The goal of qualitative data analysis is to uncover emerging themes, patterns, concepts, insights, and understandings (Patton, 2002; Suter, 2012). Data analysis in this study attempted to discover the themes and patterns that help explain the reality of teachers' levels of technology self-efficacy.

Coding was used to extract themes from the transcripts of interviews and focus groups. Auerbach and Silverstein (2003) described coding as "a procedure for organizing the text of transcripts, and discovering patterns within that organizational structure" (p. 4). Dedoose software was purchased to assist with the management, organization, and coding of the interviews and focus-group transcripts.

This study also employed data triangulation, the combination of multiple data sources and multiple methods to study the same phenomenon (Denzin, 1978). According to Suter (2012), "by examining information collected through different methods, the researcher can corroborate findings across data sets and thus reduce the impact of potential biases that can exist in a single study" (p. 28). Additionally, triangulating the data, the researcher attempted to provide a convergence of evidence that breeds credibility (Eisner, 1998; Suter, 2012). The use of multiple sources aided in developing the comprehensive picture of factors that affect a teacher's technology self-efficacy.

Role of the Researcher

The researcher has been employed as the Chief Technology Officer for the district in which this research was performed since January 2009. Previously, after teaching for 5 years as a lateral entry eighth-grade science and math teacher, the researcher accepted a position as a Technology Facilitator and served in that role for 4½ years. In 2004, the researcher earned a Master of Arts degree in Middle Grades Education.

In conjunction with this study, the researcher reflected on his own self-identified high level of technology self-efficacy and the reasons behind it. In particular, the researcher has an aptness for mathematics, logic, and the application of information learned in one situation to other situations. These skills are critical for understanding computer functioning. In reflecting on his own level of technology self-efficacy, the researcher spent time working to understand the factors that influence others' levels of technology self-efficacy. As the technology leader for the district, understanding these factors can support strategies to increase teachers' levels of technology self-efficacy in the district, with the ultimate goal of improving students' educational experiences and achievement.

Data collection for this study involved face-to-face interviews, focus groups, and document analysis. The researcher was required to engage in these activities in order to better understand the teachers' perspectives while maintaining a low profile and allowing the teachers to interact genuinely without calling attention to himself.

Limitations and Delimitations

One limitation of this study was that only one of 115 North Carolina school districts participated. Results cannot be generalized to all North Carolina schools and districts, but particular extrapolations can be made. Case-to-case translation, or transferability, uses the findings from an inquiry applied to a different group of people or setting (Firestone, 1993). Polit and Beck (2010) argued, "the researcher's job is to provide detailed descriptions that allow readers to make inferences about extrapolating the findings to other settings" (p. 1453).

The second limitation involved the interquartile range of the CTIS and classifying the teachers by technology self-efficacy level. Depending on how the teachers responded, it was possible that the third quartile range contained teachers who could be classified at the medium level of technology self-efficacy despite being in the upper quartile. This was also possible for the first quartile and low levels of technology self-efficacy.

The final limitation involved the researcher serving as facilitator of the interviews and focus groups while also serving as a central office administrator. The participants were reminded to speak freely and honestly, but this relationship may have had limitations in the study. A delimitation of the study was the researcher only selected middle and high schools that employed an instructional technology facilitator. Therefore, results apply only for this particular school format and staff.

Summary

The purpose of this study was to explore the factors influencing teacher self-efficacy with technology integration into the classroom. By taking a qualitative approach, the researcher was able to explore the thoughts, fears, and successes of teaching with today's pressures and expectations to integrate technology. The intent for this study was to investigate and report the factors affecting teacher self-efficacy with the hope of improving technology integration in the classroom and increasing student achievement.

Chapter 4: Results

Introduction

The purpose of this study was to expand the knowledge on teachers' technology self-efficacy as it relates to integrating technology in the classroom. This study examined teachers' levels of technology self-efficacy, identified specific factors affecting their current levels of technology self-efficacy, identified the similarities and differences among teachers of varying technology self-efficacy levels, and examined the role and impact professional learning opportunities have on levels of technology self-efficacy.

The research questions to be answered in this study were

1. What factors affect teachers' levels of technology self-efficacy?
2. What similarities and differences exist between and among teachers of varying technology self-efficacy levels?
3. In what ways could identified factors affecting teachers' levels of technology self-efficacy be impacted by professional learning opportunities?

The CTIS was used to determine the teachers' technology self-efficacy level. Personal interviews, focus groups, and document analysis were preformed to answer the research questions.

Survey Results

The CTIS was sent via an email link to two middle schools and one high school to all certified teaching staff. The response rate from all three schools combined was 71.8%, with 143 of 199 certified teachers returning the survey. Middle School 1 had a response rate of 72%. The response rate of Middle School 2 was 76%. High School 1 had a response rate of 70%. In order to quantify the survey results, responses to each of the survey questions were assigned a point value ranging from 1 to 5. The following point values were assigned to each response: strongly disagree=1, disagree=2; neither agree nor disagree=3; agree=4; strongly agree=5. The interquartile range was then calculated for each school in order to form three levels of technology self-efficacy. The lower 25th percentile quartile of the scores formed the low levels of technology self-efficacy. The middle quartile formed the mid-levels of technology self-efficacy. The upper 75th percentile quartile of the scores formed the high levels of technology self-efficacy. Two teachers from each quartile were selected at both of the middle schools to participate in the interviews. Three teachers from each quartile were selected at the high school.

Middle School 1 survey results. Middle School 1 had a response rate of 72% with 35 of 50 teachers returning the survey. The lower quartile scores ranged from 55 to 70. The middle quartile scores ranged from 71 to 83. The upper quartile scores ranged from 84 to the highest score of 105. Of the survey respondents, 17.1% were male; and 82.9% were female. Half of the male respondents scored in the lower quartile, 16.7% scored in the middle quartile, and 33.3% scored in the upper quartile. Of the female respondents, 20.7% scored in the lower quartile; 72.4% scored in the middle quartile; and 6.9% scored in the upper quartile. Table 2 shows the percent of each gender that scored in each of the technology self-efficacy quartiles.

Table 2

Middle School 1 Survey Results of Self-Efficacy by Gender

Self-Efficacy Level	Male Respondents Who Scored at Level %	Female Respondents Who Scored at Level %
Lower Quartile	50.0	20.7
Middle Quartile	16.7	72.4
Upper Quartile	33.3	6.9

Age. The respondents were all within four age ranges. Seven teachers were between 25 and 34 years of age, 17 were between 35 and 44 years of age, nine were between 45 and 54 years old, and two were between the ages of 55 and 64 years of age. No teachers who responded were younger than 25 years of age or older than 56 years of age. Of the seven teachers between the ages of 25 and 34 years of age, 28.6% scored in the lower quartile; 57.1% scored in the middle quartile; and 14.3% scored in the upper quartile. Within the 35 to 44 years of age range, 37.5% scored in the lower quartile; 43.8% scored in the middle quartile; and 18.8% scored in the upper quartile. Of the nine teachers who were between 45 and 54 years of age, 66.7% scored in the lower quartile; 22.2% scored in the middle quartile; and 11.1% scored in the upper quartile. Table 3 shows the percent of each age range in each technology self-efficacy quartile.

Table 3

Middle School 1 Survey Results of Self-Efficacy by Age

Self-Efficacy Level	25 to 34 years of Age Respondents Who Scored at Level %	35 to 44 years of Age Respondents Who Scored at Level %	45 to 54 years of Age Respondents Who Scored at Level %
Lower Quartile	28.6	37.5	66.7
Middle Quartile	57.1	43.8	22.2
Upper Quartile	14.3	18.8	11.1

Experience. The respondents from Middle School 1 represented nearly all experience levels, from first year teachers (5.7% of the respondents) to those with 26 to 30 years of experience (2.9%). The survey was dominated by those teachers with 1 to 5 years of experience and those with 11 to 15 years of experience; 28.6% of the teachers in each range. Teachers with 16 to 20 years of experience made up 20% of the respondents. Teachers with 6 to 10 years of experience made up 11.4% of the respondents. Finally, 2.9% of the respondents were teachers with 21 to 25 years of experience. Table 4 shows the percent of each experience level that completed the survey.

Table 4

Middle School 1 Respondents by Experience Level

Experience Level	n	%
0 (First year teaching)	2	5.7%
1 to 5 years	10	28.6%
6 to 10 years	4	11.4%
11 to 15 years	10	28.6%
16 to 20 years	7	20%
21 to 25 years	1	2.9%
26 to 30 years	1	2.9%

Table 5 shows each experience level of survey respondents in terms of what percentage of respondents scored at each self-efficacy level.

Table 5

Middle School 1 Survey Results of Self-Efficacy by Experience Level

Self-Efficacy Level	0 (First year teaching) experience Who Scored at Level %	1 to 5 years of experience Who Scored at Level %	6 to 10 years of experience Who Scored at Level %	11 to 15 years of experience Who Scored at Level %	16 to 20 years of experience Who Scored at Level %	21 to 25 years of experience Who Scored at Level %	26 to 30 years of experience Who Scored at Level %
Lower Quartile	50	0	50	30	28.6	0	100
Middle Quartile	0	70	25	40	57.1	100	0
Upper Quartile	50	30	25	30	14.3	0	0

Middle School 2 survey results. Middle School 2 had a response rate of 76% with 38 of the 50 teachers returning the survey. The lower quartile scores ranged from the minimum score of 51 to 75. The middle quartile ranged from 76 to 82.75. The upper quartile ranged from 83 to the top score of 105. Of the respondents, 18.5% were males; and 81.5% were female. Of the seven male respondents, one (14.3%) was in the lower quartile; four (57.1%) were in the middle quartile; and two (28.6%) were in the upper quartile. Examining the female respondents, 32.3% were in the lower quartile; 41.9% were in the middle quartile; and 25.8% were in the upper quartile. Table 6 shows the percent of each gender that scored in each of the technology self-efficacy quartiles.

Table 6

Middle School 2 Survey Results of Self-Efficacy by Gender

Self-Efficacy Level	Percent of Male Respondents Who Scored at Level %	Percent of Female Respondents Who Scored at Level %
Lower Quartile	14.3	32.3
Middle Quartile	57.1	41.9
Upper Quartile	28.6	25.8

Age. The respondents from Middle School 2 fell within four age ranges, 25 to 34 years of age, 35 to 44 years of age, 45 to 54 years of age, and 55 to 64 years of age. Eight teachers classified themselves between the ages of 25 to 34 years old. Of those eight teachers, 25% were in the lower quartile; 62.5% were in the middle quartile; and 12.5% were in the upper quartile. Thirteen teachers classified themselves between the ages of 35 and 44 and the distribution between the quartiles was nearly even. Five (38.5%) teachers fell in the lower quartile, while the middle and upper quartile each had four (30.8%) teachers. Ten teachers were between 45 and 54 years of age with 20% in the lower quartile and 40% in both the middle and upper quartile. The oldest age range at Middle School 2, 55 to 64 years of age, included seven teachers. Of those seven teachers, 28.6% were in the lower quartile; 57.1% in the middle quartile; and 14.3% in the upper quartile. Table 7 shows the percent of each age range in each technology self-efficacy quartile.

Table 7

Middle School 2 Survey Results of Self-Efficacy by Age

Self-Efficacy Level	25 to 34 years of Age Respondents Who Scored at Level %	35 to 44 years of Age Respondents Who Scored at Level %	45 to 54 years of Age Respondents Who Scored at Level %	55 to 64 years of Age Respondents Who Scored at Level %
Lower Quartile	25	38.5	20	28.6
Middle Quartile	62.5	30.8	40.0	57.1
Upper Quartile	12.5	30.8	40.0	14.3

Experience. The respondents from Middle School 2 represented all experience levels. There was a single first-year teacher, a single teacher with 21 to 25 years of experience, and a single teacher with over 30 years of experience. Eight respondents taught between 1 and 5 years. Four respondents taught between 6 and 10 years. There were 10 respondents in the 11 to 15 and 16 to 20 years of experience range. Finally, three teachers had 26 to 30 years of experience. Table 8 shows the percent of each experience level that completed the survey.

Table 8

Middle School 2 Respondents by Experience Level

Experience Level	N	%
0 (First year teaching)	1	2.6%
1 to 5 years	8	21.1%
6 to 10 years	4	10.5%
11 to 15 years	10	26.2%
16 to 20 years	10	26.2%
21 to 25 years	1	2.6%
26 to 30 years	3	7.9%
30+ years	1	2.6

Table 9 shows each experience level of survey respondents in terms of what percentage of respondents scored at each self-efficacy level.

Table 9

Middle School 2 Survey Results of Self-Efficacy by Experience Level

Self-Efficacy Level	0 (First year teaching) experience Who Scored at Level %	1 to 5 years of exper-ience Who Scored at Level %	6 to 10 years of exper-ience Who Scored at Level %	11 to 15 years of exper-ience Who Scored at Level %	16 to 20 years of exper-ience Who Scored at Level %	21 to 25 years of exper-ience Who Scored at Level %	26 to 30 years of exper-ience Who Scored at Level %	30+ years of experi-ence Who Scored at Level %
Lower Quartile	0	37.5	25	40	20	0	33.3	0
Middle Quartile	100	50	75	40	40	100	0	0
Upper Quartile	0	12.5	0	20	40	0	66.7	100

High School 1. High School 1 had a response rate of 70% with 69 of the 99 certified teachers returning the survey. The lower quartile scores ranged from the minimum score of 46 to 73. The middle quartile ranged from 74 to 83. The upper quartile had a range from 84 to the top score of 105. When broken down by gender, 37% of the respondents were male, and 63% were female. Within the male respondents, 20% scored in the lower quartile; 64% scored in the middle quartile; and 16% scored in the upper quartile. When examining female respondents, 30.2% were in the lower quartile; 44.2% were in the middle quartile; and 25.6% were in the upper quartile. Table 10 shows the percent of each gender that scored in each of the technology self-efficacy quartiles.

Table 10

High School 1 Survey Results of Self-Efficacy by Gender

Self-Efficacy Level	Male	Female
	%	%
Lower Quartile	20	30.2
Middle Quartile	64	44.2
Upper Quartile	16	25.6

Age. High School 1 had respondents from all six age ranges. A single teacher classified herself in the range of 18 to 24 years of age; she scored in the middle quartile. Thirteen respondents were between the ages of 25 to 34 years, two (15.4%) scored in the lower quartile, eight (61.5%) in the middle quartile, and three (23.1%) in the upper quartile. A total of 16 respondents we between 35 and 44 years of age; three (18.8%) scored in the lower quartile, seven (43.8%) scored in the middle quartile, and six (37.5%) scored in the upper quartile. The age range of 45 to 54 years had the most respondents with 23. Of those, eight (34.8%) scored in the lower quartile; 11 (47.8%) scored in the middle quartile; and four (17.4%) scored in the upper quartile. Eleven respondents were between 5 to 64 years of age. Four (36.4%) scored in the lower quartile, six (54.5%) scored in the middle quartile, and one (9.1%) scored in the upper quartile. Finally, three respondents were above 64 years of age. The three respondents were evenly distributed among the quartiles. Table 11 shows the percent of each age range in each technology self-efficacy quartile.

Table 11

High School 1 Survey Results of Self-Efficacy by Age

Self-Efficacy Level	18 to 24 years of Age Respondents Who Score at Level %	25 to 34 years of Age Respondents Who Scored at Level %	35 to 44 years of Age Respondents Who Scored at Level %	45 to 54 years of Age Respondents Who Scored at Level %	55 to 64 years of Age Respondents Who Scored at Level %	65 + years of Age Respondents Who Scored at Level %
Lower Quartile	0	15.4	18.8	34.8	36.4	33.3
Middle Quartile	100	61.5	43.8	47.8	54.5	33.3
Upper Quartile	0	23.1	37.5	17.4	9.1	33.3

Experience. The respondents from High School 1 represented all experience levels. There were four first-year teachers. The majority of the respondents, 15, had 1 to 5 years of experience. Eleven respondents had 6 to 10 years of experience, and 10 had 11 to 15 years of experience. Thirteen respondents had between 16 and 20 years of experience. Teachers with 21 to 25 years of experience accounted for five respondents. Eight respondents had 26 to 30 years of experience. Finally, two teachers had over 30 years of experience. Table 12 shows the percent of each experience level that completed the survey.

Table 12

High School 1 Respondents by Experience Level

Experience Level	n	%
0 (First year teaching)	4	5.9
1 to 5 years	15	22.1
6 to 10 years	11	16.2
11 to 15 years	10	14.7
16 to 20 years	13	19.1
21 to 25 years	5	7.4
26 to 30 years	8	11.8
30+ years	2	2.9

Table 13 shows each experience level of survey respondents in terms of what percentage of respondents scored at each self-efficacy level.

Table 13

High School 1 Survey Results of Self-Efficacy by Experience Level

Self-Efficacy Level	0 (First year teaching) Exp Who Scored at Level %	1 to 5 years of Exp Who Scored at Level %	6 to 10 years of Exp Who Scored at Level %	11 to 15 years of Exp Who Scored at Level %	16 to 20 years of Exp Who Scored at Level %	21 to 25 years of ExpWho Scored at Level %	26 to 30 years of Exp Who Scored at Level %	30+ years of Exp Who Scored at Level %
Lower Quartile	25	20	27.3	40	23.1	40	25	0
Middle Quartile	25	53.3	63.6	30	61.5	40	50	100
Upper Quartile	50	26.7	9.1	30	15.4	20	25	0

Interviews

Twenty-one interviews were conducted from teachers in three schools in the same district, two middle schools and one high school. Six interviews were conducted at each middle school. This allowed for two interviews per technology self-efficacy quartile at each middle school. Due to the larger staff at the high school, nine interviews were conducted. This allowed for three interviews per technology self-efficacy quartile. The quartile results from the CTIS were used to create lists of potential interview participants. Three lists were created for each school, one for each quartile. Each list was then randomized using a list randomizer. For the middle schools, the first two teachers from each quartile were asked to participate in an interview. For the high school, the first three teachers from each quartile were invited to participate. If for any reason a teacher declined an interview, the next teacher was then invited to participate. In the end, six teachers were interviewed at each middle school, and nine teachers at the high school. Table 14 provides a list of the interview participants along with their demographic information.

Table 14

Interview Participants with School, Gender, Age Range, Experience, CTIS Score, and Technology Self-Efficacy

Participant	School	Gender	Age Range Years	Experience Range Years	CTIS Score	Quartile
Teacher A	Middle School 1	Female	45-54	0	66	Low
Teacher B	Middle School 1	Female	35-44	16-20	68	Low
Teacher C	Middle School 1	Male	35-44	11-15	71	Middle
Teacher D	Middle School 1	Female	35-44	11-15	84	Middle
Teacher E	Middle School 1	Male	35-44	11-15	102	Upper
Teacher F	Middle School 1	Male	35-44	16-20	103	Upper
Teacher G	Middle School 2	Female	55-64	16-20	51	Low
Teacher H	Middle School 2	Female	35-44	1-5	75	Low
Teacher I	Middle School 2	Female	25-34	6-10	81	Middle
Teacher J	Middle School 2	Male	55-64	11-15	77	Middle
Teacher K	Middle School 2	Female	35-44	16-20	103	Upper
Teacher L	Middle School 2	Female	35-44	11-15	83	Upper
Teacher M	Middle School 2	Female	45-54	11-15	62	Low
Teacher N	High School 1	Female	45-54	11-15	57	Low
Teacher O	High School 1	Female	65-74	6-10	73	Low
Teacher P	High School 1	Female	35-44	16-20	82	Middle
Teacher Q	High School 1	Male	35-44	6-10	79	Middle
Teacher R	High School 1	Female	25-34	1-5	87	Upper
Teacher S	High School 1	Female	45-54	21-25	100	Upper
Teacher T	High School 1	Male	45-54	11-15	83	Middle
Teacher U	High School 1	Female	35-44	11-15	104	Upper

Each interview was scheduled at the time and location that best suited the participant, typically at the participant's home school. A total of 10 questions (Appendix C) were asked. The first two questions were personal background questions. The remaining eight questions were focused interview questions used to answer the research questions.

Focus Groups

Upon completion of the personal interviews, focus groups were convened. The focus groups were limited to six participants. The participant list was built on teachers who agreed to participant in the interview and focus group or focus group only. The list was randomized and participant invitations were extended. If for any reason a teacher declined to participant in the focus group, the next teacher was then invited to participate. Focus Group 1 at Middle School 1 consisted of four teachers. Focus Group 2 at Middle School 2 consisted of three teachers. Focus Group 3 at High School 1 consisted of four teachers. At total of 11 teachers participated in the focus groups.

Table 15

Focus-Group Participants with School, Gender, Age Range, Experience, CTIS Score, and Technology Self-Efficacy

Participant	School	Gender	Age Range Years	Experience Range Years	CTIS Score	Quartile
Teacher F	Middle School 1	Male	35-44	16-20	103	Upper
Teacher V	Middle School 1	Female	35-44	11-15	84	Middle
Teacher W	Middle School 1	Female	35-44	16-20	84	Middle
Teacher X	Middle School 1	Female	35-44	0	87	Upper
Teacher H	Middle School 2	Female	35-44	1-5	75	Low
Teacher Y	Middle School 2	Female	55-64	16-20	78	Middle
Teacher Z	Middle School 2	Female	35-44	11-15	78	Middle
Teacher T	High School 1	Male	45-54	11-15	83	Mid
Teacher U	High School 1	Female	35-44	11-15	104	Upper
Teacher AA	High School 1	Female	35-44	16-20	97	Upper
Teacher AB	High School 1	Female	45-54	26-30	93	Upper

Each focus group was scheduled based on a time and location that best suited all participants and was conducted at their home school. A total of six questions (Appendix D) were asked. The first two questions were background questions. The remaining four questions were specific questions used to answer the research questions.

Analysis Process

Upon completion of both personal interviews and focus groups, the audio was professionally transcribed. Transcripts were then qualitatively coded using Dedoose software. Open coding was completed on each of the transcripts. Open coding allowed for ideas or concepts to emerge from the data. These concepts were later grouped into thematic categories.

Research Question 1

What factors affect teachers' levels of technology self-efficacy? Two major categories emerged from the coding that classifies the factors that affect a teacher's level of technology self-efficacy. The first category was site-based factors. Included in this category are factors that are influenced by the participant's home school or home school district. The second category was personal factors. This category includes factors that are related to the participant's personal life or factors from school districts other than the participant's home school district. Two or more participants expressed all identified factors. Research Question 2 discusses the similarities and differences of the identified factors between teachers of varying technology self-efficacy levels.

Site-based factors. Site-based factors can further be broken down into two smaller categories. First are the people who are part of the school or district. This would include peer teachers, additional school staff, district staff, and students. The second category was things related to the school building, operations, or resources. This includes student access to computers, connectivity, the operation and setup of the school, and the culture. Table 16 shows the numbers of the count of interviews where the factor was identified and the percent of participants who mentioned the factor.

Table 16

Site Based Factors Count and Percentage

Factor	n	%
Peer Teachers (Support)	17	80.1
Peer Teachers (Barrier)	3	14.3
Instructional Technology Facilitator (Support)	15	71.4
Academic Coach (Support)	6	28.6
School Administrators (Support)	5	23.8
Media Coordinators (Support)	3	14.3
District Staff (Support)	5	23.8
Students (Support)	2	9.5
Technical Glitches (Barrier)	12	57.1
Technical Setup (Barrier)	3	14.3
Lack of Time (Barrier)	10	47.6

The influence of peer teachers was the most heavily mentioned factor identified. Peer teachers were coded in 17 of the 21 participant interviews. Peer teachers' support included everything from team teaching, collaborating on lessons, to borrowing computers. In his personal interview, Teacher P stated,

> Another teacher I worked with was very good at the computer technology stuff, and she helped me a lot. I think it was more motivation because I saw technology being used first hand. I had that experience, and I was able to work along with her. So just having that real life experience, a real time experience, working, and just having somebody to collaborate with. What worked, what didn't. How can we do this better next time kinds of things. (personal communication, October 8, 2015)

However, not every peer teacher experience is positive. Two participants mentioned the negative effect peer teachers have. For example, Teacher L stated, "when you're excited about something, and you share it, and they're [peer teachers] like, 'Ah, I'm not going to use that. That won't work'" (personal communication, September 17, 2015). Table 17 shows the number of times in which peer teachers were coded and the percent coded by technology self-efficacy quartile.

Table 17

Peer Teacher Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	N	%	n	%	n	%
Peer Teacher Support	9	33.3	8	37.5	7	29.2
Peer Teacher Barrier	0	0	1	25	3	75

The instructional technology facilitator was another identified people-related factor. Fifteen of the 21 interview participants mentioned the importance of this position in the school. Teacher T summarized their role: "Anytime I have a question about how to use something, they are very quick to help me with the question. And they're also innovative" (personal communication, September 30, 2015). While Teacher U stated, "probably the best working relationship would be kind of like what [the instructional technology facilitator and I had at [Middle School 1]" (personal communication, September 22, 2015). Table 18 shows the number of times in which instructional technology facilitator was coded and the percent coded by technology self-efficacy quartile.

Table 18

Instructional Technology Facilitator Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Instructional Technology Facilitator Support	8	36.4	7	31.8	7	31.8

Additional school-based staff and district-level staff was a third people-related identified factor. Six participants mentioned academic coaches. Academic coaches are master-level teachers who help coach other teachers in a certain subject area. Teacher N said this about the academic coaches: “they have been a good support system in different ways of doing things with technology and without” (personal communication, October 12, 2015). Six participants mentioned technology technicians. Teacher G stated, “when you have a tech person that can answer the phone and help you with something or come to your room and figure out why this mouse pad isn’t working, those are supportive, in a very tangible way” (personal communication, October 1, 2015). Five participants mentioned school administrators as a support. Three participants also cited school media coordinators as a support. Finally, five participants also identified the district-level staff and administrators as a positive factor. Table 19 shows the number of times in which additional school and district personnel were coded and the percent coded by technology self-efficacy quartile.

Table 19

Additional School and District Personnel Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	N	%	n	%	N	%
Academic Coaches Support	5	55.6	3	33.3	1	11.1
Technology Technician Support	3	37.5	3	37.5	2	25
School Administrators Support	1	20	1	20	30	60
Media Coordinators Support	1	25	0	0	3	75
District Level Personnel Support	2	40	1	20	2	40

Students were a support factor identified by two participants. Teacher M stated this about learning from students,

> I have learned a lot from students. There's some technology out there that's new, and I don't get on it as much as they do, so like with the timeline [project], a couple of my students have introduced me on how they're going to do this project, and I find it interesting. (personal communication, September 18, 2015)

While teacher B shared, "going back to children or kids that we teach, I think sometimes they have [an] impact" (personal communication, September 16, 2015). Table 20 shows the number of times in which students were coded and the percent coded by technology self-efficacy quartile.

Table 20

Students Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Student Support	2	100	0	0	0	0

Finally, five participants mentioned their own lack of knowledge having a negative impact on their instructional use of technology. Teacher F stated, "a lack of knowledge of what's out there to be used" (personal communication, September 16, 2015). Teacher O also shared the same sentiment:

> There's so much out there too. And that's another problem. What works the best, trying to figure out what would work the best in the classroom, and they do a lot of different types of things, and they all look wonderful, but just actually figuring out what should I use, is a hard thing. (personal communication, September 16, 2015)

Several participants shared in their personal interviews or in the focus groups the overwhelming amount of educational technology resources that are available on the web and shared during professional learning opportunities that they have attended.

The second subcategory of site-based factors centered around the school building and its operation. These factors included technical glitches and setup, lack of time, and the culture in the school building.

Technical glitches and the setup of classroom technology were identified as a barrier by 12 of the participants. This is a broad factor that can include many different components. Several participants mentioned issues with the internet. Teacher D stated, "sometimes I have this great lesson plan, and the internet crashes. Or that particular website will not work, so I don't know what alternative route to take" (personal communication, October 12, 2015). While Teacher C plainly stated, "there's always downtime" (personal communication, September 17, 2015). Other times, the internet may be running but certain websites are down, as Teacher T stated, "sometimes the website just won't load for the kids" (personal communication, September 30, 2015). Computer software can also be the cause of the issue. Teacher C also stated, "the computer software doesn't match up with the newer stuff" (personal communication, September 17, 2015). Finally, teachers sometimes are not able to identify the exact reason for the issue. Teacher G stated, "glitches and things like that can drive you crazy when you're trying to get through an activity, and then can't do it" (personal communication, October 1, 2015). While Teacher P stated, "sometimes you plan it out, and it works, and then when you get in the classroom, something doesn't work" (personal communication, October 8, 2015).

Three participants claimed how the technology in the classroom is setup hinders their ability to integrate instructional technology. Teacher C commented about the technology setup of his room:

> The setup of the . . . , once you set up a big screen in your classroom, you know a lot of times you'll have a maintenance man that sets up the screen, and he doesn't ask you where you wanted it. So now you have a classroom that's set up incorrectly. (personal communication, September 17, 2015)

Table 21 shows the number of times in which factors related to the school building and its operation were coded and the percent coded by technology self-efficacy quartile.

Table 21

School Building and Operation Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Technical Glitches Barrier	2	15.4	7	53.8	4	30.8
Technology Setup Barrier	2	66.7	1	33.3	0	0

Lack of time was another factor identified by 10 of the participants. Participants also identified lack of time as a personal factor as well as a site-based factor. Most participants gave nonspecific lack of time answers. For example, Teacher K stated, “I feel like we don’t have time. Teachers don’t have time to turn around” (personal communication, September 23, 2015); while two participants felt their time was limited due to the number of different class subjects for which they had to prepare and plan. Teacher Q stated, “I feel stretched thin because I teach 3 preps in a given day, which doesn’t allow me to be as innovative as I’d like to be” (personal communication, October 5, 2015). Paperwork was another factor that impacted teacher time. Teacher O stated, “all the special ed paperwork . . . it takes a lot of time” (personal communication, September 16, 2015). Table 22 shows the number to times lack of time was coded and percentage by technology self-efficacy quartile.

Table 22

Lack of Time Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Lack of Time	5	55.6	1	11.1	3	33.3

The final category of site-based factors can be described as the culture of the school. Two participants mentioned the freedom or safety they feel to try new things. Teacher U stated, "[Administrators] give me a lot of freedom to do those things" (personal communication, September 22, 2015). Teacher L commented, "If there's a workshop or something new, our administration is good about letting us try new things" (personal communication, September 17, 2015). The data technology has provided for discussions in PLCs was voiced by a participant. Again Teacher L stated, "its given us data to use [in PLC meetings]." Table 23 shows the number to times culture was coded and percentage by technology self-efficacy quartile.

Table 23

Culture Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	N	%	n	%	n	%
Culture Support	0	0	0	0	3	100

Personal factors. The second major categories of factors influencing a teacher's' technology self-efficacy was personal-related factors. These factors can be classified into three smaller categories. These categories include people, social media, and personal smart phone. Table 24 shows the numbers of the total number of interviews in which the factor was identified and the percent of participants who mentioned the factor.

Table 24

Personal Factors Count and Percentage

Factor	n	%
Peer Teachers Outside of District (Support)	6	28.6
Spouse (Support)	3	14.3
Younger Family Member (Support)	4	19.0
Social Media Personal Use	7	33.3
Social Media Professional Use (Support)	6	28.6
Smartphone	12	57.1

People outside of the school or district was an important factor in the participants use of instructional technology if the classroom. Included in this category are spouses, younger family members, and peer teachers from other districts. People were mentioned in 13 of the participant interviews. Peer teacher from other districts was the most heavily mentioned during the personal interviews. Teacher R stated, “I talked to one of the teachers I know across the state that uses [Chromebooks], and she tells me ideas, and then I go play with it for a while.” Four participants mentioned instructional technology support from a younger family member. Teacher N referred to her daughter in the personal interview, “my daughter tells me about a lot. So different applications that the students may be using, typically she’s the one to tell me about it, because I don’t discover them on my own” (personal communication, October 12, 2015). Finally the participant’s spouses also provided external support. Teacher K stated this about her spouse:

> My husband, he’s my go to person. He understands systems that I don’t, in ways that I don’t. You know, I’ll say, “I need to make a movie,” and he knows exactly

what to do. He's my tech person at home. (personal communication, September 23, 2015)

Table 25 shows the number of times in which different people were coded and the percent coded by technology self-efficacy quartile.

Table 25

Personal Factors People Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Peer Teacher Outside District Support	1	16.7	3	50	2	33.3
Spouse Support	0	0	0	100	3	100
Younger Family Member Support	3	75	0	0	1	25

Social media was identified as an external personal-related factor. Social media was used in both a professional manner and a personal manner. When used in a personal manner, most participants used it for communication with family. Teacher I stated this about her social media usage, "I use my Facebook page to talk to my parents and other relatives" (personal communication, October 12, 2015). Teacher U described her professional use of social media:

> Using Twitter I feel like I'm still connected to people. I try to connect professionally with people who are blogging about it, and who are posting things about it. I feel like there are certain people that I watch, and know that they understand technology the way that should be used in education. So I watch what they say, and if they post something then I'll look at that. (personal

communication, September 22, 2015)

Table 26 shows the number of times in which social media was coded and the percent coded by technology self-efficacy quartile.

Table 26

Social Media Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Social Media Personal Use	3	37.5	4	50	1	12.5
Social Media Professional Use (Support)	1	14.3	4	57.1	2	28.6

Smart phones were also identified as an external personal factor. While not specifically asked about, 12 participants mentioned smartphones. When asked about using technology outside of education, Teacher K stated, “the most simple way is my phone. I can’t live without my phone” (personal communication, September 23, 2015). Smartphone use was mentioned for personal use, as Teacher L stated,

> For instance, we went to Disney in November, the apps for your phone, telling you when the princesses are going to be at certain places, things like that that just really make your life easier that you don’t think about. (personal communication, September 17, 2015)

Teacher C shared his insight to smartphones in the education setting:

> Well, for one I’m sympathetic with kids that are on their phone, because if you can’t get adults to get off your phone in a seminar, it’s amazing to me how teachers can get mad at kids, and then we have a teachers’ meeting and none of

> the adults can get off their phone. I really think as we get further along and more and more people have smart phones and whatnot, that more and more classes will be based around different things that everybody can do on their phone together. I mean really people haven't come to the realization that the phone is a minicomputer in their hand yet, but that's basically what it is. (personal communication, September 17, 2015)

Participants also mentioned smartphones while not actually owning one: "No iPhone, I don't want the data bill" (Teacher G, personal communication, October 1, 2015). Teacher A stated, "I still have a flip phone, so I'm sort of a dinosaur with phones" (personal communication, September 17, 2015). Table 27 shows the number of times in which smartphones were coded and the percent coded by technology self-efficacy quartile.

Table 27

Smartphone Code Count and Percentage by Technology Self-Efficacy Quartile

Factor	Lower Quartile		Middle Quartile		Upper Quartile	
	n	%	n	%	n	%
Smartphone (Support)	4	26.7	3	20	8	53.3

The factors that influence a teacher's technology self-efficacy emerged from personal interviews, focus groups, and professional development document analysis. These factors were classified into two major categories, site-based factors and personal factors. Site-based factors were factors related to the participant's home school or district. Personal factors were factors that were outside of the school or district.

People proved the most significant support factor, mentioned in both site-based factors and personal factors.

Research Question 2

What similarities and differences exist between and among teachers of varying technology self-efficacy levels? The second research question addressed how the similarities and differences of the identified factors exist between and among teachers of varying technology self-efficacy levels. The factors were identified through the open coding of the personal interview transcripts and examined on the individual's technology self-efficacy quartile as determined by the CTIS results.

The most emphatic theme identified throughout all of the interviews and focus groups was the positive impact of people. This included people present in the participant's home school or district, relatives, and connections for other districts. When examining people who were part of the school district, it was coded nearly even across levels of teacher technology self-efficacy. It was cited by both lower and upper levels of technology self-efficacy 35.1% of the time. The middle quartile of technology self-efficacy expressed it 29.9% of the time. Figure 1 depicts the percent site-based people were coded as a support by technology self-efficacy level among those participants who mentioned it.

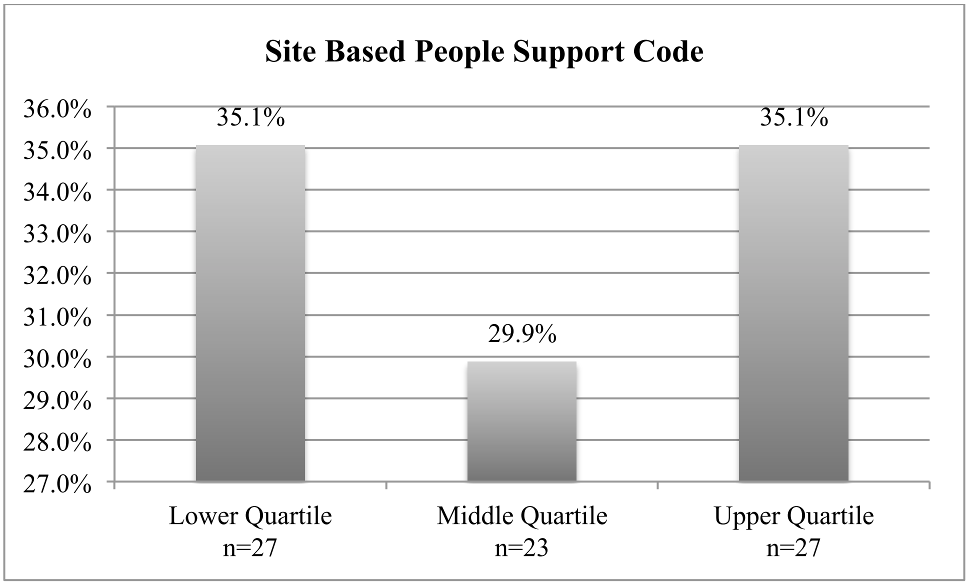

Figure 1. Site-Based People Support Code.

The distribution remained nearly even at all technology self-efficacy when examining the support of the instructional technology facilitator. The impact of the instructional technology facilitator was cited by teachers with low levels of technology self-efficacy 36.4% of the time. Teachers at the middle and upper ranges of technology self-efficacy mentioned the instructional technology facilitator 31.8% of the time. Figure 2 depicts the percent the instructional technology facilitator was coded by technology self-efficacy level among those participants who mentioned it.

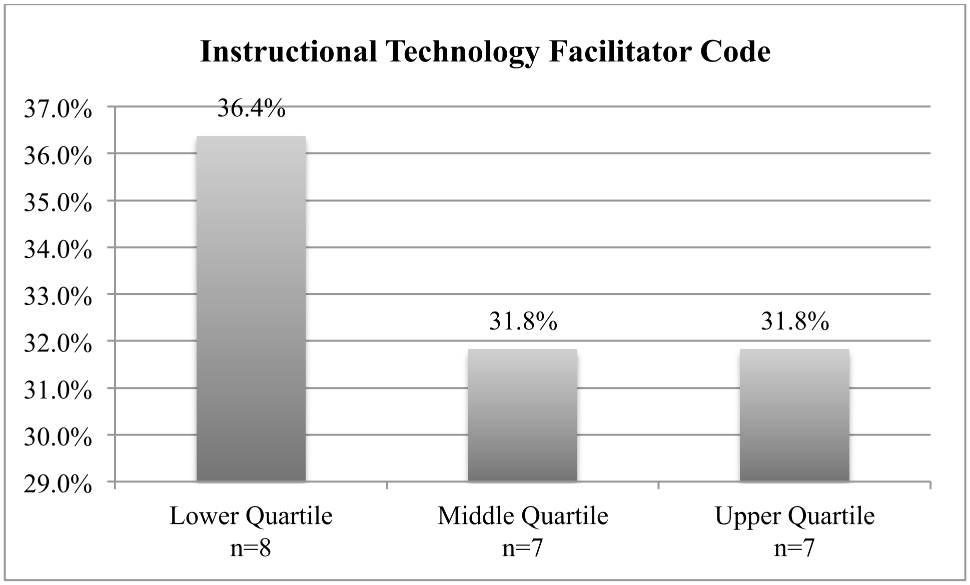

Figure 2. Instructional Technology Facilitator Code.

The even distribution remained nearly even at all technology self-efficacy levels when specifically looking at support by peer teachers. Each quartile mentioned peer teachers around a third of the time. Figure 3 depicts the percent peer teachers were coded by technology self-efficacy level among those participants who mentioned it.

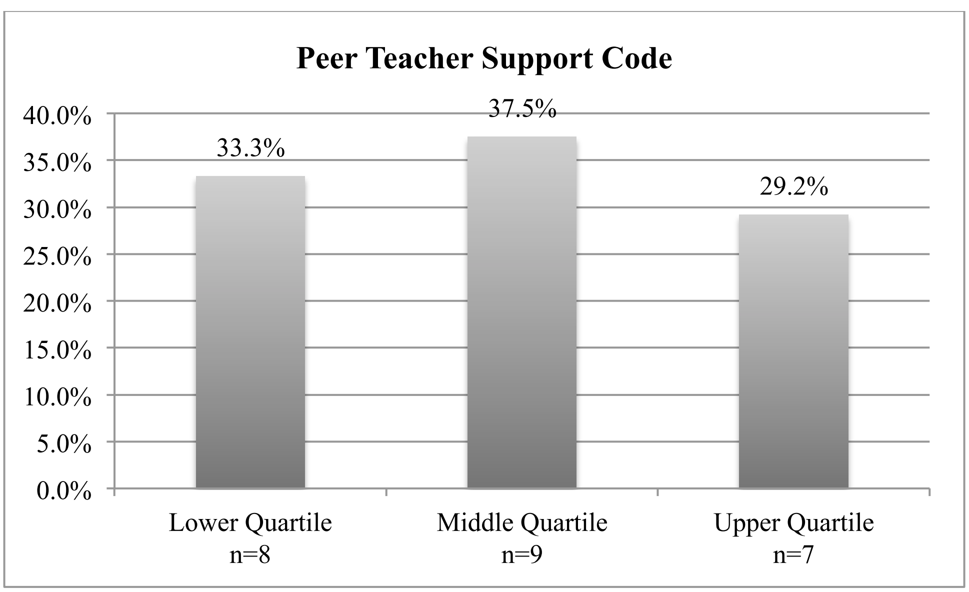

Figure 3. Peer Teacher Support Code.

However, differences emerge when you look at the negative impact, or barrier, peer teachers can have. Among those who mentioned the negative impacts from peer teachers, 75% were from the upper quartile of technology self-efficacy. The middle quartile accounted for the other 25% of negative peer teacher mentions. No one from the lower quartile mentioned the impact of negative peer teachers. Figure 3 depicts the percent peer teachers as a barrier was coded by technology self-efficacy level among those participants who mentioned it.

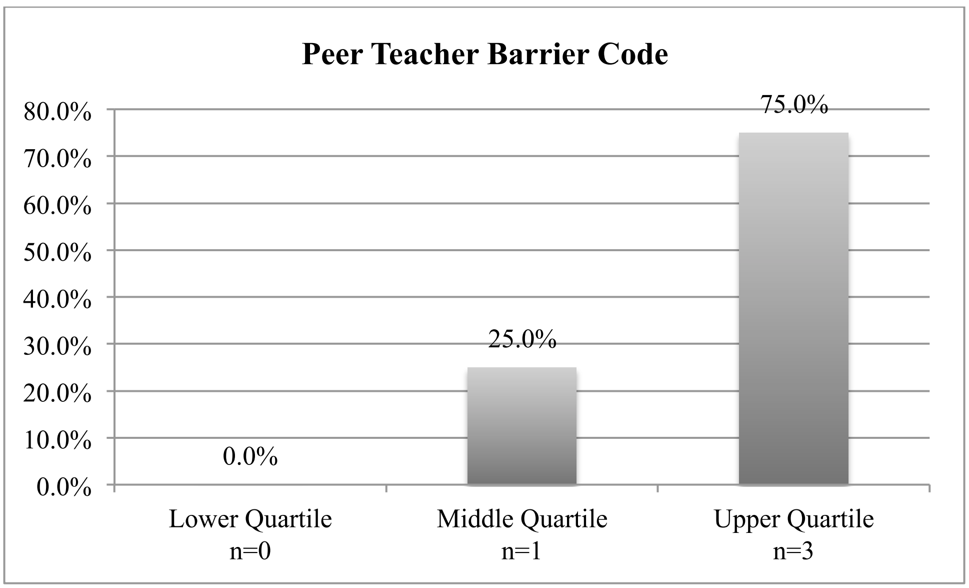

Figure 4. Peer Teachers Barrier Code.

Differences can also be found in the various other internal staff roles. The support of the academic coaches had the biggest impact with teachers of low technology self-efficacy, mentioned 55.6% of the time. The middle and upper ranges of teacher technology self-efficacy cited academic coaches 33.3% and 11.1% of the time. Figure 5 depicts the percent an academic coach was coded for support by technology self-efficacy level among those participants who mentioned it.

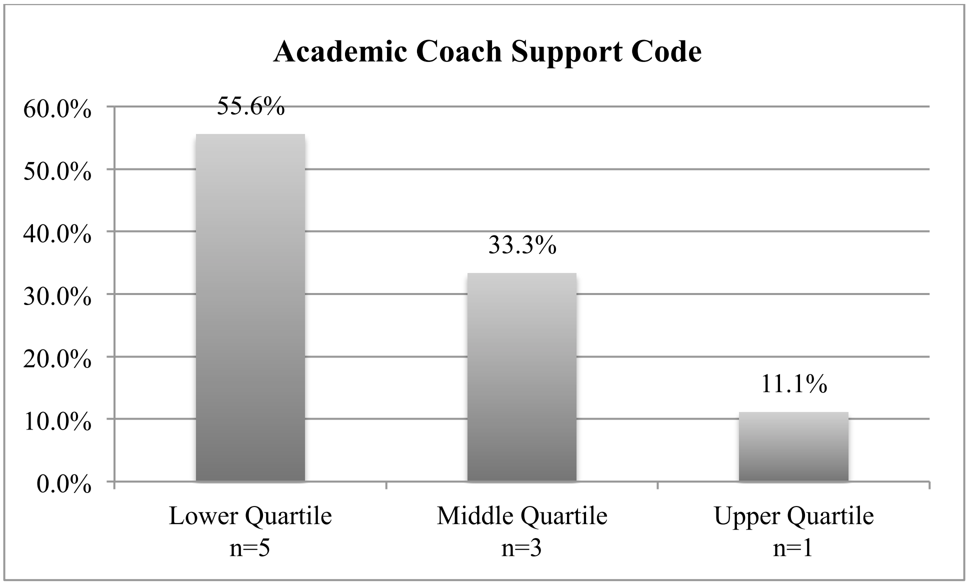

Figure 5. Academic Coach Support Code.

The media coordinators had a larger impact on the teachers with a high level of technology self-efficacy. Among those who mentioned the Media Coordinators, 75% were from teachers with high levels of technology self-efficacy. Teachers with low levels of technology self-efficacy mentioned the Media Coordinator the other 25% of the time. Figure 6 depicts the percent a media coordinator was coded for support by technology self-efficacy level among those participants who mentioned it.

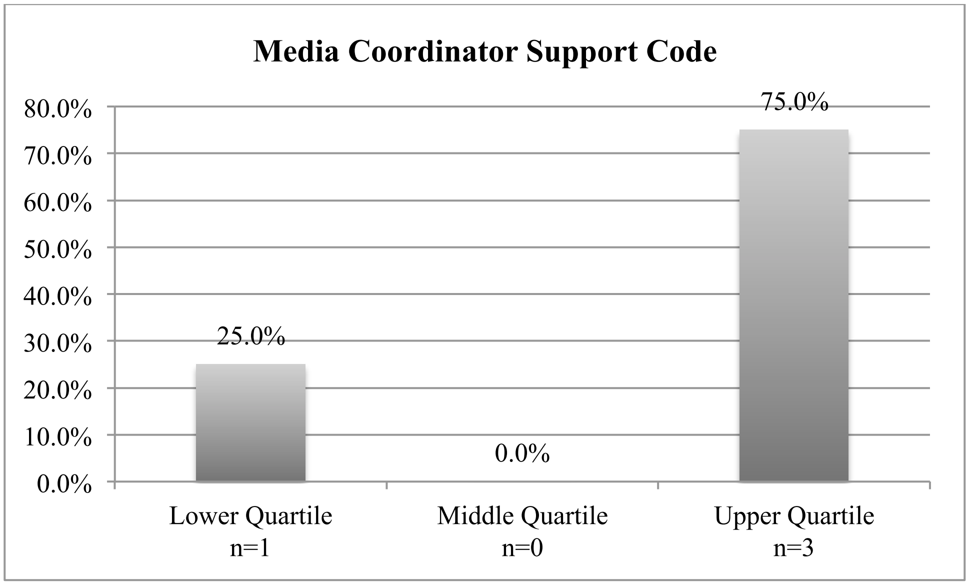

Figure 6. Media Coordinator Support Code.

School-based administrator support seemed to have a bigger impact on teachers with a high level of technology self-efficacy being mentioned 60% of the time. Teachers who were classified in the lower and middle ranges of technology self-efficacy mentioned school administrators 20% of the time each. Figure 7 depicts the percent school administrator support was coded by technology self-efficacy level among those participants who mentioned it.

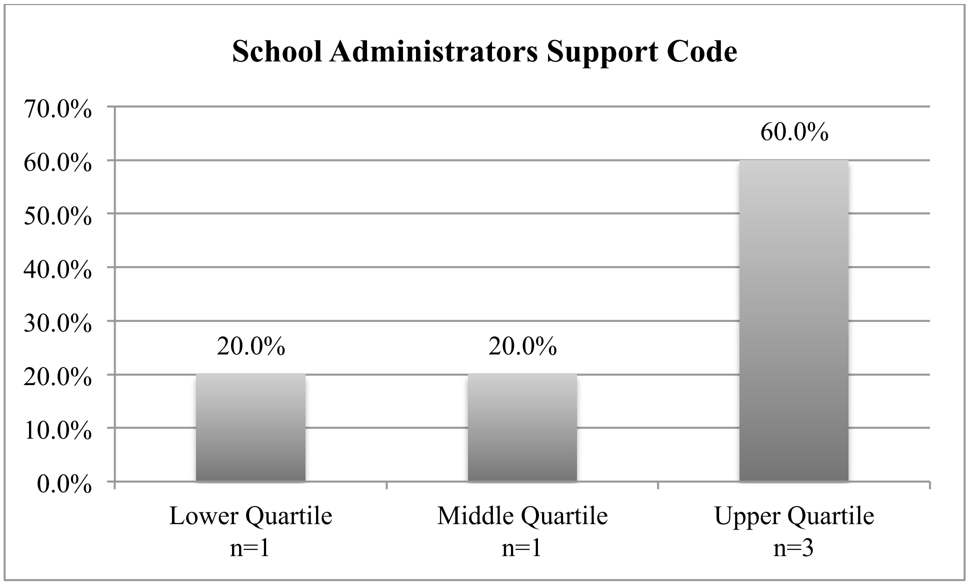

Figure 7. School Administrators Code.

The district-level personnel seemed to have a greater positive impact on the teachers with low or high levels technology self-efficacy. Both the lower and upper quartiles of teachers cited district-level staff 40% of the time, while the middle quartile mentioned district staff 20% of the time. Figure 8 depicts the percent district administrators and personnel support was coded by technology self-efficacy level among those participants who mentioned it.

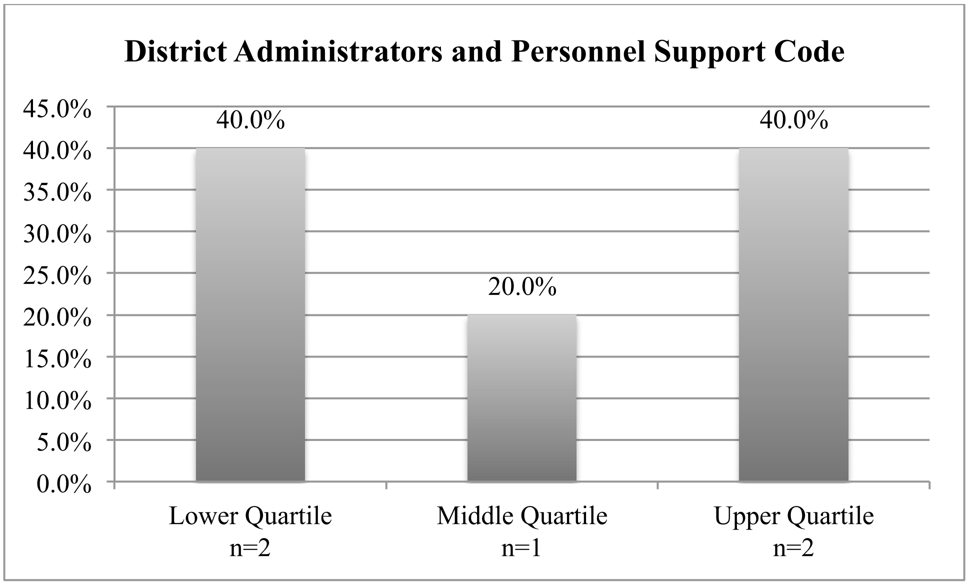

Figure 8. District Administrators and Personnel Code.

The impact positive students have was only mentioned in two interviews. Both mentions came from teachers categorized with low levels of technology self-efficacy.

Differences exist when you examine the references to people external of the school district. Those with high levels of technology self-efficacy mentioned the support of external people nearly half of the time at 46.4%. While low and middle ranges of technology self-efficacy mention the impact 30.8% and 23.1% of the time respectively. Figure 9 depicts the percent external people support was coded by technology self-efficacy level among those participants who mentioned it.

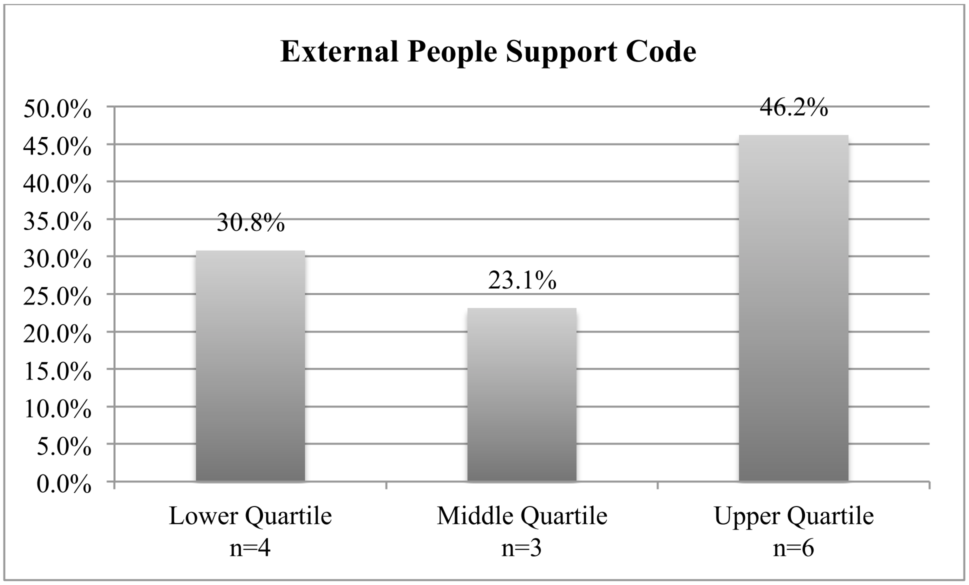

Figure 9. External People Support Code.

These differences continue when examining the other categories of external people. Among the participants who mentioned the support of peer teachers outside of the district, half were from the middle range of technology self-efficacy. The upper and lower ranges of technology self-efficacy mentioned external peer teachers 33.3% and 16.7% of the time respectively. Figure 10 depicts the percent a peer teacher outside of the district was coded as a support by technology self-efficacy level among those participants who mentioned it.

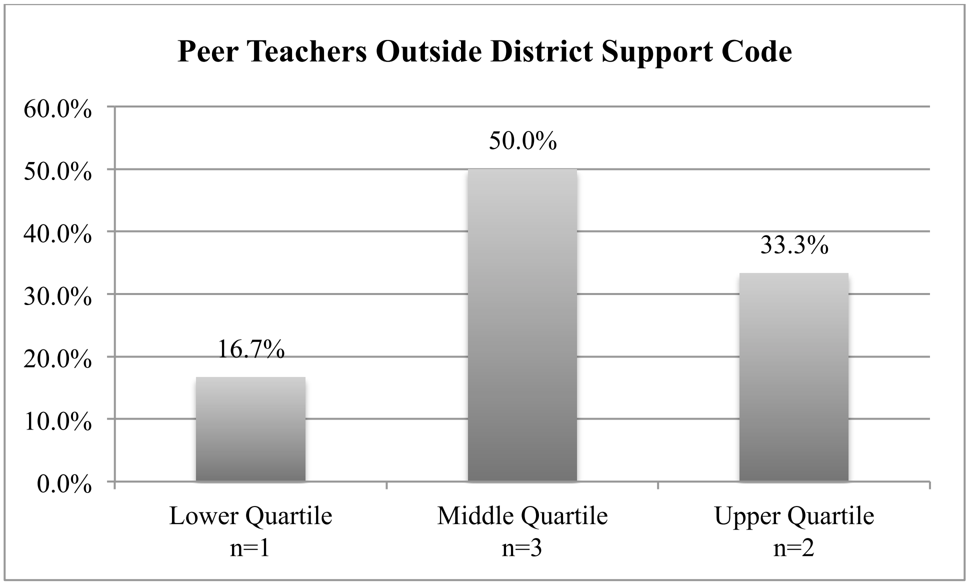

Figure 10. Peer Teachers Outside District as Support Code.

Participants with a high level of technology self-efficacy only cited the positive impact the spouse can have on the teacher's use of instructional technology. Figure 11 depicts the percent peer spouses were coded for support by technology self-efficacy level among those participants who mentioned it.

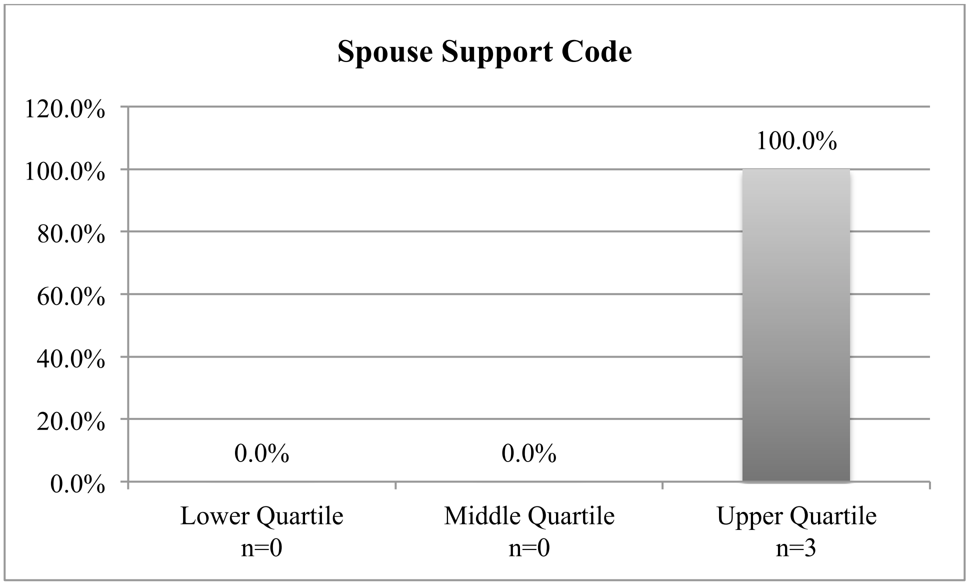

Figure 11. Spouse Support Code.

Finally, differences existed among those who cited the positive influence a younger family member has on their classroom use of instructional technology. The majority, 75%, of the mentions came from participants with a low level of technology self-efficacy. The other 25% of the mentions were from teachers with a high level of technology self-efficacy. Figure 12 depicts the percent younger family member support was coded by technology self-efficacy level among those participants who mentioned it.

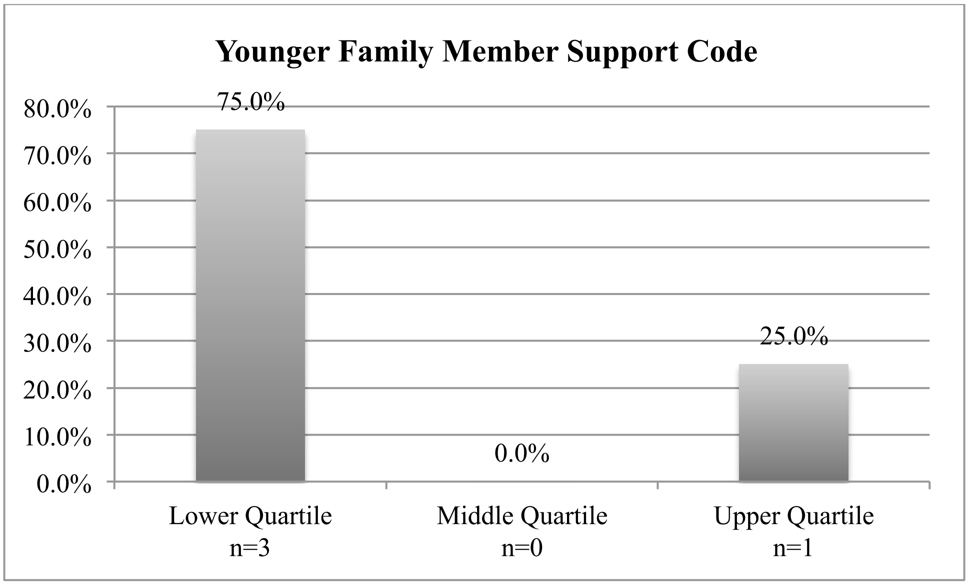

Figure 12. Younger Family Member Support Code.

Differences also existed among the identified factors from the school building or operations. Lack of time was cited by a large amount of teachers but seemed to be more substantial for teachers with low levels of technology self-efficacy. Those teachers mentioned lack of time 58.3% of the time. Teachers in the middle and upper range of technology self-efficacy mentioned lack of time 16.7% and 25% of the time respectively. Figure 13 depicts the percent lack of time was coded as a barrier by technology self-efficacy level among those participants who mentioned it.

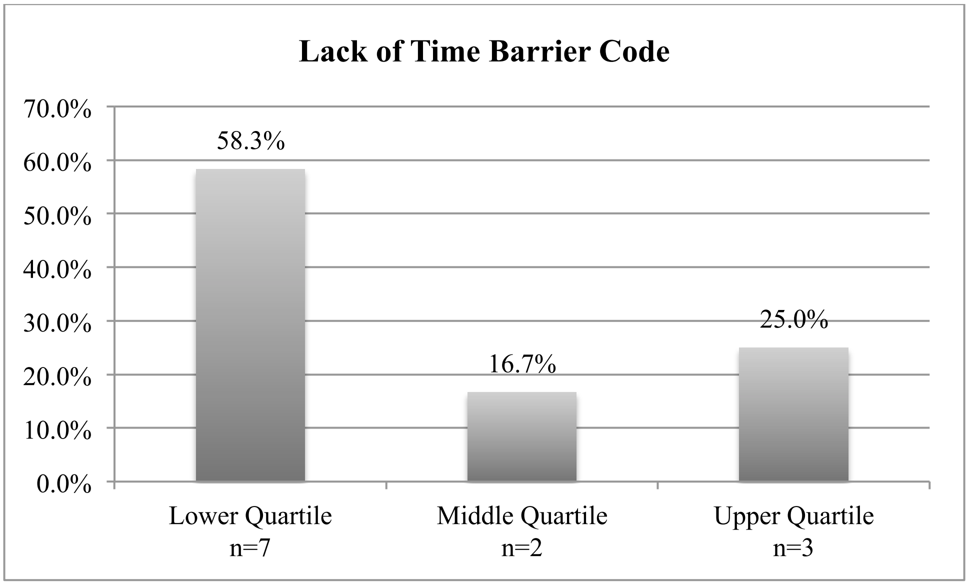

Figure 13. Lack of Time Barrier Code.

Another highly mentioned barrier was technical glitches. These affected the middle quartile of teachers being cited 53.8 percent of the time. The lower quartile was affected least being mentioned 15.4% of the time. Finally, the upper quartile mentioned technical issues 30.8% of the time. Figure 14 depicts the percent technical glitches was coded as a barrier by technology self-efficacy level among those participants who mentioned it.

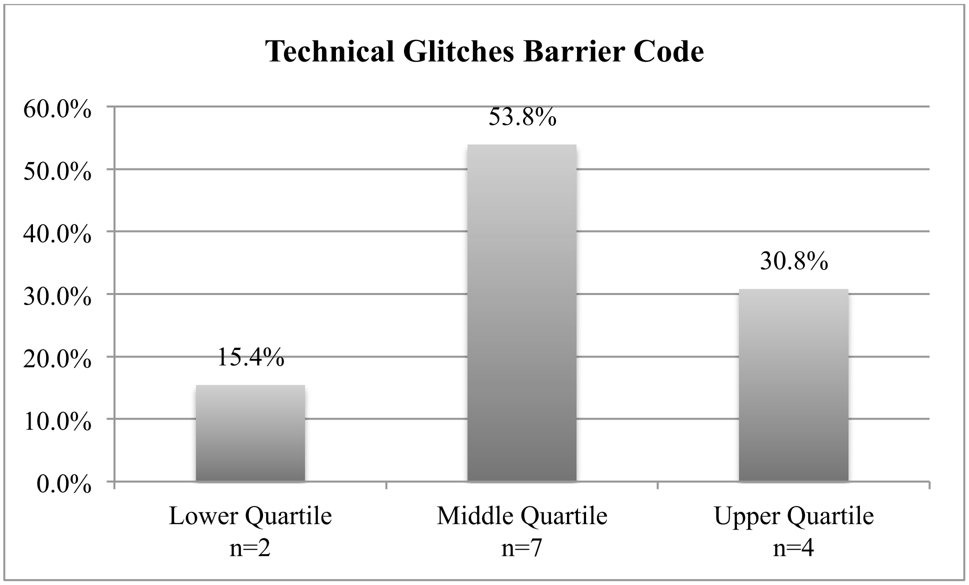

Figure 14. Technical Glitches Barrier Code.

Teacher support factors that could be categorized as the culture of the school building were only mentioned during three interviews. All three of the mentions were from teachers with a high level of technology self-efficacy. Figure 15 depicts the percent culture was coded as a support by technology self-efficacy level among those participants who mentioned it.

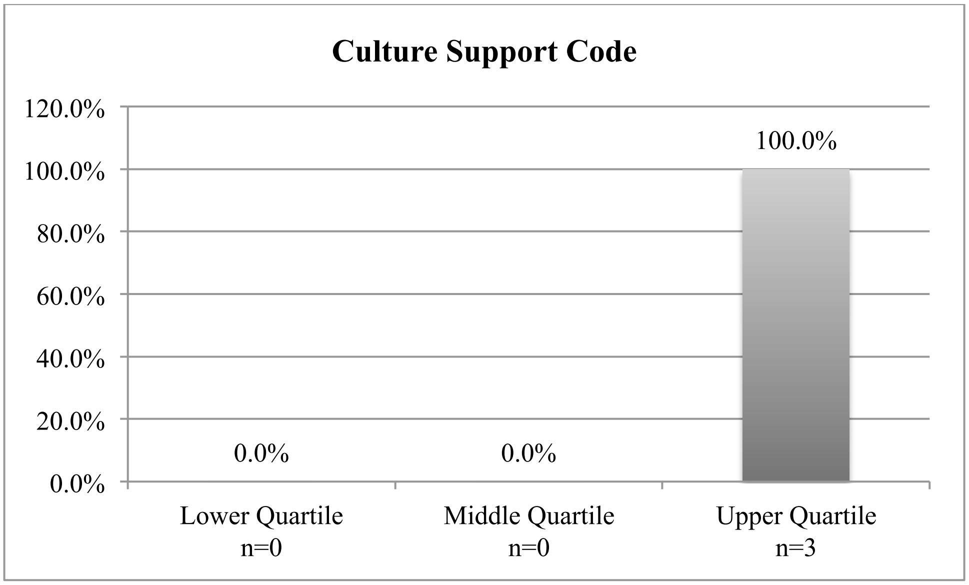

Figure 15. Culture Support Code.

While smartphone usage was not specifically asked about, it emerged as a positive support factor during the coding process due to the high number of mentions. Smartphone usage had the most impact for teachers who fell in the upper quartile of technology self-efficacy being cited 53.3% of the time. Smartphone usage among the teachers with low and middle levels of technology self-efficacy was nearly even, being mentioned 26.7% and 20% of the time respectively. Figure 16 depicts the percent smartphone support was coded by technology self-efficacy level among those participants who mentioned it.

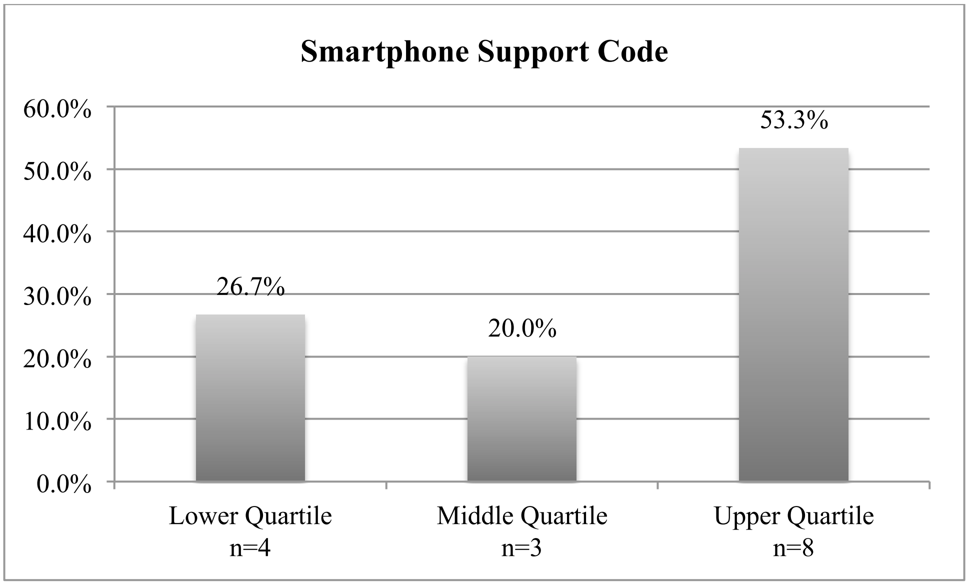

Figure 16. Smartphone Support Code.

Social media also emerged as a support factor among the participants. Social media was mentioned as a personal tool as well as a professional tool. As a personal tool, teachers in the middle quartile of technology self-efficacy cited their use of social media 50% of the time. Teachers in the lower quartile mentioned personal use of social media 37.5% of the time. Finally, teachers with a high level of technology self-efficacy mentioned personal use of social media 12.5% of the time. This changed when the social media was used as a professional tool. The middle quartile participants remained the most impacted by professional use of social media, citing its use 57.1% of the time. The upper and lower quartiles swapped positions. The upper quartile jumped to 28.6% mentions of social media as a professional tool while the lower quartile dropped to 14.3%. Figure 17 depicts the percent social media for personal use was coded by technology self-efficacy level among those participants who mentioned it, and Figure 18 shows the percent social media for professional use was coded for support.

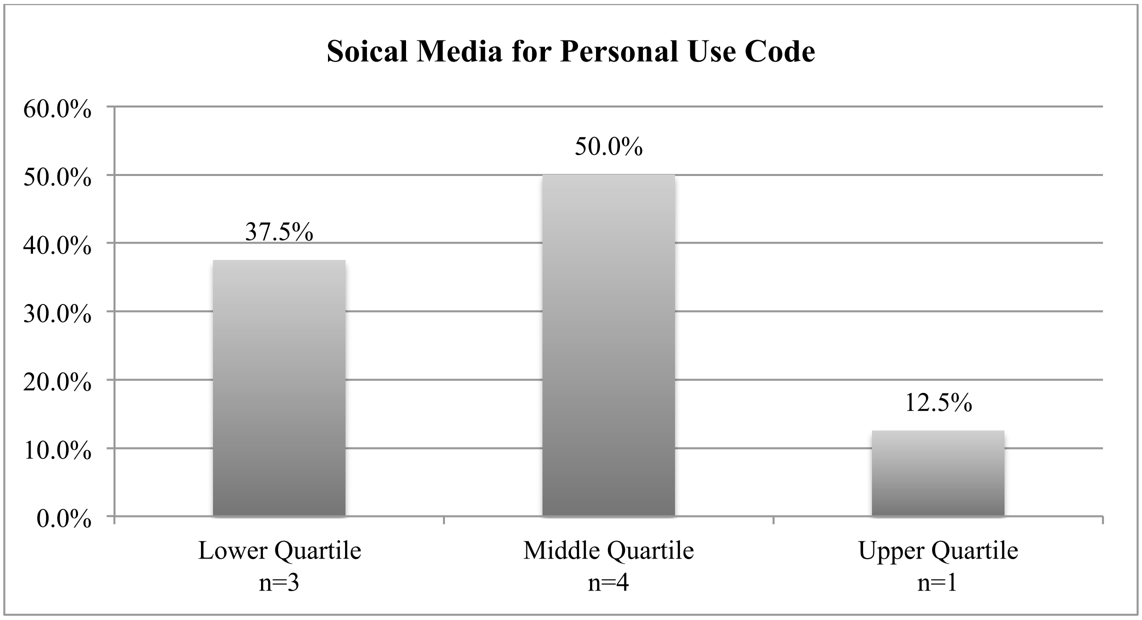

Figure 17. Social Media for Personal Use Code.

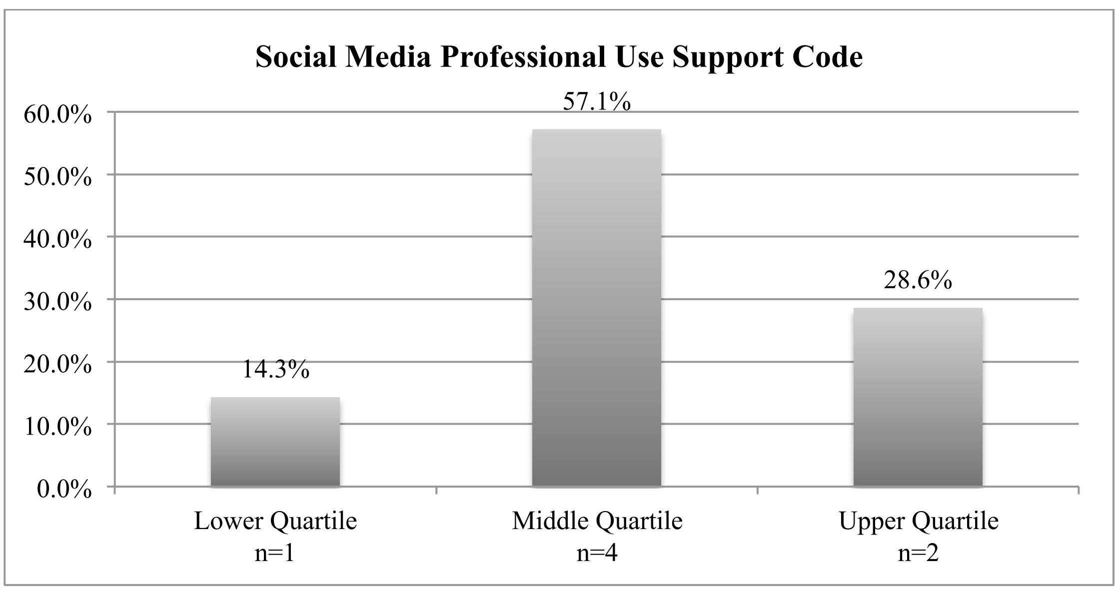

Figure 18. Social Media Support for Professional Use.

The similarities and differences of the identified factors that exist between and among teachers of varying technology self-efficacy levels were revealed through the coding of the personal interviews. Similarities emerged among all teacher levels of technology self-efficacy. In general, site-based people was equally important to all levels of technology self-efficacy. When broken down further, support from the peer teachers and instructional technology facilitator were equally important to all levels of technology self-efficacy. After that, differences become prominent. When peer teachers became a barrier, it affected the teachers with a high technology self-efficacy. However, teachers with a high technology self-efficacy also found more support in other people. They cited the support of media coordinators, people outside of the district and spouses. The upper quartile is the only quartile to mention the positive culture of the school. Teachers with low technology self-efficacy found increased support from the academic coaches. Those teachers in the middle quartile for technology self-efficacy mentioned the personal and professional use of social media. Finally, the middle quartile also cited technical glitches more prominently as a barrier compared to the other quartiles.

Research Question 3

In what ways can the identified factors be impacted by professional learning opportunities? The third and final research question addressed in what ways could identified factors be impacted by professional learning opportunities? Both the interviews and focus groups included questions that addressed professional development including strengths and weaknesses and how the professional learning opportunity impacted the individual's self-confidences using technology. Two categories emerged when examining the professional learning opportunities. Participants shared their overall opinions of their professional learning opportunities. Participants were welcome to share about any professional learning opportunities. This included ones offered by the school or district, workshops outside of the district, conferences, and any others the participant pursued on their own. These were general and not specific to any one particular session or training. Participants also shared their experiences and gave recommendations based on individual sessions or trainings they attended.

When examining the professional learning opportunities in an overall general sense, basic school-related factors emerged. Participants felt that hands on time with the technology or tool had a positive impact. Teacher R stated,

> In a good PD [professional development] they let me play with it, because if I can't access and figure out how to do the program, I'm not going to be able to use it. And I'm not going to be able to remember it at all. So they need to show it, and they actually need to let me have time to take it in. (personal communication, October 1, 2015)

Multiple participants agreed that having support on hand during the professional learning opportunities was positive. When asked of the strengths of the professional learning opportunities he attended, Teacher J stated, "[support] being there to help me when I made a mistake or was confused" (personal communication, September 15, 2015). Participants also felt positive if the professional learning opportunities were short and regularly scheduled. However, professional learning opportunities did not meet the needs of all participants. Often, the scheduled time was a factor. Teacher B stated the following on scheduling professional learning opportunities:

> I think that another barrier is just having the training, even though [the school district] has offered a lot of training, I think sometimes it's difficult, especially with coaches and health and PE teachers . . . our time is so much given towards students and my responsibility to coaching that we don't have that time being spent with us. (personal communication, September 16, 2015)

Finally, participants wanted more professional learning opportunities. Teacher H plainly stated, “I would definitely like more training” (personal communication, September 21, 2015).

More personal factors emerged while examining professional learning opportunities based on individual sessions or trainings. These personal factors widely varied. Teacher P preferred that lots of information be presented. When asked of the strengths of the professional development she attended, she stated, “they gave us a lot of useful information, a lot of ideas and ways of how to use it” (personal communication, October 8, 2015). Teacher A felt that her professional learning opportunities presented too much information and were overwhelming when she stated, “I think if we could have just focused on a few and got very familiar with using them so we felt really comfortable to let our kids use them, it might have been less overwhelming” (personal communication, September 17, 2015). Others felt the information presented was just an introduction and not very deep. While in a focus group, Teacher T stated, “everything [professional learning opportunities] seems more like an introduction. There’s not much development of it. I feel like I’ve been introduced to a lot of different things” (personal communication, September 30, 2015). Comparing these professional learning opportunities impacts to the teacher’s technology self-efficacy shows that among those who mentioned that they preferred a lot of information present, half (50%) were in the upper quartile. The remaining half was split between the lower and middle quartile. Of those who voiced too much information was being presented, 75% were from the lower quartile and 25% were from the upper quartile. The middle and upper quartile felt the professional learning opportunities were just introductory, with 62.5% and 25% of the mentions respectively. Only 12% of the lower quartile felt the professional learning opportunities were introductory in nature.

Nearly an even amount of participants from all quartiles felt that the professional learning opportunities needed to be differentiated or made relevant specifically to them. Teacher X, who scored in the low level of technology self-efficacy, expressed this about differentiation in a focus group:

> When we go in and we see a sample that is five grades levels below us in a subject that we don't relate to, you don't really retain it as well as you would if you get to play with it with your content, and see where you can plug it in. (personal communication, October 19, 2015)

Teacher D, who scored in the middle quartile of technology self-efficacy, plainly stated, "making it [professional learning opportunities] relevant to my classroom" (personal communication, September 21, 2015). Teacher F, who scored in the upper quartile of technology self-efficacy suggested smaller groups during professional learning opportunities. He stated, "improvements [in professional learning opportunities] could have been where we were working in small groups" (personal communication, September 16, 2015). Teacher S, who also scored in the upper quartile of technology self-efficacy, voiced this in her personal interview:

> Probably one of the best things that was . . . was at least some opportunity that we could sign up for what was more applicable to us. I think that's good to let people know up front what resources are going to be offered for instruction, and let us sign up for what's most relevant to our needs. (personal communication, September 22, 2015)

Teacher U, again from the upper quartile of technology self-efficacy stated, "I would level as to those who are comfortable with it already, beginners, intermediates, advanced users of the same technology" (personal communication, September 22, 2015).

A nearly even amount of participants from each technology self-efficacy quartile also expressed the importance of following up with participants of the professional learning opportunity once the event is over. Teacher G, who scored in the lower quartile of technology self-efficacy, suggested,

> I guess I would follow it [professional learning opportunity] up. I think a 2-part thing [professional learning opportunity] would work well, where you learn it and then go use it, and then come back and then you always have more questions after you use something. (personal communication, October 1, 2015)

Teacher P, who is in the middle quartile of technology self-efficacy, would use what is learned in professional learning opportunities when she stated, "I'll kind of attempt as long as I've got some support" (personal communication, October 8, 2015). Teacher L, who is in the upper quartile of technology self-efficacy, stated, "after given activities that we can go and try them on our own. We could come back and see how we've done" (personal communication, September 17, 2015).

Through the interviews, focus groups, and document analysis, it seems current professional learning opportunities are not having an impact on the identified factors. However, there is much room for improvement, and many of the identified factors could be impacted. Professional learning opportunities must stop focusing on tools. Instead, they should focus on desired student skills while incorporating the identified factors. The technology self-efficacy factors can be impacted by offering professional learning opportunities that are job-embedded with a focus on creating teacher leadership, personal learning communities, and collaboration among staff. It is possible to build on the site-based collaboration to include teachers from other districts through the use of social media and showcase the potential of smartphones in the classroom.

Summary

The CTIS was issued to all certified teachers at the three participating schools. Results from the survey were used to calculate the lower, middle, and upper quartiles of the teachers' technology self-efficacy levels. A total of 21 teachers were selected to participant in personal interviews, with six from each middle school and nine for the high school. Each of the quartiles was evenly represented. In addition to the personal interviews, focus groups were conducted at each of three schools. School improvement plans and professional development materials were also cross-referenced.

Factors that affect a teacher's level of technology self-efficacy were identified through open coding. Major categories were formed, which included site-based factors and personal factors. Subcategories, which supported the teacher, of the site-based factors included peer teachers, school and district staff, and school culture. Peer teachers were also found to be a barrier, along with technical glitches and lack of time. Personal factors included that support teacher technology self-efficacy included people, social media, and personal smartphones.

The factors were then compared with the participants' technology self-efficacy quartile in order to determine the similarities and differences that exist between and among teachers of varying technology self-efficacy levels. All levels of technology self-efficacy agreed on the impact of peer teachers and of the instructional technology facilitator. Differences existed in nearly all other identified factors particularly with regard to academic coaches, media coordinators, and connections made with others outside of the district.

Personal interviews and focus groups were also coded with regard to how factors might be impacted by professional learning opportunities. Not all identified factors can be impacted by professional learning opportunities such as technical glitches and lack of time; it is possible to positively influence many. Specific improvements could be made to improve professional learning opportunities and positively shape many of the identified factors. Through job-embedded professional learning opportunities, teacher leadership and collaboration could be fostered. Teacher technology self-efficacy could be positively impacted if the professional learning opportunities outcome includes increased connections, relationships, and learning through social media. All quartiles agreed that professional learning opportunities need to be differentiated based on skill level, grade, and content area. Participants from all quartiles also agreed that follow-up and additional support is needed after a professional learning opportunity has occurred.

The next chapter focuses on a discussion of the research study. The discussion contains a summary of the findings, recommendations, implications for practice, and recommendations for future research.

Chapter 5: Discussion

This chapter contains a summary of the findings, recommendations from the findings, implications for practice, and recommendations for future research. The purpose of this study was to expand the knowledge on teachers' technology self-efficacy as it relates to integrating technology in the classroom. This study examined teacher levels of technology self-efficacy, identified specific factors affecting their current levels, and examined the role and impact professional learning opportunities have on levels of technology self-efficacy.

The research questions to be answered in this study were

1. What factors affect teachers' levels of technology self-efficacy?
2. What similarities and differences exist between and among teachers of varying technology self-efficacy levels?
3. In what ways could identified factors affecting teachers' levels of technology self-efficacy be impacted by professional learning opportunities?

In order to identify participants, a quantitative survey was used. To answer the research questions, various types of qualitative data were collected and coded using an open-coding method to determine major themes. Teacher levels of technology self-efficacy were determined by the CTIS developed by Wang et al. (2004). Personal interviews and focus groups were utilized to answer all three of the research questions. The research was conducted to find out how to mitigate the factors hindering teachers from integrating technology into their classrooms and how to improve the role professional learning opportunities play in technology integration. This research could be used to inform the district's technology department and other departments' practices of teacher support and professional learning opportunities.

Findings

The results from Chapter 4 can be categorized into site-based and personal factors. Each of the factors played a role in the teacher's use of technology integration but not all could be impacted by professional learning opportunities. In this chapter, four major factors are discussed: people, social media, smartphones, and professional learning opportunities. These factors were chosen based on their strength in the personal interviews and coding. Teachers of all technology self-efficacy levels cited the factors as having an impact on their use technology in the classroom. Finally, these factors were chosen based on the participants' responses to professional learning opportunity questions during interviews and focus groups.

People. Results from open-coding analysis of the interviews and focus groups indicated that people played an important role in integrating technology into the classroom. The support of people spanned site-based and personal factors and was strong in both themes. This was seen across all levels of technology self-efficacy. In terms of this study, people include peer teachers, instructional technology facilitators, academic coaches, school administrators, district administrators, students, and family members. Peer teachers were cited the most as having an impact by the participants during interviews and focus groups. Published studies and articles on teacher leadership reinforce the value of influence of teachers. Schrum and Levin (2013) found teacher leaders emerged as an important aspect of bringing about school change and student achievement using technology as a key leverage point. This is further supported in another study of teacher leaders impacting school culture. Roby (2011) stated, "Informal leaders have the potential to influence the culture of the school, and this can be dramatic. The potential positive affect of teacher leader efforts could lead to a school culture that includes continuous learning for all" (p. 788).

Instructional technology facilitators and academic coaches also emerged as major contributing factors to the integration of technology into the classroom in this study. Both were coded a total of 31 times. Researchers have found that planning instructional technology integrated lessons is challenging for teachers (Mishra & Koehler, 2006). Teachers today no longer teach the textbook. Instead, the instructional design process requires teachers to consider the content to teach, how best to teach it, and what resources to use. Teachers must also consider how to manage the students and how to measure their learning success. The instructional technology facilitators and the academic coaches aid teachers in the growing complex task (Williamson & Redish, 2009).

As discussed in Chapter 4, school and district administrators were voiced as having an impact on technology integration in the classroom. However, participants in this study did not cite them nearly as much as peer teachers, instructional technology facilitators, or academic coaches. These administrators establish the program and culture of the school and district. Habegger (2008) noted that a positive school culture is imperative; and principals who focused their time on creating such a culture enabled other areas, such as designing instruction for student success, to achieve success. District administrators help shape the direction and policy of the entire school district. They must understand how programs and policies can be shaped so technology initiatives can effectively accommodate the issues most relevant to teachers and students (Culp, Honey, & Mandinach, 2005).

Two participants mentioned the impact of student input in their interviews. However, the participants were more apt to consult younger family members. Student voice did not seem to be frowned upon but simply was not used. Fullan (2007) concluded that adults consider students to be the beneficiaries of change and not participants in the change process. Growing bodies of research have found that student voice initiatives have positively impacted school reform efforts and improved teacher classroom practices (Beattie, 2012; Mitra, 2008). Additionally, over 40% of students polled in Grades 6-12 claimed their teacher was an obstacle to using technology in the classroom (Project Tomorrow, 2007).

Social media. Results from open coding the interviews and focus groups found that social media was used by teachers from all levels of technology self-efficacy. This includes both the personal use of social media and the use for professional purposes. The importance of teacher collaboration has been well documented (Killion, 2013; Killion & Crow, 2011). However, even in the most collaborative school, teachers can find themselves isolated. Teacher isolation can restrict opportunities for professional growth and impede change initiatives (Flinders, 1988). Schlichte, Yssel, and Merbler (2005) studied the importance of positive teacher relationships, and poor relationships lead to increased attrition. There has been increasing academic and research interest in social media as professional tools, but very little data are found in the current literature (Piotrowski, 2015). However, research has cited Twitter as a tool to combat isolation and connect with positive colleagues and leaders (Carpenter & Krutka, 2014).

A growing trend has been for educators to create their own PLN. A PLN is a strategy that uses social media and technology to collect, communicate, collaborate, and create with other connected colleagues at any time and any place. Every connected educator becomes a potential source for information and collaboration (Whitby, 2013).

While participants in this study did not specifically mention a PLN, they did claim to use social media to collaborate with peers and learn from experts. Additionally, in 2012, the U.S. Department of Education launched the Connected Educator Month. The mission of the initiative remains to create a globally connected movement that fosters collaboration and innovation. The key goal is to transform professional learning and affect educational change (U.S. Department of Education, 2012). A majority of teens, 71%, are now using more than one social network site (Lenhart, 2015). Social media has become something educators can no longer ignore.

Smartphones. Data collected from personal interviews and focus groups in this study revealed that the majority of teachers enjoyed using their smartphones. Teachers without smartphones also acknowledged their importance. Apple and Samsung tied for highest smartphone customer satisfaction according to the American Customer Satisfaction Index (ACSI, 2015) report. Smartphone usage among adults has increased from 35% in the spring of 2011 to 64% in 2015 (Smith, 2015).

Teens have also adopted smartphones at a quick pace. Fully, 88% of teens have access to a mobile phone; and the majority of them, 73%, have smartphones (Lenhart, 2015). The way teens communicate also depends on their access, or lack of access, to a smartphone. Teens with a smartphone prefer texting as their main way of communicating. Non-smartphone-using teens are more likely to use social media as their preferred method of communicating (Anderson, 2015). Banning smartphones has not deterred students from bringing them to school. Sixty-five percent of teens with cellphones who attend schools that completely ban phones still bring them to school every day (Lenhart et al., 2010). With the decline of personal computer sales and increased capacity of smartphones, some are predicting that your smartphone could be the only computer you own (Bonnington, 2015). In 2011, it was estimated that 28% of smartphone users mostly used their phone to go online (Smith, 2011). A single participant in this study acknowledged smartphone potential when describing students having their own mini-computers in their pockets. The importance of cellphones as computing devices must be recognized.

While smartphones have become a part of daily life for both adults and students, this is not always the case inside the school buildings. It is estimated that close to 70% of the schools that previously banned cellphones are reversing their policies (Kiema, 2015). It is not as simple as changing a policy and allowing students access to their phone. A recent study by the London School of Economics and Political Science found that schools that banned students from carrying phones saw a clear improvement in their test scores (Beland & Murphy, 2015). Teachers feel cellphones are a distraction and lead to cheating (Kiema, 2015). Adding smartphones to yesterday's classroom does not produce results. Instead, teachers must leverage the devices when needed and have the capacity to guide the students to concentrate (Schwartz, 2013).

Professional learning opportunities. A substantial factor identified in this study was the professional learning opportunities offered to the teachers. During the personal interviews and focus groups, it became apparent that teachers of this district had a wide variety of opinions on professional learning opportunities. Opinions differed on the amount of information presented and the depth of that information. All levels of technology self-efficacy had varying likes and dislikes of the professional learning opportunities. From the interviews focusing on Research Question 3, it appears that the professional learning opportunities were often a one-shot deal and presented to whole groups with little differentiation. This initial supposition was supported by analysis of the school improvement plans and professional development materials. Research supports that this type of professional learning opportunity has little to no impact on student achievement (Yoon, Duncan, Wen-Yu Lee, Scarloss, & Shapley, 2007).

Creating and implementing an effective professional development program requires careful thought and consideration. In this research study, all technology self-efficacy levels suggested district professional learning opportunities should be reconsidered, differentiated, and made relevant. Tyson (2013) considered five key steps to better professional learning opportunities: shared vision, shared leadership, choice and differentiation, collaboration, and support. When a school community has a shared vision and commitment to high standards of student achievement, it is better equipped to take an honest look at student learning. This forms a basis for professional learning opportunities that focus on student learning outcomes (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2009). The vision must be a shared vision. Relying on someone else's vision leads to a school culture of dependency and conformity; only shared visions take root (Fullan, 1993; Hirsh, Psencik, & Brown, 2014).

The next key for successful professional learning opportunities is shared leadership. Teachers should not see professional learning opportunities as something simply to attend. Instead, teachers should be given and take an active role in designing and implementing professional learning opportunities. Participants in this study did not attend professional learning opportunities because they felt they would not benefit from attending. No participant mentioned being involved in the active planning of professional learning opportunities for this district. Few teachers have been given the opportunity to design professional learning opportunities, even when those opportunities are targeted toward their peers (Cuban, 2003). A case study in higher education by Turkle (1995) found that when teachers design professional learning opportunities and their opinions are strongly considered, changes in classroom practice occur.

Professional learning opportunities need to be centered on choice and differentiation. During the interviews, participants were asked how to improve professional development; nearly half of the teachers suggested having a choice or differentiated professional learning opportunities. Today's teachers are asked to differentiate their instruction, but all too often they attend professional learning opportunities that are taught from a one-size-fits-all approach. This approach is ineffective (Díaz-Maggioli, 2004; Yoon et al., 2007). Some school districts are making the change. The District of Columbia Public Schools retooled their professional development days by offering a buffet of professional development choices. Under this model, teachers are getting more personalized professional development: Resources are matched to their own needs and choices (Quattrocchi, 2015). Many teachers are not waiting for their district for improved professional learning opportunities. The rise in popularity of social media has given teachers a conduit to seek out their own personalized professional learning opportunities. Many educators, including some of the participants in this study, have joined Twitter. The platform has provided teachers with professional connections and access to ideas and resources at any hour from international colleagues and experts.

Effective professional learning opportunities do not end when the training is over;

there must be ongoing collaboration. The desire for a follow-up or 2-part workshop was mentioned in multiple interviews and focus groups. Schools are recognizing the importance of collaboration, and many teachers participate in PLCs. These learning communities have shown to increase the effectiveness of the educator and student outcomes (Killion & Crow, 2011). Collaboration needs to be embedded into the teacher's job and part of the school day, not an afterthought (Killion, 2013).

Finally, professional learning opportunities need to be followed up with ongoing support. Within this study, all levels of technology self-efficacy cite the importance of the instructional technology facilitator and their technology integration. The academic coaches also played a part, especially among educators with a low technology self-efficacy. Research supports the importance of their coaching. Truesdale (2003) examined differences between teachers who simply attended a workshop and teachers who attended and received coaching through implementation. The study found that coached teachers transferred the newly learned skills into their teaching, while teachers who did not receive coaching quickly lost interest and did not implement new skills into their classroom. Another study of 50 teachers agreed. Teachers who received coaching after attending a workshop were significantly more likely to use the new teaching practice in their classroom than those who only attended the workshop (Knight & Cornett, 2009).

Recommendation from Findings

The saying goes that culture trumps strategy every time. Four themes emerged from the coding and were previously discussed individually; but when it comes to recommendations, each of the themes are intertwined and difficult to separate from each other. People, social media, smartphones, and professional learning opportunities help create and shape the school culture.

In this research study, people were cited as the most significant factor impacting a teacher's use of technology in the classroom. Culture starts at the top with the school and district administrators (Habegger, 2008). They set the tone and expectation that filter down to the schools, teachers, and students (Fleck, 2005). If the district has a clear goal and vision, it must be a shared vision with the administrators. Care must be taken when hiring new administrators. While applicants should have the necessary experience and credentials, they should be examined to see if they fit in the school culture while also testing for a cultural mismatch. The Walt Disney Company feels testing for cultural fit is one the most important steps in their hiring process (Jones, 2015).

Professional learning opportunities have the great potential to strengthen the everyday performance of educators (Killion & Crow, 2011). In 2011, employees of NCDPI recommended that the North Carolina State Board of Education endorse the Learning Forward standards. The ultimate goal of recommendation was statewide consistency for professional development implementation (North Carolina State Board of Education, 2011). The Learning Forward standards place importance on educators being active participants in their professional learning (Killion & Crow, 2011). These opportunities should be embedded into the school culture and directly linked to goals and visions of the school. These are not workshops with mandatory attendance (Hirsch & Killion, 2007). Effective professional learning opportunities should embody the shared vision of the school. All school personnel should have a stake in the design and implementation of professional learning opportunities. One-size-fits-all professional learning opportunities should not be used (Díaz-Maggioli, 2004; Yoon et al., 2007). Instead, teachers should have a choice in professional learning opportunities. The professional learning opportunities should be taught with differentiation, and they should be personalized. Professional learning opportunities should focus on the skills students should have and not how to use a tool. This is consistent with outcome standards from Learning Forward (Killion & Crow, 2011). The culture of the school should be one of collaboration. Finally, the professional learning opportunities should be followed up with ongoing coaching and support as evidenced in the implementation standard for Learning Forward (Killion & Crow, 2011).

The instructional technology facilitators and academic coaches were also identified factors in technology integration and should play a major role in the professional learning opportunities. This is stressed in the North Carolina professional technology facilitator standards. Both instructional technology facilitators and academic coaches must provide ongoing coaching and support (NCDPI, 2009a; Sugar, 2005). Essentially, their roles are becoming one and the same. Instructional technology facilitators in this district were hired based on instructional technology teaching skills. Academic coaches were hired based on content area and teaching skills but were not required to have instructional technology skills. For future hiring, findings from this study would lead to the recommendation of combining the positions and hiring a person who has specific content area knowledge, pedagogical knowledge, and technology integration skills. This recommendation is especially true at the high school level since teachers are more specialized in content areas. Technology has become embedded in all subject areas; staff providing coaching to teachers should have these skills.

While the instructional technology facilitator and academic coaches may be the leaders of the professional learning opportunities, they cannot be the sole deliverers. For professional learning opportunities to be effective, they must be willing to collaborate with teachers. Teachers should be an integral part of the professional learning opportunities. Teachers should be encouraged to take a leadership role in the planning, design, and execution of professional learning opportunities (Cuban, 2003; Darling-Hammond et al., 2009). The collaborative culture of the school should allow teachers to also serve as ongoing support and coaching to other teachers (Aguilar, 2013; Waldron & McLeskey, 2010). Additionally, the instructional technology facilitators and academic coaches should coach the teachers to become leaders within the school (NCDPI, 2009a; Williamson & Redish, 2007).

Not only should professional learning opportunities help build the collaborative culture within the school, they should help teachers collaborate with the world. Social media should be a part of the professional learning opportunities. Student learning does not end with the school bell, nor should teacher learning. Social media should be used locally within the school as a method for teachers to collaborate and coach one another. This coaching and collaboration can be spread across the district with the use of hashtags (Atkins, 2015). As teachers become more comfortable with social media, their collaborative contacts can spread across the world (Kreuger, 2015). School and district administrators cannot ignore social media (Ferriter, 2015).

A surprising but obvious factor in the research was the smartphone. Smartphones are essentially pocket computers. A single smartphone today has more computing power than all of NASA when it first to sent astronauts to the moon (Rosoff, 2014). Student smartphones cost districts nothing. Districts should use this untapped potential. However, it is not as simple as stating all students are now allowed to carry smartphones in class. The fact that 73% of teens have access to smartphones must also be considered (Lenhart, 2015). When planning for technology initiatives or purchases, school and district administrators should verify that the purchases could be utilized on a smartphone. District technology departments should adopt a technology agnostic approach. That is, schools should not be dependent one device, operating system, or software with very specific technical requirements. Instead, allow any or multiple devices to be used to solve the problem. Professional learning opportunities should be developed to provide support on how to integrate smartphones in the classroom with updated new classroom management skills and techniques to adjust to this additional tool.

All of this should be done for the most important people in the building, the students. The collaborative culture of the school should be one where each student is seen as every teacher's responsibility, rather than the assigned teachers. All staff should have a shared vision and be working together to improve student outcomes. Professional learning opportunities should embody the vision and have the goal of improving student outcomes (Fullan, Hord, & Von Frank, 2015; Killion & Crow, 2011). Finally, students should have a voice in their own education.

Implications for Practice

This research provides qualitative data about the factors influencing teacher technology self-efficacy and the impact professional learning opportunities play. The findings, while not generalizable to all districts, do provide a glimpse into what needs to be considered when pursuing increased technology integration in the classrooms. Issues that arise and need to be considered are the time and funding needed to drive changes in the classroom.

As a result of this research, the researcher will do things differently for the foreseeable future. Current professional development plans and opportunities need to be reconsidered and transformed into true professional learning opportunities. This would include allowing teachers to plan, design, and deliver the professional learning opportunities. Districts should follow NCDPI and adopt Learning Forward Standards for Professional Learning to aid in the design of professional learning opportunities. Professional learning opportunities will incorporate specific learning designs and be differentiated for individual teachers. Professional learning opportunities will be opportunities for teachers to collaborate, coach, and grow as leaders. Professional learning opportunities will be ongoing and followed up with ongoing support and coaching. Teachers will be involved in the shaping and creating of a shared technology vision. Asking teachers to complete needs assessment is not enough. A more collaborative culture can be built by including social media in the professional learning opportunities. Offering badges, or micro-credentials, for those completing professional learning opportunities can showcase teacher skill and leadership. Badges have the power to magnify the opportunity for educators to make personal decisions about their own learning, goals, resources, and outcomes (Blattner & Abramovich, 2015). Finally, the coaching capacity of the instructional technology facilitators needs to continuously expand by perusing their own professional learning opportunities.

In order to ensure continuous improvement of increasing teacher technology self-efficacy, the same research process will be conducted next year including interviews and coding so the factors identified can be addressed to allow teachers to improve student outcomes. Students may also be included in the research.

Future Research

Based on the findings of this study, the researcher would recommend that future research extend these findings. While not specifically asked, many teachers expressed their perspective of student views on technology in the classroom. Some claimed students were practically experts on technology and loved using it in class, while others felt students saw technology as a toy and not a tool for learning. Future research could include a replication of this study to research teachers' perspectives on how their students view classroom technology. Additional future research may include student interviews, asking them to share their experiences with technology in the classroom and their opinions on their teachers' technology integration.

Secondly, research needs to be expanded on PLNs and social media and how they affect teacher technology self-efficacy and their roles in professional learning opportunities. Teachers on Twitter often claim Twitter is the best professional development. Research should be done to examine Twitter's role as professional development and its impact on technology self-efficacy. Additionally, research should be done to determine if Twitter as professional development has a positive impact on student learning or if it is only considered good compared to the poor professional development teachers often receive.

Conclusion

In reviewing the findings of this research study, it is clear that teacher technology self-efficacy can be increased and therefore student outcomes improved if a variety of factors are taken into consideration. The most important factors are people and professional learning opportunities. Once the barriers of access to computer and technical glitches have been minimized, it is up to the people to carry out the vision and increase student achievement. Teachers must be provided the professional learning opportunities, ongoing support, and coaching to see this to fruition.

In conclusion, technology alone will not bring changes in teaching practices or improved student outcomes. When all administrators, instructional technology facilitators, academic coaches, teachers, and students are working together in an intentional environment, we will see transforming practices in the classroom.

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Appendix A

Permission to Use the CTI Survey

Aaron,

Yes, please feel free to use the survey in your study.

Thanks,

Ling

Ling Wang, Ph.D.

Professor of Graduate School of Computer and Information Sciences

Nova Southeastern University

954-262-2020

Appendix B

Computer Technology Integration Survey

Direction:
The purpose of this survey is to determine how you feel about integrating technology into classroom teaching. For each statement below, indicate the strength of your agreement or disagreement by circling one of the five scales.

Below is a definition of technology integration with accompanying examples:

Technology integration:

Using computers to support students as they construct their own knowledge through the completion of authentic, meaningful tasks.

Examples:

- Students working on research projects, obtaining information from the internet.
- Students constructing Web pages to show their projects to others.
- Students using application software to create student products (such as composing music, developing PowerPoint presentations, developing HyperStudio stacks).

Using the above as a baseline, please circle one response for each of the statements in the table:

SD = Strongly Disagree, D = Disagree, NA/ND = Neither Agree nor Disagree, A = Agree, SA = Strongly Agree

1.	I feel confident that I understand computer capabilities well enough to maximize them in my classroom.	SD	D	NA/ND	A	SA
2.	I feel confident that I have the skills necessary to use the computer for instruction.	SD	D	NA/ND	A	SA
3.	I feel confident that I can successfully teach relevant subject content with appropriate use of technology.	SD	D	NA/ND	A	SA
4.	I feel confident in my ability to evaluate software for teaching and learning.	SD	D	NA/ND	A	SA

5.	I feel confident that I can use correct computer terminology when directing students' computer use.	SD	D	NA/ND	A	SA
6.	I feel confident I can help students when they have difficulty with the computer.	SD	D	NA/ND	A	SA
7.	I feel confident I can effectively monitor students' computer use for project development in my classroom.	SD	D	NA/ND	A	SA
8.	I feel confident that I can motivate my students to participate in technology-based projects.	SD	D	NA/ND	A	SA
9.	I feel confident I can mentor students in appropriate uses of technology.	SD	D	NA/ND	A	SA
10.	I feel confident I can consistently use educational technology in effective ways.	SD	D	NA/ND	A	SA
11.	I feel confident I can provide individual feedback to students during technology use.	SD	D	NA/ND	A	SA
12.	I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.	SD	D	NA/ND	A	SA
13.	I feel confident about selecting appropriate technology for instruction based on curriculum standards.	SD	D	NA/ND	A	SA
14.	I feel confident about assigning and grading technology-based projects.	SD	D	NA/ND	A	SA
15.	I feel confident about keeping curricular goals and technology uses in mind when selecting an ideal way to assess student learning.	SD	D	NA/ND	A	SA
16.	I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practices.	SD	D	NA/ND	A	SA
17.	I feel confident that I will be comfortable using technology in my teaching.	SD	D	NA/ND	A	SA
18.	I feel confident I can be responsive to students' needs during computer use.	SD	D	NA/ND	A	SA
19.	I feel confident that, as time goes by, my ability to address my students' technology needs will continue to improve.	SD	D	NA/ND	A	SA
20.	I feel confident that I can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology.	SD	D	NA/ND	A	SA
21.	I feel confident that I can carry out technology-based projects even when I am opposed by skeptical colleagues.	SD	D	NA/ND	A	SA

Appendix C

Personal Interview Questions

Participant Background Interview Questions

1. How long and in what roles have you been in education?
2. Do you enjoy using technology outside of education?

Focused Interview Questions

3. Tell me about your participation in professional development targeting the use of instructional technology. What were the strengths of that professional development? How could it have been improved?
4. Tell me about the influence other teachers or staff members (may be individuals or students) have on your technology practices.
5. Tell me about the influence of experience outside of the school setting on your use of instructional technology.
6. Do you consider yourself an innovative teacher? Why or why not?
7. What barriers have you experienced in your attempts to use technology in your classroom?
8. What supports have you experienced in your attempts to use technology in your classroom?
9. How often do you experiment or take the time to learn a new technology. In what way?
10. What more can you tell me about your experiences with instructional technology in your classroom? In education in general?

Appendix D

Focus Group Questions

Focus Group Background Questions

1. What role does technology play in your everyday life?
2. What role does technology play in education today?

Focus Group Specific Questions

3. What factors do you attribute to your self-confidence in using technology in your classroom instruction?
4. Can you describe any professional development or professional learning that has had a positive or negative affect on your self-confidence in using technology in your classroom instruction?
5. What do you believe would help make you more comfortable in using technology in your classroom instruction?

Summary Question

6. How would you describe your attitude toward using technology in your classroom instruction?