AN EXAMINATION OF THE RELATIONSHIP BETWEEN INSTRUCTIONAL TECHNOLOGY INTEGRATION AND STUDENT ACHIEVEMENT

by

Carla D. Holt

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APPROVED BY:

Cristie McClendon, PhD, Committee Chair

Walter Childs, EdD, Committee Member

Murray Williams, EdD, Committee Member

Scott Watson, PhD, Associate Dean, Advanced Programs

ABSTRACT

This correlational, causal-comparative research study examined the relationships between secondary career and technical education teachers' gender, experience, professional development and their perceptions of technology use. The research also investigated how the teachers in this study perceive the adequacy of their student's technology skills for meeting college and workplace demands. Eighty-four career and technical education teachers in six North Carolina high schools completed the School Technology Needs Assessment Survey 4.0 (STNA), which also included demographic questions that asked about age, gender and years of experience. A two sample t test, correlation analysis and multiple linear regression were performed. The results of the two sample t test and correlation analysis, which incorporated the factors of teacher technology integration and gender, showed no significance between teacher technology integration and gender. The results of the linear regression analysis, which incorporated the dependent variable of teacher technology integration and independent variables of years of experience, computer self-efficacy, instructional technology training received and average NC CTE post assessment scores of students, showed no significance between teacher technology integration and years taught as well as post assessment scores. The analysis found a significant relationship between teacher technology integration and computer self-efficacy and professional development. The data from this study suggest that though analysis did not show a significance with all of the independent variables, the results did support that there was a perception that student engagement increased with the effective use of technology and the teacher's technology integration in the classroom.

Keywords: two sample t-test, linear regression analysis, correlational research design, causal-comparative research, career and technical education (CTE), computer self-efficacy, instructional technology training, student achievement, teacher technology integration, post assessment scores

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LIST OF ABBREVIATIONS

α	Level of statistical significance
Adequate Yearly Progress	AYP
Career and Technology Education	CTE
International Society for Technology in Education	ISTE
School Technology Needs Assessment	STNA
No Child Left Behind	NCLB
r	Correlation coefficient
Revised Bloom's Taxonomy	RBT
M	Mean
SD	Standard deviation
H	Hypothesis
Z	Z test statistic

CHAPTER ONE: INTRODUCTION

When the federal report, *A Nation at Risk,* was released in 1983, the authors iterated that United States' public schools were not preparing students with the higher order thinking and technological skills necessary to meet the global demand for "highly skilled workers in new fields" ("A Nation at Risk",1983, p. 10). This publication, along with others, eventually led to the *No Child Left Behind Act* (NCLB). Initiated in 2001, this Act requires states to address disparities in achievement levels by implementing initiatives that would better prepare students with the skills necessary for the global workplace ("Ed.gov US Deparment of Education," 2008). Twenty-first century skills identified include critical thinking, effective communication, collaboration, and problem solving. One method used by schools to address the issue and to raise achievement levels is the integration of technology into the curriculum. There were two significant reasons for this method. One reason is that technology is at the core of virtually every aspect of our daily lives. The other reason is that technology use by teachers in public education classrooms had already increased substantially over the last decade ("Transforming American Education: Learning powered by technology: National Education Technology Plan 2010," 2010).

Most students today are familiar with technology tools through their use of the Internet, electronic games, cellular phones, mp3 players, tablets and computers (Cravey, 2008; Hertzler, 2010). Therefore, implementing technology tools in classrooms has long been recognized by schools as a potential way to appeal to learners, close achievement gaps, and help increase achievement levels in preparation for success in college and the workplace (Alsafran & Brown, 2012; Shapley, Sheehan, Maloney, Caranikas-Walker, & Texas Center for Educational, 2009). However, schools face a number of challenges in integrating technology in the classroom, including decreased federal funding, budget constraints, and teacher perceptions of the benefits of technology tools (Townsend, Oliver, Tricia, & Maxfield, 2012). While most states are attempting to integrate the use of technology as an instructional tool, the amount of technology infused in instruction by both teachers and students varies widely ("North Carolina State School Technology Plan," 2011). Schools must now find ways to fill the gap between the current level of funding for the purchase and maintenance of instructional technology and the requirements of educational initiatives directed toward equipping students with the twenty-first century skills needed for college and the workplace ("Career & College: Ready, Set, Go! North Carolina's Plan For Public Schools," 2010). The desired outcome of this study was to provide administrators and educational leaders with data and information to help guide decisions relative to the purchase, integration, and implementation of instructional technology in order to increase student achievement.

Background

North Carolina has established educational initiatives to strengthen students and better prepare them to be competitive in the global society, including adopting the National Common Core Curriculum Standards and implementing the Essential Standards Initiative ("North Carolina Department of Public Instruction Common Core State and NC Essential Standards," 2012). North Carolina has also instituted the Future-Ready Core Graduation Requirements for all freshmen beginning in the 2009-2010 school year. The Future Ready Core Graduation Requirements mandate that students have a concentration in their secondary high school career which allows them to customize their curricula and help integrate their long-term career interests and post-secondary goals ("Career & College: Ready, Set, Go! North Carolina's Plan For Public Schools," 2010). The Career and Technical Education curriculum, part of the Common Core Curriculum, supports the North Carolina Future-Ready Core Graduation Requirements with 16 career clusters that align with the recommendations designed by the state. Instructional technology is embedded within North Carolina's Common Core Curriculum and Essential Standards and plays an integral part in career and technology education. All of the 16 career clusters utilize some instructional technology within the curriculum ("North Carolina Department of Public Instruction Career and Technical Education," 2011).

Each initiative, Common Core Curriculum, Essential Standards, and North Carolina Future Ready Core Graduation Requirements, requires teachers to use instructional technology tools in equipping students with twenty-first century skills. In addition, each is part of the state's response to federal initiatives requiring accountability, that is, to show improvements in student achievement including preparation of twenty-first century technology skills ("Ed.gov US Deparment of Education," 2008). The Federal Enhancing Education through Technology (Ed-Tech) program is part of the NCLB act and supports state's efforts to improve student achievement through the use of technology in elementary and secondary schools. Another goal of the Ed-Tech initiative is to hold the state accountable for helping students become technologically literate through the integration of technology tools ("Ed.gov US Deparment of Education," 2008).

With the requirements for and emphasis on instructional technology, schools have increased investments in instructional technology tools as a way to engage students and increase student achievement. Even with the increased investment, only 54% of teachers regularly employ instructional technology tools in the classroom, according to the Quality Education Data poll. Barriers such as lack of support, training, and resources have hindered full integration ("Technology Update," 2005).

In addition to examining the level of technology integration in classrooms, researchers have focused on the impact of instructional technology on student achievement. Cravey (2008), Rooney (2011) and Bryan (2008) examined student achievement in slightly different ways. Cravey looked at the effectiveness of educational technology using students passing the state mandated tests in reading, math, and social studies as dependent variables. This study used the School Technology and Readiness (STaR) constructs to determine if there was a relationship between instructional technology integration and student academic achievement in reading, math and social studies. The four constructs analyzed in the study were teaching and learning, educator preparation and development, administration and support services and infrastructure for technology (Cravey, 2008). Cravey (2008) found that in each of the four constructs analyzed in the study, the technology implementation level as measured by the four constructs was not shown to have an impact on student achievement levels.

While Cravey (2008) defined student achievement in terms of the level of implementation based on a self-regulated analysis, Rooney (2011) and Bryan (2008) used specific test scores of students to define student achievement. Rooney (2011) used percentages of composite scores of students passing on state standardized tests and teachers' attitude toward the use of instructional technology in the classroom to define student achievement. In the study, Rooney (2011)concluded that there was not a direct significant impact between composite scores on state standardized tests and use of instructional technology but that instructional technology in itself can have an overall impact on the learning environment. Bryan's qualitative study used state end-of-course test scores along with an open-ended questionnaire to see if instructional technology professional development impacted teaching and students' learning and achievement. Contrary to the Cravey (2008)study, the Bryan (2008)study indicated that teachers' instructional technology development training could have a positive influence on student achievement. However, the impact on student achievement would vary based on level of support from administration, technology availability and how well the instructional technology training was developed and implemented (Bryan, 2008).

In spite of the varied measures of student achievement, research has increasingly shown that student interest in technology tools continues to increase and this interest can have a positive effect on student learning. Kuhn's (2006) qualitative research focused on teachers' perceptions of whether or not to utilize technology as a method of promoting students' learning. Kuhn studied both novice and experienced teachers and through a series of interviews and observations collected data in order to describe why teachers decided or declined to use instructional technologies in classrooms. Kuhn found that both novice and experienced teachers made decisions to use or not to use technology as well as how and why to use technology primarily during the planning of lessons and units. He concluded that teachers should develop skills that will help them make technology decisions that will increase "learning and teaching efficiency, provide learning opportunities that would not exist without it, and use technology for new and creative ways of teaching" (Kuhn, 2006, p. 198). With the focus on the teacher as the implementer of instructional technology, Kuhn theorized that the effective implementation of technology in the curriculum can contribute to the overall achievement of students. Kuhn (2006) supported using instructional technology tools as a strategy to facilitate the differentiated instruction teaching method for learning. The use of technology in the classroom, he posits, can decrease the achievement gaps (Kuhn, 2006).

Since the publication of *A Nation at Risk* in 1983, concern about the achievement levels of students in key areas such as math and science and the development of requisite twenty-first century skills in critical thinking, communication, collaboration, and problem solving has been a major focus of educators, policy makers, and researchers. As the nation has struggled to address the concern, the integration of technology into the curriculum as one method of engaging students, delivering and/or enhancing instruction, and thus increasing student achievement levels in target subject areas and in twenty-first century skills has taken center stage. States and schools have expended considerable portions of their budgets on the acquisition of technology and its integration into curriculums. With growing economic and budgetary concerns, states have sought to determine how much and what forms of technology are most effective in achieving their goals and meeting federal and state-mandated requirements. The level of infusion of technology into the curriculum continues to vary widely from school to school; and as previously stated above, still only 54% of teachers regularly integrate technology into their classroom instruction. During the first decade of the twenty-first century, researchers sought to provide answers to the relevancy of technology integration into the curriculum. Researchers have suggested that while technology integration into curriculum has the potential to engage students and impact their achievement levels, this potential is realized only when it is directed purposefully toward building higher order thinking processes in students and achieving learning outcomes in subject areas such as science, math, and reading.

Problem Statement

In developing the North Carolina's Common Core Curriculum and Essential Standards, educators and policy makers used the Revised Bloom's Taxonomy (RBT) as their aim was not only to engage students, but also to help move them toward the complex thinking expected of twenty-first century graduates ("North Carolina Department of Public Instruction: Career and College, Ready, Set, Go!," 2011). Technology, an essential component of the standards, is identified as a priority to help merge the cognitive process with both content and pedagogical knowledge ("North Carolina Department of Public Instruction Common Core State and NC Essential Standards," 2012).

School districts strive to provide and implement technology for teacher and student use. As students are considered *native digital users,* the importance of technology in classrooms has become essential to prepare students for twenty-first century (Prensky, 2001a). Implementing technology tools requires a substantial investment. With continued cuts in both federal and state funding, educational leaders are scrutinizing budgets and trying to make the best and most effective use of funds (Allen, 2008; Townsend et al., 2012; "Transforming American Education: Learning powered by technology: National Education Technology Plan 2010," 2010). Since there is no consensus on the effectiveness of technology integration in improving student achievement (Barron, Kemker, Harmes, & Kalaydjian, 2003; Protheroe, 2005), the “great impetus and wide-spread public support that currently exists for spreading the computer to schools nationwide and the associated costs” (Hadsell & Burke, 2007, p. 111) make further study of the impact of technology integration on student achievement necessary. Despite the fact that the integration of technology in curriculums and classrooms is a priority, research has not “unequivocally” proven that instructional technology implementation is a cost effective way to improve student achievement (Protheroe, 2005). Further, few studies focus on teachers’ perceptions of the impact of technology integration in curriculum on student achievement or attempted to correlate teachers’ perception with student achievement results, i.e., end of grade tests.

Statement of Purpose

The purpose of this correlational, causal-comparative quantitative study was to determine if there was a relationship between teacher experience, gender, and courses taught and their perceptions of technology use at the school site. The study also examined how the teachers in this study perceive the adequacy of their student's technology skills for meeting college and workplace demands. A secondary purpose of the study was to determine if differences exist based on demographic characteristics (years of experience, gender) of participants.

This study was quantitative in nature and utilized a correlational, causal-comparative research design. The correlational research design uses a statistical test to explain the relationship between variables (Creswell, 2012). The causal-comparative research design uses a statistical test to determine whether the independent variable affected the outcome, or dependent variable, by comparing two or more groups of individuals (Brewer & Kuhn, 2010). The correlational, causal-comparative research design was chosen for this study and uses level of technology integration in the classroom as the dependent variable and teachers' age, gender, years of experience, computer self-efficacy, instructional technology professional development received and student test scores as the independent variables. To gather data for this study, a validated survey instrument was utilized to obtain data from participants in the research study. The survey was the method chosen for this study because it was the best tool to gather all data needed from participants in this study. In addition, it is the preferred method of data collection for the participating school district. After exploring various survey instruments, the School Technology Needs Assessment (STNA) survey was selected as the tool to collect data for this study. The survey instrument, STNA, was designed and validated by The Friday Institute and initiated by the participating school district. The Friday Institute is a research institution that collaborates with education, government and private industry to empower educators and their students to be twenty-first century leaders and learners. The survey was given to approximately 100 secondary Career and Technical Education (CTE) teachers within the participating district and correlated with student test results. The population was chosen because it provided varied genders, age ranges, ethnicities, years of employment in education and educational levels. The CTE program is also the only curriculum where all courses within that curriculum give state end of course assessments.

Protheroe (2005) stressed the importance and urgency of ascertaining evidence of the impact of instructional technology integration on student achievement in light of accountability and other issues involved in implementing instructional technology. The current study sought to understand the relationship, if any, between teachers' perceptions of instructional technology integration in classrooms and student achievement. Understanding the relationship between teacher instructional technology integration and student achievement is a complex issue, one that must examine teacher perceptions of instructional technology tools and integration in the classroom in relationship to achievement. The study also examined the twenty-first century student and the teacher perceptions of the student technology skills acquired in preparation for college and the workplace. These topics are studied in an effort to provide insight for educators and leaders as they make decisions about the use of educational technology as a method to increase student engagement while complying with state and federal accountability requirements.

Significance of the Study

This study examined the relationship between a Career and Technology education teachers' integration of technological tools in the classroom and their perceptions of its relationship to student achievement. Research is available that recognizes the relevance of instructional technology tools in classrooms. Parker, Bianchi, and Cheah (2008) studied how users perceive technology and its effects on classroom dynamics such as student engagement. The researchers conducted a study of post-secondary faculty and students and the use of two commonly used technology tools. The researchers found no clear evidence of the efficacy of the use of instructional technology. Başer, Mutlu, Şendurur, and Şendurur (2012) conducted a study of 189 junior high school students' perceptions of technology integration in schools and found that students' perceptions of technology warrant the integration of technology into the classrooms by educational institutions. In contrast to this research study, both of the research studies mentioned above recognized that technology has been shown to have some effect on student engagement, but failed to examine it specifically from the teachers' perspective.

While these two studies examined some aspects of instructional integration tools in elementary, secondary and postsecondary students, there is much less specific research and data available that show the actual effectiveness and impact of instructional technology on student achievement. With budget constraints and increased federal and state accountability requirements, the importance of understanding the impact of teacher instructional technology integration in the classroom on student achievement is critical (Johnson, 2009) .

Research Questions:

This study focused on the following research questions:

1. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom?

2. Does a relationship exist between the teachers' level of technology integration in the classroom and student achievement as measured by performance on end of course tests?

Hypotheses:

This study focused on the following hypotheses:

$H_0$1: There will be no statistically significant relationship between a teachers' gender and the level of teachers' technology integration in the classroom.

$H_0$2: There will be no statistically significant relationship between a teachers' years of experience and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$3: There will be no statistically significant relationship between a teachers' computer self-efficacy and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$4: There will be no significant relationship between a teachers' instructional technology training and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$5: There will be no statistically significant relationship between the level of technology integration and student achievement as measured by performance on the post assessment state end of course tests as reported by the School Technology Needs Assessment (STNA).

Identification of Variables

This study utilized a quantitative, correlational, causal-comparative research design. In order to determine if there was a relationship with the independent and dependent variables, the study utilized a survey instrument to gather data for this research. Instructional technology integration was the dependent variable in the study. The independent variables included the following: teacher self-reported computer self-efficacy, professional development training received, and demographic data including gender and years of teaching experience. The use of a validated survey instrument helped diminish the possible effects of issues with data reliability.

Definitions

Career Technical Education – A program of study that seeks to prepare students for post-secondary education and careers as it infuses academic content with technical and occupational knowledge ("Career and Technical Education Briefing Papers," ; "The Carl D. Perkins Career and Technical Education Act of 2006," 2006)

Computer Self-Efficacy – Awareness, confidence and belief in an individual's ability and comfort level with computer use and/or computer applications (Compeau & Higgins, 1995; Iscioglu, 2011).

Digital Native – A person born during the digital age and who is comfortable with digital language of computers, games and the internet (Prensky, 2001a, p. 46).

Digital Immigrant – Persons not born during the digital age that may become fascinated and adopt the aspects of the new technology (Prensky, 2001a).

Instructional Technology – The methods, tools, resources and applications used and designed for promotion of student learning ("Instructional Technology," 2006).

No Child Left Behind Act (NCLB) – The purpose of this act was ultimately to raise student achievement and close the achievement gaps among students. More commonly known as No Child Left Behind, this reauthorized Elementary and Secondary Education Act supports standards based reform in an effort to force and achieve high standards ("Ed.gov US Deparment of Education," 2008).

Post-Assessment (Career and Technical) – A formal, validated, summative assessment used to determine mastery of content and skills (Honeycutt, 2011).

Revised Bloom's Taxonomy (RBT) – A framework for classifying educational goals, objectives and standards. The RBT is organized into six levels. The levels are remembering, understanding, applying, analyzing, evaluating and creating (Krathwohl, 2002).

Student Achievement – A status or measure of a specific, defined level of success for the student. This will be measured in this study by the student outcomes or improvements levels on the post-assessment test ("National Board for Professional Teaching Standards," 2013).

Twenty-first Century Skills –A framework developed that recommends a mastery of a specific set of skills, knowledge, and expertise for students to possess in order to be successful in life and career in the twenty-first century. The set of skills include mastery of critical thinking; communication and collaboration; information, media, and technology skills; life and career skills; financial, environmental, civic and heath literacy; and global awareness ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011).

Research Summary

As our economy becomes more globalized, the necessity for students to be prepared to compete worldwide is critical. The necessity of increasing the academic achievement of students overall has contributed to more involvement in public education through state and federal legislation. North Carolina has enacted policies and guidelines that challenge school districts to institute practices and policies in educational institutions that will better prepare the students ("North Carolina Department of Public Instruction: Career and College, Ready, Set, Go!," 2011). The overall goal of technology integration in the curriculum is to increase student engagement, to equip students with twenty-first century college and workplace skills, and to increase student achievement ("North Carolina Department of Public Instruction: Career and College, Ready, Set, Go!," 2011). The increased integration of technology in curriculums and classrooms has been set as a priority to accomplish this goal. Budgetary implications, public concerns, and research suggesting that successfully integrating technology into the curriculum can increase student achievement provide a rationale for researching this topic (Parker et al., 2008). This study examined instructional technology, the integration of technology within the classroom and its relationship to student achievement as measured by the state post-assessment test. The North Carolina Career and Technology teachers in a specific district were surveyed. The survey included questions related to computer self-efficacy, professional instructional technology development, experience and level of instructional technology integration (Corn, 2010).

CHAPTER TWO: REVIEW OF LITERATURE

The literature review begins with an overview of the history of technology use and the evolvement of the adoption of technology use in the classroom. The second section introduces B.F. Skinner's behaviorist theory, which provides the theoretical framework for this study. The behaviorist theory states that learning is a change in behavior which is result of a stimulus (Ely, 2008). The next sections examine the history of technology integration, how technology evolved due to high stakes testing, the twenty-first century student and skills and technology integration pre and post the federal mandate of No Child Left Behind (2001). The last section examines constructs influencing technology integration, which include teachers' professional development level and computer self- efficacy. The researcher utilized EBSCOhost (Academic Search Complete and Education Search Complete), JSTOR and Sage Publications as the primary journal and electronic databases to locate research literature. Using the keywords of technology integration, Career and Technical education, computer self-efficacy, technology professional development, the researcher was able to generate the potential literature for review.

History of Instructional Technology

As early as 1990, the National Center for Education Statistics began measuring the use of educational technology in classrooms. The *Report on Teachers' Use of Technology* stated that the percent of computers available for student use increased substantially between 1990 and 1999 (Smerdon et al., 2000). In the early 1990's very few classrooms were equipped with computers and internet connections; but by the end of the decade, approximately 84% of classrooms had at least one computer available for student use (Smerdon et al., 2000). These computers were used mainly for creating documents or spreadsheets, conducting research via the Internet, practicing drills, solving problems and analyzing data (Smerdon et al., 2000). Smerdon et al. (2000) also noted that by 1999, teachers who felt well prepared or very well prepared to use computers and the Internet for classroom instruction increased their use of computers as a result of training and increased understanding of technology (Smerdon et al., 2000).

Though the percentage of classrooms with at least one computer available for student use was increasing, teacher integration of technology in classroom instruction was accelerating, and the frequency and use of computers by students was rising, criticism of computer use in the classroom increased. Many critics questioned the effectiveness of computer use within the classroom. Such criticism sparked debates about the need for technology integration within the educational classroom, especially at "all levels of the educational system, particularly because the investments have been and remain [sic] so high" (Cuban, 2001; Jones & Paolucci,1999, p. 17). This debate, which continues today, gave rise to research studies such as the Smerdon et al. (2000) study, the purpose of which was to understand "the extent to which these technologies are being used and for what purposes" (Smerdon et al., 2000, p. i). In other words, does the integration of technology enhance student learning and do these technologies have an effect on the bottom line of raising student achievement (Davies, 2011; "Ed.gov US Deparment of Education," 2008)?

Theoretical Background

Results of research on the effectiveness and influence of technology on student learning have been mixed. However, review of five large scale educational technology studies by Schacter (1999) demonstrated that many researchers found that environments utilizing instructional technology motivated and enhanced student learning (Davies, 2011; Molenda, 2009; Protheroe, 2005). This finding situates the issue within the framework of behaviorist theory. Behaviorism as a theory states that knowledge is received through the senses. Learning, then, is a direct function of a change in a behavior which is a result of a stimulus or a reinforcer, which can be either positive of negative (Ely, 2008).

This stimulus or reinforce concept is attributed to Skinner, who is considered the father of the behaviorist theory. The behaviorist theory recognizes that knowledge is acquired when the bond between stimulus and response is strengthened by means of a reinforcer (Scheurman, 1998; Skinner, 1986). Skinner's expansion of this concept included the highly influential advancement of the teaching machines movement, a method of improving learning directed more at the learner than at the teacher (Ely, 2008). The teaching machines movement extended behaviorist theory in that it posited that any desired outcome can be effected through the use of a specific stimuli, in this case the use of a device, to reinforce the desired behavior (Skinner, 1986).

Another theory that provides a framework for this problem is the constructivist theory, which posits that learning by an individual is internal and is acquired through the individual's interactions and experiences (Bozkaya, Aydin, & Kumtepe, 2012). According to Scheurman (1998), constructivism is student oriented and the role of the teacher should be to create an environment in which students gain experience at consuming information and transform their experiences into internalized thought processes. Scheurman (1998) further suggested that constructivists theorize that the goal of a good education is "to instill in students an accepted body of information and skills" (p. 8) and that education should have relative emphasis and real world applicability for the student.

The constructivist theory is apparently the underlying basis of the National Research Council Institute of Medicine's (2004) work on student engagement, of Lorin Anderson's (2001) Blooms' Revised Taxonomy, and of Phillip Schlechty's (2011) *Working on the Work* framework. Schlechty's (2011) *Working on the Work* framework theorizes that learning requires "conscious and purposeful effort" and that student engagement is the preferred means of educating students (Schlechty, 2011; Youth & Studer, 2004, p. 13). To engage students, teachers must design work that applies to students with different learning styles, that has relevance, and that creates interest in students. Out of this framework Schlechty created his 10 Design Qualities, specific attributes which require teachers to design schoolwork that will ultimately increase the rate and frequency of student engagement and thus increase student achievement (Schlechty, 2012). To accomplish this goal, the role of all involved in the educational process--teachers, principals, central office personnel and parents-- must change to accommodate the needs of students (Schlechty, 2012).

Similarly, the Blooms' Revised Taxonomy (2001), also an outgrowth of the constructivist theory, was developed to accommodate educators and students to the new developments and behaviors emerging with the changing technological advances of the 21st century. The Blooms' Revised Taxonomy framework emphasizes a mastery concept environment, created by teachers, to motivate and engage learners so they internalize learning goals and objectives (Jackson, Gaudet, McDaniel, & Brammer, 2009; Krathwohl, 2002). The ultimate goal of the framework is to move the learner from simply remembering or memorizing knowledge and facts to the ultimate stage of synthesizing and creating.

Behaviorist theory, which posits that learning is a change in behavior resulting from a stimulus or reinforcer (Ely, 2008), and constructivist theory, which holds that learning is individual and acquired through the individual's interactions and experiences (Bozkaya et al., 2012) focus not only on the nature of learning but also on the nature and the needs of the learner. Prensky (2005) suggested that since the twenty-first century is a technological world and our daily actions are performed with computers or some other form of technology, it would be remiss of educational institutions not to integrate technology tools into their curriculums (Prensky, 2005). Prensky (2005) stated that the 21st century has seen an influx of technological advances and tools, and those born into this age are termed *digital natives* because they are native speakers of the digital language of computers, video games, and the Internet. For the digital native learner the language of computers and technology is innate and considered as a second language.

Unlike those born before technology or digital immigrants who must adapt and learn the digital language, digital natives receive information rapidly, “parallel process and multi-task”, and prefer graphics over text (Prensky, 2001b, p. 3). Prensky suggested that educators must evolve their methodology of teaching “to communicate in the language and style of their students” (Prensky, 2001b, p. 4). Educators, according to Prensky (2005), must use technology tools within the classroom for the digital native learner whether or not this use will affect student achievement because the infusion and integration of technology within the classroom helps to motivate and engage the student thus making learning more relevant.

Because many educators and educational leaders are digital immigrants, they may not fully understand the importance of the use of technology tools within the classroom for those who were born into the digital world. These immigrants are those that may have adopted many aspects of the digital world; but similar to those that learn another language later in life, they may not be as eloquent or adept in their use of technology tools as the digital natives (Prensky, 2001b). Their *accent*, as Prensky coined it, may make them less comfortable with certain technology tools and, thus, more apprehensive about integrating these tools into the curriculum. However, failure to integrate technology into the curriculum may decrease the engagement and relevance lessons may have for digital native students (Prensky, 2005). Thus, the professional development of teachers and training in the integration of technology into the classroom is crucial to the achievement of educational goals. Moreover, the NCLB Act (2001) mandated an emphasis on technology integration in all areas of K-12 education. The requirements include a directive for educators and leaders to use technologies in the curriculum. The mandate also requires educational institutions to produce technologically literate students ("No Child Left Behind," 2001). In an effort to adhere to these mandates, digital immigrant educators must refocus their behaviors, find ways to increase student engagement, recognize and understand the needs of digital natives, and design curriculum that allows them to internalize thought processes and thus prepares them for the 21st century. The behavioral approach and the constructivist approach, both of which promote and are based in change, provide the theoretical framework for this problem.

The Call for Education Reform

The call for education reform began decades ago, most notably when *A Nation at Risk* was released in 1983. The National Commission on Education Excellence warned the United States that America was at risk and students were not being prepared for the global marketplace. To emphasize this point further, the report stated that the “unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world” ("A Nation at Risk",1983, p. 9). This educational mediocrity, as termed by the Commission, was so bad that “if these same conditions had been introduced by an unfriendly foreign power it would be considered an act of war” ("A Nation at Risk",1983, p. 5). The report called for reform and more accountability in the current educational system.

The Commission gave several recommendations in order to achieve “superior educational attainment that included more rigorous and measurable standards for schools, colleges, and universities, more stringent graduation requirements, stronger curriculum that included technology courses and the adoption of technology within all courses to help better prepare students for the global marketplace" ("A Nation at Risk",1983, p. 17). The Commission's stance on education required "constructive reform" in that recommended changes in the educational institutions related to content, expectations, time, and teaching. The Commission also sought to hold states accountable for implementing these recommendations.

The National Commission on Excellence in Education offered recommendations in the areas of "content, standards and expectations, time, teaching, leadership and fiscal support" (Allen, 2008; "Nation at Risk", 1983). Allen's (2008) analysis of the *Nation at Risk* noted that the growing use of technology was addressed in the report to deal with a "risk" or possible deficiency in education and its preparation of students for the changing workplace. The report, as noted by Allen, went so far as to suggest that without reform, access, and better training in the use of technology tools, the country will be faced with a growing divide between those who are prepared and ready for the skilled workplace and those who are "ill-informed, the indeed uniformed" (Allen, 2008, p. 609). The report went on to quote John Slaughter, the former director of the National Science Foundation, who warned of this growing chasm. Upon its release the report received support from educational reformers who felt that schools needed to do a better job of preparing students. In addition, the report made "Five New Basics" recommendations, three of which specifically pointed to technology as a way to equip graduates. The report recommended that graduates be taught and expected to a) understand the computer as an information, computation, and communication device; b) use the computer in the study of the other Basics and for personal and work-related purposes; and c) understand the world of computers, electronics, and related technologies (Allen, 2008, p. 609). It concluded that secondary schools have become normalized and their central purpose weakened, which allowed secondary school students to choose a curriculum that drifts from college and vocational to general education courses. In addition, 25% of the general education courses are physical and health education, work experience outside the school, remedial English and mathematics, and personal service and development. *A Nation at Risk* (1983) also found that in relation to expectations that American students spend nearly three times less class and homework time in mathematics, biology, chemistry, physics, and geography than students of other industrialized nations. The Commission also reported that the overall amount of time spent on homework has decreased and the minimum competency levels fall short of what is actually the minimum needed for education standards. The Commission concluded that the focus for improvement in education institutions is to regulate four key areas of education, which are content, expectations, time, and teaching. The content area recommendation of the report focused specifically on technology, noting that all high school graduates should be proficient in the use of technology for studying and gaining competence in the basic skills of English, mathematics, social studies, and science ("A Nation at Risk",1983).

The call for reform in *A Nation at Risk* pushed the nation further toward accountability measures (Peterson & West, 2003). This movement sought to increase expectations of both students and teachers and to find a way to measure the results of the increased efforts of the educational institutions and thus ushered in additional requirements for high stakes testing. This movement was pioneered by governors in Tennessee, South Carolina, Arkansas, and North Carolina (Peterson & West, 2003). The accountability movement used high stakes testing to demonstrate that educational institutions were meeting requirements and that students were being adequately prepared. Testing became the key way to hold teachers, students, schools and states accountable for adhering to and reaching the requirements and standards set forth by the government (Dee & Jacob, 2011; Peterson & West, 2003). Former North Carolina Governor, James B. Hunt, was one of the early proponents of transforming the education system. Hunt stated that the best way to secure America's future is through quality education. He, among other governors, sought reform that led to a push for more accountability. This accountability came in the form of high stakes testing, rigorous standards and excellent teaching through the use of educational tools, including technology, and curriculum that supported student learning and achievement (Institute, 2013).

The education reform movement gained its greatest impetus from the NCLB Act, initiated in 2001, which has prompted public school personnel to find ways to address disparities in the achievement levels of various groups of students. The NCLB Act of 2001 enacted legislation in order to actively push schools to reform and change in an effort to close the achievement gap among students and better prepare them for working and living in the 21st century. The act mandated that schools be accountable for the progress and achievement of their students by showing improvement or Adequate Yearly Progress (AYP) as reported in state standardized test scores, including those in reading and math. The legislation also challenged schools to improve the overall quality and create an enriching and accelerated educational environment. As stipulated in the NCLB act, schools must improve student academic achievement and are required to train students and make them technologically literate. Part D of NCLB, Enhancing Education Through Technology, strongly encourages integration of technology resources not only to help ensure that students are technologically literate but also to increase the engagement and achievement of students ("No Child Left Behind," 2001). In turn, this push for accountability through high stakes testing, the need for developing and preparing 21st century students with adequate 21st century skills, and the focus on technology integration in the classroom has led schools to increase the presence and use of technology ("No Child Left Behind," 2001).

High Stakes Testing

The high-stakes testing movement gained momentum as a result of the report from the Commission and the subsequent passage of the NCLB Act of 2001. The NCLB Act of 2001 required high stakes testing as an accountability measurement to gauge the preparation of students. High stakes testing is defined as those tests that " carry serious consequences for students or educators" (Merchant, 2004, p. 2). The high stakes tests were originally implemented as a measure to gather information about a student's achievement over a length of time. With the enactment of the NCLB Act and its requirements, the high stakes testing movement took on a new agenda. These tests are not only used to hold students and schools accountable but are also used to guide many important decisions, such as budgetary decisions, staffing allocations and allotting of resources for students and staff (Darling-Hammond, 2002; Goertz & Duffy, 2003; Merchant, 2004). The high stakes testing, in its current form, is one response to *A Nation at Risk's* (1983) call for higher educational standards and reform that included greater accountability, more rigorous and measurable standards, and technology literacy and integration into curriculum (Merchant, 2004).

Failure of schools to prepare students and support families in preparation of children for society is costly in human and financial terms (Comer, 2004). Early data had showed little improvement in lessening the achievement gap among the various demographics, which led to enactment of the NCLB Act of 2001 (Dee & Jacob, 2011; Goldberg & Berends, 2009; Rosenfield & Berninger, 2009). The NCLB Act of 2001 has had the effect of transforming the culture and environment of educational institutions as the law necessitates accountability for schools. Because of this legislations, schools needed to devise a variety of strategies to support and document improved student outcomes. Many schools have had to change their entire operational structure from the more traditional hierarchical structure and develop different approaches to leadership, development, and school culture.

The main focus of the NCLB Act of 2001 was to ensure that all students have an equitable opportunity to reach a high-quality education and 100% of students would obtain proficiency in reading/language arts and mathematics by 2014 ("No Child Left Behind," 2001). The states, under the act, had to determine specific content and grade level expectations for students as well as provide annual testing for students in grades 3-12. The states that receive federal funding through Title I of the NCLB Act also had to develop targets and report annual Adequate Yearly Progress (AYP) for all students and specific demographic subgroups on standardized tests ("No Child Left Behind," 2001; "North Carolina No Child Left Behind," 2008). By narrowing the achievement gap among the demographic subgroups, the intended result of the NCLB Act was to strengthen the academic ability of future workers to compete effectively and live in the global marketplace (Comer, 2004; DeBray-Pelot & McGuinn, 2009).

The use of high stakes testing for accountability has both critics and advocates. Undoubtedly, the use of high stakes testing can be the catalyst for educational reform in schools. However, the question of whether to use high stakes testing in light of its positive and negative effects arises from both critics and advocates. On the one hand, some argue that high stakes testing may increase the stress level of administrators who are chiefly responsible for accountability, students who experience frequent testing, and teachers who may feel overwhelmed and overworked (Williams, 2001). On the other hand, advocates pointed to the successes of high stakes testing. These advocates cited increases in the academic student performance and the narrowing of performance gaps between white students and students of color such as those reported in North Carolina and Texas, despite the increased stress to some administrators, students, and teachers (Goertz & Duffy, 2003).

According to Williams (2001), the use of high stakes testing increases the likelihood of creating an educational environment in which teachers feel pressured to teach to the test, to focus on facts and skills that may be found on the test rather than other aspects of the curriculum. Smith (1991) conducted a qualitative study of classrooms in Arizona and found that preparing, administering, and recovering from high stakes testing took an average of 100 hours of instructional time in a school year, a significant amount of time considering that there are only approximately 300 hours of actual direct instruction time in a given year (Smith, 1991). Because of the increased focus on teaching to the test, Abrams, Pedulla, and Madaus (2003) suggested that high stakes testing "may, in effect, lead to a de-professionalization of teachers" (Abrams et al., 2003, p. 20). Similarly, a number of studies have reported that the use of high stakes tests increases stress and decreases morale among teachers. In a study conducted by Jones, Jones, Hardin, Chapman, Yarbrough and Davis (1999), 76% of the 470 North Carolina teachers surveyed reported that since the inception of the high stakes testing they felt that morale was lower, that they were not confident that the quality of education had improved, and that their jobs were more stressful (M. G. Jones et al., 1999). Teachers in Texas, another state that is on the forefront of high stake testing, were surveyed by researchers Hoffman, Assaf, and Paris (2001). These teachers, like those in North Carolina, reported that the high stakes testing lowered morale and created a more stressful environment. Abrams et al. (2003) reported that over half of teachers in Maryland and 75% of teachers in Kentucky also reported a decline in morale as a result of the state-mandated high stakes testing. Teachers also believed that this decline in morale and motivation also extended to students. Teachers in North Carolina and Kentucky reported that their students were more anxious and that the morale of students had declined since the implementation of the high stakes testing (Abrams et al., 2003). Although teachers identified the negative impact of high stakes testing, these same teachers agree that there needed to be some measure of student accountability. The teachers responded more favorably to the use of high stakes testing to provide an acceptable measure of student achievement, but rejected the use of tests to hold schools and teachers accountable (Abrams et al., 2003).

The National Board on Educational Testing and Public Policy (2003) also sought to garner teacher perceptions of and attitudes toward high stakes testing programs. This national survey, sent to over 12,000 teachers, used an 80-item questionnaire. The survey asked teachers to respond to various statements about their state testing program, student learning, and classroom practices. The results of the survey, reported by Pedulla et al. (2003), resulted in two main themes. The first theme was of the perceptions of teachers related to the categories surveyed. Based on whether or not a state used high stakes testing, teacher perceptions differed in the areas of pressure on teachers, emphasis on test preparation, time devoted to test content, and views on accountability (Pedulla et al., 2003). The second theme was a “difference between elementary, middle, and high school teachers regarding the effects of their state's test” in areas such as school climate and classroom use of test results (Pedulla et al., 2003, p. 11). Forty-three percent of teachers in high stakes testing states, compared to only 17% of teachers in low stakes testing states, reported that they spent more time teaching content that would be tested and less time on non-tested content (Abrams et al., 2003). Teachers in the high stakes testing states reported significant decreases in instructional time devoted to “fine arts, industrial/vocational education, field trips, class trips, enrichment assemblies, and class enrichment activities”

(Abrams et al., 2003, p. 23). Those in low stakes testing states did not report a decrease in these areas. Regardless of whether they were from a high stakes or low stakes testing state, all teachers believed that the implementation of state testing programs has changed their teaching and has had a negative impact on the quality of education that a student receives (Abrams et al., 2003; Pedulla et al., 2003).

As noted above, *A Nation at Risk* report (1983) recommended education reform to include accountability standards, as measured by high stakes tests; integration of technology and technology literacy; higher expectations, and a more rigorous curriculum. This report ushered in the federal accountability movement of the NCLB Act, which mandated states not only to develop accountability measures but also to promote technology literacy and integrate technology into all areas of curriculum in order to prepare students for the global marketplace. Technology integration and its effects on high stakes testing are important factors to study due to the accountability mandates that were set forth in NCLB. Researchers will need to continue to study the impact and the effectiveness of such sweeping changes to education.

Twenty-first Century Students

The NCLB Act of 2001 challenged schools to find ways to increase student achievement, including a directive to increase students' technology literacy through access to technology and its integration within the classroom ("No Child Left Behind," 2001). To meet the accountability standards set forth by the NCLB Act, many schools continued to invest high dollars in acquiring educational technology tools, integrating technology into the curriculum, and providing technology training for teachers because there is still nationwide support for computers in schools (Hadsell & Burke, 2007).

In recent years, there has been a shortage of funding for education. With budget cuts and less money available, educators and administrators are securitizing spending to find the best and most cost effective use of available funds. Many institutions are evaluating not only purchases of new educational technology but also the way in which educational technology currently in place is used (Hadsell & Burke, 2007; "North Carolina State School Technology Plan," 2011; Scherer, 2011). While austere economic times necessitate such scrutiny, educational technology leaders such as Karen Cator, director of the US Office of Technology, and Marc Prensky, author, continue to advocate for the use of educational technology within the curriculum. These leaders have sought to inform educational leaders of the importance of becoming a “facile” user of technology to support the learning goals of the 21st century student. These 21st century students, they emphasize, should not be taught without technology (Jones, 2012; Prensky, 2005; Scherer, 2011).

As noted before, 21st century students are considered digital native students. They have been exposed to “all things technological” and have not known life without technology (Prensky, 2005). This exposure to technology has made them unlike any of the previous generations in the way they think, interact, and process information, an observation that some research supports. Virginia Jones (2012) reported that some experts in the fields of neurobiology and psychology suggest that the brains of 21st century students may actually be “physically different because of the bombardment of digital input received from birth” (Jones, 2012, p. 17). The 21st century student, unlike the digital immigrant, absorbs and processes information in nonlinear ways and relies heavily on cues such as images and texts in order to process information (Jones, 2012). In addition, the 21st century student excels in multitasking and prefers information through visual images and text cues because it provides access to various information much more quickly and concisely than traditional methods (V. Jones, 2012). These findings tend to support Prensky's (2005) contention that the digital native should not be taught without technology.

Twenty-First Century Skills

The NCLB Act mandated that schools reform their curriculum to help close the achievement gap. As a result, the practice of using high stakes testing as a measure of accountability has steadily increased. Because of the initiatives of the NCLB Act, there has also been a push to have schools integrate technology into all facets of the curriculum ("Ed.gov US Deparment of Education," 2008). The movement for higher standards and accountability, as measured by high stakes testing, has made educators take a closer look at what is being tested, what is being taught, and whether students are prepared with the 21st century skills as mandated by the various directives of state and federal requirements (M. F. Goldberg, 2004). To this end, the Partnership for 21st Century Skills (P21), a coalition of government, business community, education leaders, and policymakers, was formed in 2002. The purpose of the organization is to bring attention to importance of preparing all students in US K-12 institutions with the 21st century skills needed in college, career and the global marketplace. ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011). To help address the achievement gap and to ensure that students acquire 21st century skills, the Partnership for 21st Century Skills stated that curriculums need to develop students' skills in information literacy, media, and technology or Information, Communications and Technology Literacy (ICT) ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011). The ICT skills call for students to possess the ability to use technology for research, organization, evaluation and communication in the academic content areas including English, mathematics, science, and social studies. ICT skills include enabling objectives such as the ability to understand and apply digital technologies such as computers, tablets, and media players as well as use networking, web communication, and social media tools so as to function effectively and successfully in a knowledge economy ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011).

The NCLB Act, whose overall goal was closing the achievement gap and preparing students for the global economy, had suggested that one way to achieve the goal was through the integration of technology into the curriculum and thereby increasing students' technological literacy. The P21 Partnership provides a framework of Essential 21st century skills, including critical thinking and problem solving skills; communication and collaboration skills; creativity and innovation skills; information, media, and technology skills; flexibility and adaptability skills; social and cross-cultural skills; productivity, accountability, leadership and responsibility ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011, pp. 1-9).

Because of the need for students to be able to compete globally, it is important for students to be equipped with the 21st century skills that allow them the ability to function and think critically (Salpeter, 2003). Echoing the recommendations of the NCLB Act and The Nation at Risk report, the P21 Partnership supports the development of Information, Communications, and Technology (ICT) Literacy skills; these literacy skills should allow the student to develop higher order thinking skills, critical skills such as analysis, evaluation, and creativity skills. These skills are essential in order to be an effective citizen in the 21st century economy (Larson & Miller, 2011; Salpeter, 2003). Furthering the need for preparation, the P21 Partnership created a Framework for 21st Century Learning, a guide to create a "holistic view" of teaching and learning that focuses on outcomes for the 21st century student and "innovative support systems to help students master the multi-dimensional abilities required of them in the

21st century" ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011). The Framework guides teachers in best practices to use in creation of lesson plans, curriculum design and development, and preparation for formative and summative assessments. The Framework supports educators to help students with the mastery and fusion of academic core content areas: English, reading, language arts, mathematics, science, foreign languages, civics, government, economics, arts, history, and geography; as well as critical thinking, problem solving, communication, collaboration, creativity and innovation.

Technology Integration before No Child Left Behind

With the increased presence of technology in classrooms, The Milken Exchange on Education Technology commissioned a study on *The Impact of Education Technology on Student Achievement*. The study, conducted by Schacter (1999), analyzed five large scale and two smaller scale specific education technology studies. Schacter's research sought to outline what the research shows about the impact of education on technology on learning. Each study was selected based on the following criteria: scope, sample size, and the ability to generalize to local, state and national audiences (Schacter, 1999). The study included The Learning and Epistemology Group at MIT (1988; 1991), Scardamalia and Bereiter's Computer Supported Intentional Learning Environment (CSILE) Studies (1996), Kulik's Meta-Analysis Study (1994), Sivin-Kachala's Review of the Research (1998), The Apple Classrooms of Tomorrow (1994), West Virginia's Basic Skills/Computer Education Statewide Initiative (1999), and Harold Wenglinsky's National Study of Technology's Impact on Mathematics Achievement (1998). Each of these studies, analyzed in the work by Schacter, further studied the impact, if any, that technology had on student achievement (Schacter, 1999).

To ascertain how well computer-based instruction has worked, James Kulik used meta-analysis, a methodology developed by Gene Glass that uses a statistical analysis of a large collection of results from individual studies for the purpose of integrating the findings (Kulik, 1994). The study identified four major benefits of computer-based instruction. Students usually learn more in classes in which they receive computer-based instruction. The average effect of computer-based instruction was to raise examination scores from the 50th to the 64th percentile. Students learn their lessons in less time with computer-based instruction. Students also like their classes more when they receive computer help in them. The average effect of computer-based instruction in 22 studies was to raise attitude-toward-instruction scores by .28 standard deviations. Finally, students develop more positive attitudes toward computers when they receive help from them in school. The average effect size in 19 studies on attitude toward computers was .34 (Kulik, 1994, p. 11).

The second study that Schacter analyzed was the Sivin-Kachala Review of the Research, a study based on 219 research reviews and reports on original research projects. Similar to the conclusion of the Kulik study, this report found that technology makes a significant positive impact on education (Schacter, 1999; "Software Publishers Association's report on the," 1998). The Sivin- Kachala Review found that educational technology has been found to have positive effects on student attitudes toward learning and on student self-concept. It was also found that computer based instruction contributed to the idea that students felt more successful in school, thus increasing their motivation to learn and their self-confidence and self-esteem. According to the report, the level of effectiveness of educational technology is influenced by specific factors such as the student population, the software design, the educator's role, how the students are grouped, and the level of student access to the technology (Schacter, 1999).

The Apple Classrooms of Tomorrow (ACOT) was a large-scale study evaluated by Baker, Gearhart, and Herman. The original Apple Classrooms of Tomorrow was implemented in five classrooms in an effort to assess the effectiveness of interactive technologies on teaching and learning. The program provided students and teachers with access to technology at home and school. According to the researchers, the Apple Classrooms of Tomorrow (ACOT) utilized technology to support a constructivist approach to learning where technology is used as knowledge-building tools (E. Baker, Gearhart, & Herman, 1994). The goal of the project was to utilize technology in order to enhance classroom instruction, encourage teacher use of technology in classrooms, and support student learning and innovation. The evaluation found that participation in the project seems to suggest that Apple Classrooms of Tomorrow technology could have an effect on instructional processes that will very likely lead to positive outcomes. Participants in The Apple Classrooms of Tomorrow project experienced positive outcomes such as "greater emphasis on higher-level cognitive tasks, student initiative, and cooperative group activities" (Schacter, 1999). These outcomes were found more often in the Apple Classrooms of Tomorrow than in the traditional classrooms, though the results were not 100% conclusive (E. L. Baker, Gearhart, & Herman, 1990). Schacter also reported Apple Classrooms of Tomorrow students performed no better on standardized tests that included vocabulary, reading comprehension, mathematics concepts and work study than students who did not have access to computers or any of the initiatives implemented by the ACOT schools (Baker et al., 1990; Barron et al., 2003).

Technology Integration before No Child Left Behind: Debates on Computers in Classrooms

Other studies besides Schacter examined the role and necessity of technology in learning. In fact, the role that technology has on student achievement has been a source of continued study and debate. As early as the 1920's the use of instructional radio ushered in the use of machine in educational settings (Aslan & Reigeluth, 2011). Even with the use of machines in education, Frick (1991) noted that while some research has shown that the introduction of technology has a significant impact on educational reform, this introduction of technology has bought about both supporters and opponents. Though the opponents to technology existed, some promoters of computer technology in the classroom began to find funding sources to increase the number of classroom computers and accessibility for its students. Following the lead of the federal government, many private industries, state, and local governments felt the implementation of computers in the classroom would be a "bridge to the twenty-first century where computers are as much a part of the classroom as a blackboard" (Oppenheimer, 1997, p. 45). According to Larry Cuban, supporters of increased technology believed that to increase the number of computers in the classroom would cause increased use of computers. Proponents, according to Cuban, felt this would lead to "efficient teaching and better learning which, in turn, would yield able graduates who can compete in the workplace"(Cuban, 2001, p. 18). He further stated that some opponents argued that the funding for increased technology comes at the expense of cutting other curriculums, vocational skills and other programs that are considered to enrich a child's life (Cuban, 2001; Oppenheimer, 1997). Still other proponents believe that the increase of technology in classrooms would help American employers better compete in the global economy.

According to La Follette (1992), computers (making computers available) in a classroom is inevitable. The focus has now changed from simply having computers in the classroom to learning to use the technology resources available and to use the available resources in the most appropriate and efficient way (La Follette, 1992). La Follete further expanded the notion that the effectiveness of educational technology is based on how the technology is used and integrated into classroom teaching and learning. Similarly, Means (1993) suggested that even though efforts to integrate technology in the classroom can initially add to teacher demands, integration can have the following positive outcomes, all of which fit constructivist theory:

- Adding to the students' perception that their work is authentic and important
- Increasing the complexity with which students can deal successfully
- Dramatically enhancing student motivation and esteem
- Instigating greater collaboration
- Giving teachers additional impetus to take on a coaching and advisory role. (Means, 1993, pp. x-xi)

In another study, the results from the U.S. Department of Education's "Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology" stated that approximately 50% of teachers who have computers available actually use them in classroom instruction (Smerdon et al., 2000). Of the teachers that use the computer in classroom instruction, David Skinner (2002) reported that Larry Cuban found that rather than upending traditional methods of education, very few teachers have used technology to embrace the constructivist view of a more cooperative and creative classroom to help improve the learning process. However, as more evidence of the positive influence of educational technology use for student engagement and learning is published, this traditional use may be changing. Schacter's (1999) analysis of the West Virginia's statewide technology initiative reveal that the infusion and effective use of technology yielded positive gains in statewide high stakes test scores (Schacter, 1999). Similar results were yielded from Harold Wenglinksy's Assessment of Technology Impact on Student Achievement. Wenglinsky analyzed over 13, 000 fourth and eighth grade students' results of the National Assessment of Education Progress (NAEP) test in 1996. The study found that students who had access to educational technology tools showed positive gains in math scores when these tools were used for interactions and experiences such as simulations and higher order thinking constructivist practices. However, the analysis also found that students that used computer technologies for drill and practice performed lower on the NAEP than those students that did not use computer technology for drill and practice (Schacter, 1999). Fourth grade students who used the computer technology for simulations to develop higher order thinking skills realized greater improvement over those that did not use the technology (Schacter, 1999).

Technology Integration After No Child Left Behind

The NCLB Act of 2001 focused attention on technology and technology literacy as an integral component of the preparation of students for 21st century and of closing the achievement gap. Enhancing Education Through Technology (EETT), Part D of the NCLB Act, was enacted to improve student academic achievement through the use of technology and ensure that every student is technology literate. The EETT Act requires that technology be integrated into schools and that teachers be able to use best practices to enhance the curriculum ("Ed.gov US Deparment of Education," 2008). The U.S. Department of Education stated that the purpose of EETT Act was to help states and school districts with the integration of technology by:

1. Providing implementation and support of a comprehensive system that effectively uses technology to improve student academic achievement
2. Providing encouragement to establish or expand public-private partnerships that increase access to technology
3. Providing assistance to States and districts in acquisition, development, interconnection, implementation, improvement, and maintenance of educational technology infrastructure (networks, access, etc.)
4. Promoting initiatives that provide school teachers, principals, and administrators with the ability to integrate technology into curriculum and teaching
5. Enhancing ongoing professional development of teachers, principals, and administrators
6. Supporting the development and utilization of electronic networks and other innovation
7. Supporting rigor in evaluation of programs supported through EETT
8. Supporting local efforts using technology to involve family and community ("Ed.gov US Deparment of Education," 2008, p. 2).

EETT served as a catalyst for many school districts to infuse technology in schools in an effort to improve student achievement. The main goal of EETT was to “improve student achievement through the use of technology in elementary and secondary schools" ("Ed.gov US Deparment of Education," 2008). Program outcomes also included ensuring that: all students become technologically literate by the end of their eighth grade year; that integration of technology include teacher training and curriculum development and that innovative, research-based instructional methods be implemented in a widely expanded number of classrooms ("Ed.gov US Deparment of Education," 2008). This program awarded grants to states as a way to help with the technology and student achievement initiatives.

Funding through the EETT program helped states increase the amount of educational technology in schools (Hawkins, MacMillan, & Bruder, 1993; Ramaswami, 2008). While the acquisition of technology has increased dramatically over the past two decades, the most challenging goal for schools has been the effective integration of that technology into the curriculum (Hawkins et al., 1993). Researchers have attributed this fact to a number of barriers, including inadequate professional development of teachers, lack of funding (Walbert, 2000), insufficient planning time, inadequate resources and support systems (Ertmer, 2005; Houghton & National Governors' Association, 1997).

Schools have responded to the NCLB mandate that all students be proficient in technology and that educational technology be integrated into the curriculum. Some schools, based on amount of funding, simply increased the number of computers in classrooms. Other schools simply used computers for more administrative tasks not related directly to the student as there was a lack of teacher training (Smerdon et al., 2000). While both responses complied with parts of the NCLB mandate, the goal of technology integration had not been realized. The International Society for Technology in Education (ISTE), aligned with the goals of the NCLB Act, defines effective integration of technology as best practices in learning, teaching, and leading with technology in education designed to prepare students to "learn effectively and live productively in an increasingly global and digital world" (ISTE, 2012). Thus, effective technology integration requires professional development of teachers as well as resources in order to allow educators to teach, learn and work in a global society (ISTE, 2012).

Learning for the 21st Century, a report commissioned by the Partnership for 21st Century Skills, reiterates the necessity for integration of technology, technology use, and 21st Century Skills (Salpeter, 2003). Studies have shown that though there are benefits to technology integration in K-12 institutions, there are also perceived barriers to maximizing the potential of technology use. Khe Foon and Brush (2007) analyzed existing research studies from 1996 to spring 2006 that had empirical data findings. Each of the studies was reviewed and grouped based on barriers and strategies found within the study. Data analysis was conducted and groupings and categories were created. Based on relative frequency, the researchers grouped findings into the following categories:

1. Resources. Technology integration was affected by access and perceived availability of time to utilize technology resources.
2. Knowledge and skills. The perceived lack of technology skills by teachers hindered their ability to utilize technology within the classroom.
3. Institutional Barriers. The perceived difference between teacher and administrator concerning the importance, development and implementation of technology in classrooms impacted technology use. (Khe Foon & Brush, 2007, pp. 226-231)

The lack of resources, including infrastructure, hardware, software, and time, was often cited as reasons for not integrating technology. Khe Foon and Brush (2007) reported that studies by Sandholtz and Reily (2004); Russell, Bebell, and Higgins (2004); and Becker (2000) offered strategies to overcome perceived resource barriers including employing hybrid technology such as thin clients, using laptops, and being flexible in scheduling.

Institutional barriers as a factor that hindered technology integration were also addressed. Granger, et al. (2002) observed and questioned four schools in Canada. In the Granger, et al. (2002) study, the teachers stressed the importance of their administrators providing encouragement and being advocates for teachers and technology integration. The study concluded that school leaders and administrators should embrace technology, create a culture of encouragement, and allow teachers the flexibility and leeway to use technology (Khe Foon & Brush, 2007). In order to create this culture, researchers recommended that administrators and school leaders themselves be provided with technology training that includes methods and procedures of integrating technology into the curriculum (Khe Foon & Brush, 2007).

The perceived lack of technology skills by teachers hindered their ability to utilize technology within the classroom. This perception contributes to the teacher's attitudes and beliefs in relation to technology. Without a positive attitude and belief in technology, teachers may be less likely to learn and use technology in the classroom (N. Johnson, 2000; Khe Foon & Brush, 2007). Professional development can be used as a strategy not only to influence attitudes and beliefs positively but also to enhance and enable teachers to gain knowledge and skills necessary to employ technology in the classroom (Khe Foon & Brush, 2007). In the same studies, Khe Foon and Brush (2007) found strategies feasible for overcoming those barriers and concluded that overcoming such perceived barriers is paramount because technology has been seen as a way to help transform education and improve student learning (Khe Foon & Brush, 2007; "Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011).

Grunwald Associates, LLC, surveyed 1000 K-12 teachers, principals and assistant principals to find out their perceptions of technology use in relation to students 21st century skills (Grunwald & Associates, 2010). The goal of the study was to address what effect, if any, integration of technology or 21st century skills has on student achievement and to dispel any myths or barriers related to integration of technology. The study's findings identified five myths related to technology use and 21st century skills:

1. Teachers who are newer to the profession and teachers who have greater access to technology are more likely to use technology frequently for instruction than other teachers.
2. Only high-achieving students benefit from using technology.
3. Given that students today are comfortable with technology, teachers' use of technology is less important to student learning.
4. Teachers and administrators have shared understandings about classroom technology use and 21st century skills.
5. Teachers feel well prepared by their initial teacher preparation programs to effectively incorporate technology into classroom instruction and to foster 21st century skills. (Grunwald & Associates, 2010, p. 6)

Survey responses dispelled the myths related to technology use and 21st century skills. First, the number of years of experience and age made little to no difference in how much or how little teachers integrated technology in the classroom according to survey responses; the distribution of users from frequent to sporadic/infrequent, based on years of experience, remained similar across all of the categories. Second, the frequent use of technology was reported to help engage not only high achieving students but all types of students including English language learners, struggling students, and students with emotional/behavioral issues (Grunwald & Associates, 2010). The survey had a positive mean of 3.69 from a scale of 1 to 5 on the effect that technology had on engagement of all populations of students. Third, the study also found a relationship between teacher's perceptions and emphasis on the importance of 21st century skills and the amount of technology use. According to the survey, educators who used technology more frequently, especially at the secondary level, placed a greater emphasis on the perceived benefits of developing 21st century skills and had a more positive perception of the importance of technology on student learning (Grunwald & Associates, 2010). Fourth, teachers and administrators had differing views on classroom technology use and 21st century skills. As reported in the survey, 59% of administrators compared to 33% of teachers believe that schools are actively emphasizing 21st century skills and instructional technologies in classroom use (Grunwald & Associates, 2010). Fifth, the survey revealed that approximately 54% of teachers felt that the initial teacher preparation programs do not adequately prepare them to teach 21st century skills or effectively incorporate instructional technology tools in the classroom (Grunwald & Associates, 2010). One key to educators using technology more frequently was their perception on how well prepared they felt. The findings in this survey had implications for the importance of professional development and training of teachers in the use of technology and how to effectively integrate it within the classroom.

The State Education Technology Directors Association (SETDA), the International Society for Technology in Education (ISTE), and the Partnership for 21st Century Skills published a collaborative report in 2007 that provided information on 21st century education and the impact that technology has on student preparation and achievement (Vockley & Partnership for 21st Century, 2007). These three organizations combined to study and analyze various technology programs and strategies implemented in school districts across the country to understand what influence technology had on the educational outcomes of students. The goal of the organizations was to create a unified vision of technology, create a system of how technology is to be integrated into schools, and use technology to "achieve results for every student" (Vockley & Partnership for 21st Century, 2007). In looking at the various programs, the organizations concluded that the technology use in the highlighted programs did have an effect on student achievement. The reports highlighted such programs as the enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) program and the Alabama Connecting Classrooms, Educators and Students State-wide (ACCESS) program. Both eMINTS, implemented in nine states, and the ACCESS have shown not only that the use of technology increased student engagement but also that technology helped boost student achievement (Vockley & Partnership for 21st Century, 2007). According to the researchers, the student achievement rate in the eMINTS classrooms was consistently ten percent higher than the student academic achievement rate in control classrooms (Vockley & Partnership for 21st Century, 2007). The eMINTS program showed significant positive correlations between eMINTS participation and increased academic achievement, with eMINTS students outperforming their non-eMINTS peers in communication arts, mathematics, science and social studies (Beglau, 2007).

The eMINTS National Center, a non-profit organization, provides comprehensive, research based professional development services to elementary, secondary, and higher education institutions. Based at the University of Missouri, this organization provides professional development to help teachers integrate technology into their teaching. eMINTS uses group sessions as well as in class coaching/mentoring that focus on a four prong instructional model that "supports high-quality lesson design, promotes inquiry-based learning, creates technology-rich learning environments and builds community among students and teachers"("eMints National Center," 2011, p. 1).

The eMINTS program requires both commitment from teachers and students. Teachers commit to more planning, collaboration and training with technology while students take on more responsibility for their own learning, use computers and the internet to create a new learning environment, collaborate with peers and teachers and help prepare themselves for living and working in in the 21st century ("eMints National Center," 2011).

eMINTS is one of the programs cited by the collaborators of the Maximizing the Impact report that supported the idea of technology as a way to boost student achievement. To ascertain the impact of the eMINTS Program, Meyers and Brandt (2010) performed a quasi-experimental study that spanned over 10 years to compare academic performance of students in eMINTS classrooms with performance of students in non-eMINTS classrooms. The study consisted of 7,000 students, one- third of which were in eMINTS classes. These students were spread across 340 classes and 31 districts (Meyers & Brandt, 2010). The study found that those students in eMINTS classrooms significantly outperformed students in non-eMINTS classrooms on the state standardized Missouri Assessment Program (MAP) assessment. Additionally, the study found a statistically significant difference between the number of eMINTS students who attained proficiency or advanced levels of achievement and the non-eMINTS student in the areas of communication arts and mathematics (Meyers & Brandt, 2010).

Like the eMINTS program, the Alabama Connecting Classrooms, Educators and Students State-wide (ACCESS) program, a distance and blended learning initiative, was implemented to provide students and teachers "with equal access to high-quality instruction" in an effort to help improve student achievement (Vockley & Partnership for 21st Century, 2007). The International Society for Technology in Education (ISTE) commissioned Bielefeldt, Roblyer, and Olszewski (2010) to research the effectiveness of this type of technology integration. Using a mixed method methodology, the researchers collected data through focus groups and interviews of 80 teachers, counselors, facilitators and principals. A Likert-type statewide survey was also distributed to approximately 350 instructional staff, school and district administrators, counselors and other non-instructional professionals. The survey asked 50 Likert questions related to how the ACCESS program impacted four areas: students, teachers, school or state. Responses from both the interviews and the survey indicate that participation in the ACCESS Program and how the program utilizes technology showed a positive impact in all areas. The study also showed the ACCESS program had the largest impact in the student area particularly in improvement of graduation rates and fostering 21st century skill preparation (Bielefeldt et al., 2010).

To boost student achievement, close the achievement gap, and provide students with the technology and information skills and tools for 21st century life, the International Society for Technology in Education (ISTE) continues to identify priorities for achieving these goals. In 2010, ISTE published its top ten priorities for schools and districts:

1. Establish technology in education as the backbone of school improvement

2. Leverage education technology as a gateway for college and career readiness
3. Ensure technology expertise is infused throughout our schools and classrooms. In addition to providing all teachers with digital tools and content, we must ensure technology experts are integrated throughout all schools, particularly as we increase focus and priority on STEM (science-technology-engineering-mathematics) instruction and expand distance and online learning opportunities for students
4. Continuously upgrade educators' classroom technology skills as a pre-requisite of "highly effective" teaching
5. Invest in pre-service education technology
6. Leverage technology to “scale improvement”
7. Provide high speed broadband for all
8. Boost student learning through data and assessment efforts
9. Invest in ongoing research and development in relation to student achievement
10. Promote global digital citizenship ("ISTE," 2012).

Because technology plays an integral part of society, it becomes a part of schools. Current trends in technology are now becoming part of the K-12 educational institution. These technology trends include interactive devices such as projectors and whiteboards, interactive class response systems, mobile computing devices and web technologies including social networking and media websites (Clendenin, 1990; "Technology Update," 2005; Walbert, 2000).

Interactive devices such as whiteboards, podiums and projectors have become popular instructional technology devices for teachers in K-12 classrooms (Lutz, 2010). Lutz (2010) conducted a study on the effect of interactive devices on student achievement. Analyzing large scale student test scores and conducting focus group interviews, the researcher found statistically significant differences in math and reading scores in classrooms where teachers used interactive whiteboards in their instruction and those where teachers did not use the interactive whiteboards (Lutz, 2010). Other interactive technology devices that have found their way into the K-12 classroom include classroom response systems. These systems allow interaction between teacher and students by giving each student a hand held device that lets students respond to questions and receive feedback from the teacher (Bojinova & Oigara, 2011).

In addition to interactive devices, mobile devices are also finding their way into the K-12 classrooms. Mobile devices are smaller and more portable than regular computers and include tablet computers, laptops, smart phone and electronic readers (e-readers). Mobile devices provide a cost effective alternative for schools and districts desiring to increase technology in their school but are hampered by budget constraints (Ramaswami, 2008). Budget constraints have fueled the Bring Your Own Device (BYOD) initiative in many K-12 schools and districts. The BYOD initiative capitalizes on mobile devices, allowing students to bring in a variety of these devices in an effort to give more access to technology. Research has been initiated to ascertain the effectiveness of all of the current technology tools. The success of any of these technology tools and their positive effect on student achievement, as indicated in ISTE priorities, depends upon teacher the training and development. Through professional development training, the technology skills of the K-12 educators could develop so that it becomes part of the highly effective teaching process ("ISTE," 2012).

Professional Development

Matzen and Edmunds (2007) argued that technology professional development often merely teaches technology skills; and as a result, teachers are not driven to teach and use technology to its fullest potential. According to the researchers, technology professional development must not only teach technology skills but also teach an understanding of how technology integration can connect with the content of the curriculum (Matzen & Edmunds, 2007). In their study, the researchers conducted a mixed method evaluation of The Centers for Quality Teaching and Learning (QTL), a professional development program that helps teachers integrate technology in their curriculum and instructional practices (Matzen & Edmunds, 2007). An identical survey was given to 104 QTL participants at three different times during the year. A case study was also conducted at two different schools that participated in the QTL training. This study concluded that there was a correlation between the type of professional development received and the ways in which teachers' implemented technology into the curriculum. The study found a positive correlation between those participating in the specific QTL training and the increasing use of technology to help students develop more of the twenty-first century skills (Matzen & Edmunds, 2007).

Grunwald and Associates (2010) found that teacher professional development, specifically on-the-job technology training, failed to train teachers to effectively integrate technology into the curriculum. According to the study, 67% of teachers received technology staff development and new technology training through the train the trainer method while only 26% of teachers participate in a collaborative effort to share technology integration experiences. This method trains a few teachers who then train others on technology tools. Other approaches used technology coordinators to prove in-house training brought a trainer to a school. These "in house" or on the job technology professional development methods, according to the researchers, may not help teachers improve their technology skills or train them on how to implement technology effectively, resulting in their failure to increase the amount of technology use in the classrooms (Grunwald & Associates, 2010). These researchers recommended the use of a more collaborative approach to professional development, incorporating teachers, master teachers, instructional support staff, and other stakeholders to serve as a support system for the integration of technology.

The NCLB Act required schools to integrate technology into the curriculum. The successful integration of technology requires training and development for teachers on how to effectively integrate technology ("Ed.gov US Deparment of Education," 2008; Houghton & National Governors' Association, 1997; Olsen, 2009; Smerdon et al., 2000). Smerdon et al. (2000) recognize that professional development with educational technology is a key factor as it affects a teachers' comfort level with technology and ultimately influences the integration technology to help increase student achievement (Smerdon et al., 2000).

Computer Self-Efficacy

This research study will explore computer self-efficacy to determine if there is an effect on the teacher's level of technology integration in the classroom. Self-efficacy, as defined by Albert Bandura (1989), is people's beliefs "in their capabilities to organize and execute courses of action required to attain designated types of performances" (Iscioglu, 2011, pp. 190-191). He further explains that self-efficacy is related to a person's belief in the success of a given and that "stronger the perceived self-efficacy, the higher the goals that people set for themselves and the firmer their commitment to those goals" (Bandura, 1989, p. 730). Iscioglu (2011) reported that there are two dimensions of teachers' self-efficacy: 1) teachers' self-confidence about their having talents to influence students' behaviors, and 2) teachers' self-confidence regarding their ability to achieve special tasks (Iscioglu, 2011, p. 191).

The computer is one of the main tools used in the integration of technology and computer supported education in classrooms. Because of this, teacher confidence in their ability to utilize computers plays an integral role in their integration of technology within the classroom (Celik & Yesilyurt, 2013). Paraskeva, Bouta, and Papagianni (2008) asserted that teacher attitudes toward and beliefs about technology tools influence their use and effective integration for school learning and engagement, offering students new and different learning opportunities or experiences. The researchers distinguished between general self-efficacy and computer self-efficacy, relating general self-efficacy to a teacher's instructional practices and to their students' achievement. Since self-efficacy is the personal judgment about one's capability and constitutes a valid predictor of an individual's performance of a specific task (Paraskeva, Bouta, & Papagianni, 2008), computer self-efficacy is an individuals' judgment of his or her capability to use a computer and perform computer related tasks.

According to Paraskeva et al. (2008), research has shown that computer self-efficacy influences the desire to utilize instructional technologies based on findings of a 1995 study by Compeau and Higgins and a 2004 study by Looney et al. Paraskeva et al. (2008). The study concluded that computer self-efficacy is derived from specific individual characteristics. Some of the characteristics include self-efficiency, motivation, needs, anxiety level, prior use, and level of training. The most influential characteristic believed to affect computer self-efficacy, though varied by gender, age and subject, was prior positive experience and mastery of those previous experiences (Paraskeva et al., 2008).

Iscioglu (2011) supported the findings of the Parasekeva et al. study. Iscioglu states that the key to appropriate use of the technology is "the teachers' comfort with the hardware and software, their understanding of technology as a method of curriculum delivery, and a change of mindset which will allow them to embrace possibilities that technology brings to the classroom of the future" (Iscioglu, 2011, p. 190). Iscioglu found that without a positive high computer self-efficacy, the use of computers in planning and integration of computers within the curriculum will be limited.

Summary

The effects of technology integration in the curriculum on student achievement and high stakes testing as a measure of accountability are important factors to study due to the federal and state mandates and the importance of students being prepared with twenty-first century skills for the global marketplace. The behaviorist and constructivist theories provide the theoretical framework for such study (Skinner, 1986; Scheurman, 1998). Behaviorism states that knowledge is received through the senses and that learning is a direct function of a change in a behavior which is a result of a stimulus. The stimulus or reinforcer can be either positive of negative. This stimulus or reinforcer concept was attributed to B. F. Skinner, considered the father of the behaviorist theory. The behaviorist theory recognizes that knowledge is acquired when the bond between stimulus and response is strengthened by means of a reinforce (Skinner, 1986).

The constructivist theory is a belief that learning by an individual is internal and is acquired through the individual's interaction and experiences. The constructivist theory seems to be the underlying basis in the National Research Council Institute of Medicine's (2004) work on student engagement, Lorin Anderson's (2001) Blooms' Revised Taxonomy, and Phillip

Schlechty's (2011) Working on the Work framework. Each of these frameworks focus on student engagement and creating an environment that promotes learning.

Calls for educational reform beginning with *A Nation at Risk* (1983) and culminating in the NCLB Act focused attention on preparing students with 21st century skills for a global market place. A Nation at Risk (1983) identified the need for higher educational standards and reform that included greater accountability, more rigorous and measurable standards, and technology literacy and integration into curriculum. The NCLB Act mandated that schools reform their curriculum to help close the achievement gap. The movement for "higher standards and accountability", as measured by high stakes testing, has made educators take a closer look at what is being tested and taught and if it helps prepare students with the 21st century skills as mandated by the various directives of state and federal requirements. The Partnership for 21st Century Skills (P21) states that technology integration helps to decrease the achievement gap and to prepare students with 21st century skills ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011).

The NCLB Act (2001) also bought focus to technology and technology literacy as an integral component of equipping students for the 21st century and closing the achievement gap. The Enhancing Education Through Technology (EETT), Part D of the NCLB Act, was enacted to improve student academic achievement through the use of technology and ensure that every student is technology literate. However, institutions have interpreted technology integration in various ways. Some educational institutions interpret technology integration as placing or increasing computers in the classroom. Others see it as achieving best practices in learning, teaching, and leading with technology in education in an effort to prepare students to "learn effectively and live productively in an increasingly global and digital world" (ISTE, 2012).

Reform in curriculum, accountability standard, and integration of technology, all designed to help increase student academic achievement, have required educational institutions to place a greater emphasis on teacher professional development. Professional development of the teacher as it relates to technology often focuses on developing their technology skills; and as a result, teachers are not equipped to teach and utilize technology to its fullest potential. To achieve curricular reform, teachers must understand how technology integration can connect with the content of the curriculum. The "in house" or on the job technology professional development methods may not help teachers improve their technology skills or train them on how to implement technology effectively. Professional development should be collaborative, incorporating teachers, master teachers, instructional support personnel, and other stakeholders, and should provide a support system for the integration of technology. Research has shown that the "perceived computer self-efficacy among teachers" plays an integral role in the integration of technology by teachers within the classroom (Celik & Yesilyurt, 2013). As noted earlier, computer self-efficacy is an individual's judgment of his or her capability to use a computer and perform computer related tasks. Although computer self-efficacy varies by gender, age and subject of teachers, it is influenced most by prior positive experience and mastery of those previous experiences (Paraskeva et al., 2008).

CHAPTER THREE: METHODOLOGY

Introduction

Public school districts spend large amounts of money funding and supporting technology and technology initiatives under the premise that it helps overall student achievement. The federal legislation reauthorization of the NCLB act required both integration and implementation of technology in classrooms. This research study examined the relationship between technology integration and student achievement. It also analyzed the degree to which teachers integrate technology as well as investigated if a relationship exists between teacher's technology integration and their student scores on the North Carolina Career and Technical Education (CTE) state standardized post assessments. The purpose of this chapter is to explain the methodology used to complete this correlational, causal-comparative research study. This chapter includes a description of the research design used for this study, an explanation of the research participants, instrumentation used, procedures, and how the data will be analyzed to answer the research questions.

Research Design

The research design used for this study was a quantitative, correlational, causal-comparative research design, which is a design that tests for a statistical relationship between variables. Creswell (2012) defined a correlational study as one that uses a statistical test to "describe and measure the degree of association (or relationship) between two or more variables or sets of scores" (Creswell, 2012, p. 338). Brewer and Kuhn (2010), defined a causal-comparative study as one that "uses a statistical test to find relationships between independent and dependent variables after an action or event has already occurred" (Brewer, E. W. and J. Kuhn, 2010, p.124-125). It seeks to determine whether the independent variable affected the outcome, or dependent variable, by comparing two or more groups of individuals (Brewer, E. W. and J. Kuhn, 2010).

Using a correlational, causal-comparative research design, the researcher sought to determine if there was a relationship between teacher experience, gender and courses taught and their perceptions of technology use at the school site. The study also examined how the teachers in this study perceive the adequacy of their student's technology skills for meeting college and workplace demands. A secondary purpose of the study was to determine if differences exist based on demographic characteristics (years of experience, gender, courses taught) of participants.

A survey instrument was used to gather data because it is the preferred method of data collection for the participating school district. In analyzing the data, the researcher used technology integration as the dependent variable and age, gender, computer self-efficacy, technology professional development of teachers, and student test scores as independent variables. Additional demographic data including ethnicity, highest degree earned, national board certification and number of years of teaching experience were gathered from the survey instrument for additional observation and possible future use. Quantitative data were obtained from the participants who self-reported the average numerical Career and Technical Education (CTE) Post Assessment test scores on the survey for the courses they taught during the 2013-2014 school year. The self-reported average numerical score from the CTE Post Assessments tests was reported on the survey instrument in five different categories. The five categories reported directly reflect the way they are reported on the North Carolina CTE Post Assessment tests. These categories, as reported on the NC CTE Post Assessment tests, coincide with the traditional five letter grades of A-F. Since letter grades are not used to report test scores, categories of “does not meet”, “meet” and “exceeds” were developed by NC Department of Public Instruction to report the NC CTE Post Assessment test scores. Students who score 70% or lower (traditional letter grade of F) on the test will fall in the “does not meet” category. Students who score between 71 and 76% (traditional letter grade of D) will fall into the “does not meet category as well. Students who score between 77 and 84% (traditional letter grade of C) will fall into the meets category. Students who score between 85 and 93% (traditional letter grade of B) will fall into the meets category as well and students who score 93% and above (traditional letter grade of A) will be in the “exceeds” category("North Carolina Department of Public Instruction Career and Technical Education," 2011). Descriptive statistics such as the mean and standard deviation for demographic data were analyzed and reported in narrative and table form. Multiple linear regression was performed with teacher level of technology integration as the dependent variable and teachers’ gender, years of experience, computer self-efficacy, instructional technology training received, and the average NC CTE scores of students as the independent variables. Using multiple linear regression, the coefficient of determination (R^2) is reported and discussed (Gall, Gall, & Borg, 2007).

Research Questions

This study focused on the following research questions:

1. Is there a relationship between a teachers’ gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom?
2. Does a relationship exist between the teachers' level of technology integration in the classroom and student

achievement as measured by performance on end of course tests?

Hypothesis

This study focused on the following hypotheses:

$H_0$1: There will be no statistically significant relationship between a teachers' gender and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$2: There will be no statistically significant relationship between a teachers' years of experience and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$3: There will be no statistically significant relationship between a teachers' computer self-efficacy and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$4: There will be no significant relationship between a teachers' instructional technology training and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$5: There will be no statistically significant relationship between the level of technology integration and student achievement as measured by performance on the post assessment state end of course tests as reported by the School Technology Needs Assessment (STNA).

Participants

The participants in this study were teachers in the secondary Career and Technology education program. There are 100 secondary Career and Technical education (CTE) teachers in the participating school district. All 100 of the CTE teachers in the district were invited to participate in the survey. The participating school district expects a 40% return rate of the surveys from participants. The participants represented varied genders, age ranges (21-65), ethnicities, years of employment in education (1 – 30+ years) and educational degree levels. The participants also varied in terms national board certifications. Also, the CTE program is the only curriculum where all courses within that curriculum administer state end of course assessments.

Instrumentation

The data for this research study was gathered using a survey instrument. After exploring various survey instruments, the School Technology Needs Assessment 4.0 (STNA) survey, published in 2009, was chosen to gather the data from the Career and Technology education teacher participants. Initiated by the North Carolina Department of Public Instruction, the STNA survey is an instrument designed to help schools assess their educational technology needs effectively, aid in the design of better technology implementation, and evaluate technology initiatives (Corn, 2010). The survey collected the following data from the survey participants: demographic data (gender, age, ethnicity, years of teaching experience, highest degree earned, national board certification status, main grade level of students taught, specific CTE program area), data on teacher technology integration and use, data on computer self-efficacy, perception, impact on student achievement and participant needs related to technology professional development. Also collected was an average of the student's NC CTE post-assessment scores which was self-reported from the participants.

The STNA survey instrument contains 86 self-report, 3-point Likert scale items. Part I contains nine demographic questions regarding gender, age, ethnicity, teaching experience, highest degree earned, national board certification status, grades taught, and CTE Program area taught. Part II of the STNA survey instrument addresses technology integration in the classroom and includes questions related to infrastructure and staff support, teacher technology use, computer self-efficacy, perceived student impact, and technology professional development.

The STNA survey instrument has been validated through the SERVE Center at the University of North Carolina at Greensboro. The center conducted a reliability and validity study using data from over 2000 respondents from over 60 schools across the United States. There were 86 items on the survey. Because of the large number of items on the survey, Corn (2010) grouped all the survey items into one of three Factor Structures to better determine the validity and reliability of the survey items. All survey items fit into one of the three Factor Structures designed by Corn (2010). Factor Structure A was survey items related to technology program strategies. Factor Structure B contained items related to technology program outcomes and Factor Structure C focused on items related to professional development needs. Items in Factor Structure B, which focused specifically on technology program objectives of teacher technology use, student technology use, teacher impact and student impact, were determined to be invariant across all grade level respondents and showed an internal consistency reliability range from 0.855 to 0.935 (Corn, 2010, p. 366). Data analysis also showed that the survey items in Factor Structure B, were "identified as stable, reliable and invariant across multiple response groups"(Corn, 2010, p. 367). Additional data analysis was conducted on Factor Structures A and C were to determine variability of the items and constructs within those structures. Analysis showed that there were only a small number, 19 of the 86 STNA items, where there was variability which was within the internal consistency reliability range. This analysis established the validity and reliability of the STNA survey (Corn, 2010, p. 367). The results concluded that data analyses showed each of STNA constructs and sub constructs to have high internal consistency reliability (alpha ranged from .807 to .967) ("SERVE Center: The University Of North Carolina at Greensboro ", 2013).

Procedures

Before data collection commenced, the researcher received IRB approval from Liberty University to gather data. Additionally, permission was received from the target school district to collect data. Since the district sponsors use of the survey the STNA survey used in this research study was deployed from the school district office. Utilizing Stephen Olejnik’s statistical power analysis table, the conventional alpha of .05 was used to determine the level of significance and necessary sample size for this research study (Gall et al., 2007, p. 145). The district office sent the survey to the participants through electronic mail. All 100 CTE teachers in the target district were invited to complete the survey. Each teacher received an email from the school district to their school email address explaining the deployment of the survey and an invitation to take the survey. Electronic devices were the chosen method for deployment of this survey. The participating district's initiative is to remain paperless as much as possible. The survey software used to administer the STNA survey is K12 Insight, a secure web portal. Teachers opened the email on an electronic device of their choosing (computer, laptop, phone, or tablet). The teacher then clicked on a link in the email to begin the anonymous STNA (School Technology Needs Assessment) survey. The teacher responded, with a “yes” or “no” to an informed consent statement before the survey questions appear. Subsequently, if the teacher clicked “yes” the survey opened and the teacher completed the questions on an electronic device.

Once they finished, they clicked the “submit” button. Teachers self-reported the average scores of their students’ post assessment test scores and teacher demographics such as gender, age, years of experience, computer self-efficacy and instructional technology training which was collected for analysis to determine the results based on the research questions.

Data Analysis

Participants submitted data from the research survey electronically through the use of the K12 Survey Insight System. The K12 Insight System is a secure web portal that allows the district to deploy surveys and collect data electronically. Raw data results gathered from the survey was disseminated to the researcher from the district office. The researcher then analyzed the data for the study to determine if there was a relationship between instructional technology integration and student achievement. Narrative and table form was used to discuss the mean and standard deviations of the demographic data. Statistical analysis was performed using SPSS 22.0. A two-sample *t* test and correlational analysis was used to test null hypotheses one of Research Question One in an effort to determine if gender was related to teachers’ integration of technology into classroom instruction. A two sample *t* test, as explained by Gall et al. (2007), was chosen because this test is utilized when trying to examine questions about the means from two random sample populations (male and female) or groups and do they differ significantly on some single characteristic, in this case teacher technology integration (p. 440-441). Since multiple linear regression determines the correlation between a criterion variable and a combination of two or more predictor variables, the multiple linear regression test was used to test null hypothesis two, three, four and five of this research study (Gall et al., 2007, p. 353). This test was used to determine if there is a correlation between teacher perception of technology integration in the classroom (dependent variable) and the teacher’s gender, years of experience, computer self-efficacy, instructional technology training and post-assessment state end of test student scores (independent variables).

Summary

This study explored the following main research questions:

1. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom?
2. Does a relationship exist between the teachers' level of technology integration in the classroom and student achievement as measured by performance on end of course tests?

The research study answered these questions through an evaluation of the relationship between instructional technology and student achievement. This study administered the STNA survey instrument to public secondary CTE schoolteachers in a North Carolina school district to determine their perception of their level of technology integration in the classroom. The study also analyzed if there is a correlational relationship between educational technology integration in the classroom and student achievement as measured by the North Carolina state standardized CTE post-assessments. Demographic data from the STNA survey instrument was gathered and reported from North Carolina Career and Technical Education teachers from a large school district in North Carolina.

CHAPTER FOUR: FINDINGS

Research Questions

1. Is there a relationship between a teachers’ gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom?
2. Does a relationship exist between the teachers' level of technology integration in the classroom and student achievement as measured by performance on end of course tests?

Hypotheses

$H_0$1: There will be no statistically significant relationship between a teachers’ gender and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$2: There will be no statistically significant relationship between a teachers’ years of experience and the level of teachers’ technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$3: There will be no statistically significant relationship between a teachers’ computer self-efficacy and the level of teachers’ technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

$H_0$4: There will be no statistically significant relationship between a teachers’ instructional technology training and the level of teachers’ technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

H_05: There will be no statistically significant relationship between the level of technology integration and student achievement as measured by performance on the post assessment state end of course tests as reported by the School Technology Needs Assessment (STNA)

Descriptive Statistics

Demographic Profile of the Sample

All 100 secondary Career Technical Education (CTE) teachers in the selected school district were invited to participate in the survey. Of the 100 surveys that were distributed, 84 teachers completed surveys, for an 84% response rate. This section presents demographic information of the 84 participants.

The sample consisted of 52 female respondents (61.9%) and 32 male respondents (38.1%). Most of the participants were ages 41 and above, with the largest group of participants (29.76%) between the ages of 41-50. The sample of participants had an average of 11.79 years of teaching experience. Fifty-three percent of the participants had 10 years or less of teaching experience, with the majority having taught 2 years or less. The remaining 43% of the participants taught 11 years or more with little variation between the years of experience ranges. Most of the participants (n=44), reported having a Bachelor's degree. Thirty-two percent of the participants attained their master's degree (n=27) while 15.7 % (n=13) had either an associate's or some other form of degree. Approximately 12% of the participants had National Board Certification. Table 1 contains frequency information on the demographics of gender and age specifics for the 84 participants that responded to the survey. Table 2 provides an overview of the participants by years of teaching experience and educational background.

Table 1.

Demographic Characteristics of Participants

Characteristic	Category	Frequency	Percent
Gender	Female	52	61.9%
	Male	32	38.1%
Age (Years)	21-30	16	19.05%
	31-40	19	22.62%
	41-50	25	29.76%
	51-60	20	23.81%
	61+	4	4.76%

Table 2.

Participant Teaching Experience and Educational Background

Characteristic	Category	Frequency	Percent
Teaching Experience	2 years or less	21	25.00%
	3-5 years	14	17.00%
	6-10 years	9	11.00%
	11-15 years	11	13.00%
	16-20 years	13	15.00%
	21 years or more	16	19.00%
Education	Associate’s	10	11.90%
	Bachelor’s	44	52.38%
	Master’s	27	32.14%
	Doctoral	0	0.00%
	Other	3	3.57%
National Board Certification	Yes	10	11.90%
	No	74	88.10%

School Technology Needs Assessment (STNA) 4.0 Survey

The Career and Technology teachers responded to the School Technology Needs Assessment Survey. Questions 1-7 of the survey instrument identified the frequency of the participants’ demographic data. The remainder of the survey instrument was presented on a 3-

point Likert-type scale. The survey assessed the teachers' perceptions on the use of technology in their content, teacher computer self-efficacy, adequacy of instructional technology professional development and technology integration on academic achievement. Question 8 of the STNA survey identified teacher computer self-efficacy. Question 8 consisted of 15 likert questions. For purposes of statistical analysis, the format of Question 8 were coded as "Often" = 1, "Occasionally" = 0, and "Never" = -1 (M=.5881). The individual means from each question in question 8 were computed to give a single computer self-efficacy variable. Questions 9-11 of the STNA survey consisted of 17 likert questions, which identified teacher technology integration. The questions were coded as "Agree" = 1, "Neither Agree or Disagree" = 0, and "Disagree" = -1. The individual means from each respondent and each question 9-11 of the STNA survey were calculated to give a teacher technology integration variable (M=.6652). And lastly, Question 12 had 11 likert questions and identified teacher professional development and training (M=.7132). The questions were coded as "Yes" = 1, "Does not matter" = 0, and "No" = -1. Appendix B shows a more detailed description of the survey questions.

Null Hypothesis One

Research question one. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom?

H_{01}: There will be no statistically significant relationship between a teachers' gender and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

The first null hypothesis stated that there would be no statistically significant relationship between a teachers' gender and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results. A two-sample *t* test, along with correlation analysis, was used to test null hypotheses one of Research Question One in an effort to determine if there was a correlation with gender to teachers' integration of technology into classroom instruction. To determine if there is a relationship, a two sample *t* test, as explained by Gall et al. (2007), was chosen because this test is utilized when trying to examine questions about the means from two random sample populations (male and female) or groups and if they differ significantly on some single characteristic, in this case teacher technology integration (p. 440-441).

Assumptions for t test. A two-sample *t* test was used to analyze the data for Hypothesis one. The two-sample *t* test is based on three assumptions. First, the random sample populations should follow a normal distribution (Lowry, 2015). Second, the variances of the two populations should have the same variance, and lastly, each value is independent from the other values of data (Gall et al., 2007; Lowry, 2015). To test for normal distribution, a pictorial representation was shown. The data were coded as "Female=0" and "Male-1". Based on the histogram, the data, in particular the male (Male=0) are skewed more heavily toward the right as shown in Figure 1.

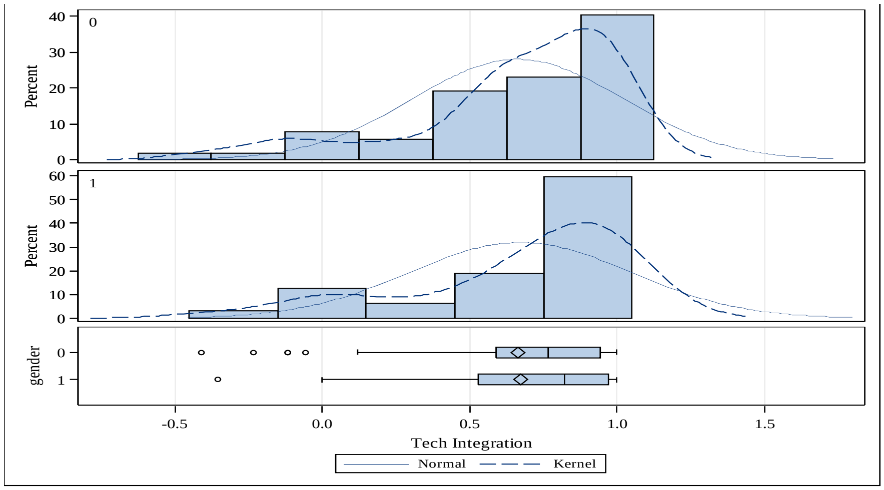

Figure 1. Histogram of gender technology integration.

A quantile-quantile, or Q-Q plot, was run to check validity of a distributional assumption for the male and female teacher technology integration. The Q-Q plot is an "exploratory graphical device used to check the validity of a distributional assumption for a data set"(Lane, 2015, p. 118). In Figure 2 most observed values appear to snake near the line though all points are not on the line.

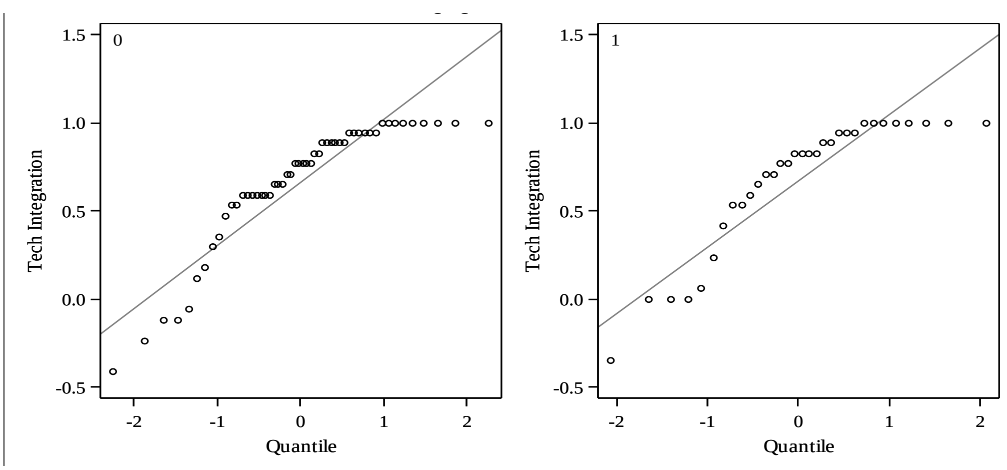

Figure 2. Q-Q plot for Hypothesis 1.

The third assumption assumes that the data is independent from the other values of data. This was supported by the voluntary, convenience sample (n=84, population>10*84), which was a condition for the *t* test. The data for this hypothesis do not meet all of the assumptions for a *t* test due to the male data violating the assumption of normality. However, the sample size is large enough (more than 30) to support that it is still approaching normality. Though this is not the perfect fit for the t test, even if that was not the case, the t test shows the data for hypothesis one is not significant.

Data analysis hypothesis $H_0$1. The first step consisted of computing the group teachers' technology integration variable, the dependent variable, which was derived from the composite of single items on the STNA survey. Questions nine, ten and eleven of the STNA survey were all related to teacher technology integration and individual means of participants' responses to questions 9-11 were computed using SPSS 22.0. For statistical analysis, all responses from questions 9-11 were grouped together. The individual means were then averaged to create the single technology integration variable (M=.6652). The teacher's technology integration variable was then used to compute all five of the Null Hypotheses in both Research Questions One and Two. Table 3 shows the composite Teacher Technology Integration variable.

Table 3.

STNA Teacher Technology Integration

Characteristic	N	Min	Max	M	SD
9(a). : Students use a variety of technologies	84	-1	1	.80	.433
9(b). : Students use technology during the school day to communicate and collaborate with others, beyond the classroom.	84	-1	1	.60	.518
9(c). : Students use technology to access online resources and information as a part of classroom activities.	84	0	1	.81	.395
9(d). : Students use the same kinds of tools that professional researchers use	84	-1	1	.40	.696
9(e). : Students work on technology-enhanced projects	84	-1	1	.67	.545
9(f). : Students use technology to help solve problems.	84	-1	1	.76	.456
9(h). : Students use technology to create new ideas and representations of information.	84	-1	1	.69	.514
9(g). : Students use technology to support higher-order thinking.	84	-1	1	.75	.462
10(a). : My teaching is more student-centered and interactive when technology is integrated into instruction.	84	-1	1	.69	.537
10(b). : My teaching practices emphasize teacher uses of technology skills to support instruction.	84	-1	1	.73	.523
10(c). : My teaching practices emphasize student uses of productivity applications.	84	-1	1	.68	.519

10(d). : My teaching practices emphasize student uses of technology as an integral part of specific teaching strategies.	84	-1	1	.76	.456
11(a). . Technology has helped my students become more socially aware, confident, and positive about their future.	84	-1	1	.56	.628
11(b). . Technology has helped my students become independent learners and self-starters.	84	-1	1	.52	.685
11(c). . Technology has helped my students work more collaboratively.	84	-1	1	.58	.662
11(d). . Technology has increased my student's engagement in their learning.	84	-1	1	.71	.593
11(e). . Technology has helped my students achieve greater academic success.	84	-1	1	.60	.604
Composite				.6652	

For the independent variable, gender, question one of the STNA survey asked respondents to select their gender. The survey coded participants who responded as “Female=0” and “Male=1”. SPSS 22.0 was used to compute the descriptives analysis. Table 3 shows the computed descriptives analysis for the teacher technology integration variable. Along with the teacher technology integration variable, the descriptives for male and female technology integration variables were computed and shown in the Table 4. Therefore, the individual mean calculations of male and female technology integration variables were necessary for this analysis. The individual means for the participant responses are shown in the Appendix B. Thirty-two males and 52 females completed the survey. The mean score for males was slightly higher than for females, indicating that it appears on average, that males tend to use technology integration slightly more than females based on the data.

Table 4

Descriptive Statistics for Technology Integration

Technology Integration Mean

	Mean	Std. Deviation	N
Technology Integration Mean	.6653	.36123	84
Gender	.62	.489	84

Female and Male Technology Integration Mean

Gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
Female	52	0.6618	0.3560	0.0494	-0.4118	1.0000
Male	32	0.6710	0.3753	0.0663	-0.3529	1.0000
Diff (1-2)		-0.00919	0.3634	0.0816		

As supported by the research of Gall et al. (2007), the two-sample *t* test, which gave a correlation coefficient, was run using SPSS 22.0 to examine the means from two random sample populations (male and female) and to determine if there was a correlation with gender (male and female) and teacher technology integration. The data showed that there was not a statistically significant relationship because the correlation coefficient, or r, was .012 as well as the p value was .912 which does not meet the requirements of a 95% confidence level of a 2-sided *t* test. Therefore, the null hypothesis was not rejected at a significance level of 0.05. One can conclude that there was no statistically significant relationship between gender and technology integration. More specifically, based on the data, a Career and Technology teachers' gender had little to no influence on the teachers' integration of technology in the classroom. Table 5 shows the descriptive statistics for Hypothesis 1 which include the r value of .012 and a p value of .912 which supports that there is no evidence to go against the null hypothesis.

Table 5

Descriptive Statistics for Hypothesis 1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	Gender	-.009	.082	-.012	-.113	.912

Pearson Correlation Coefficient		
	Technology Integration Mean	Gender
Technology Integration	1.00000	0.01243 0.912
Gender	0.01243 0.912	1.00000

Null Hypothesis Two

Research question one. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom? The second null hypothesis stated that there would be no statistically significant relationship between a teachers' years of experience and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results. The independent variable, years of experience, question four of the STNA, asked participants to type in the number of years they taught. The dependent variable was teacher technology integration, which was an average of the means of questions 9-11 of the STNA survey as shown in Table 3. A simple linear regression analysis was utilized to address Hypothesis 2. Linear regression attempts to "model the relationship between two variables by fitting a linear equation to observed data (Lane, 2015, p. 463) ." Cohen, Welkowitz, and Lea (2011) stated that the relationship between variables (i.e. teachers' years of experience and teachers' technology integration) are never perfect; therefore, linear regression not only provides a systematic way to make these predictions, but it also provides specific information about how much better your predictions will be compared to random selections" (p. 255).

Assumption testing for hypothesis two. The assumptions for linear regression include that there is additivity and linearity, equal variance of errors (homoscedasticity) and normality of errors (Osborne & Waters, 2002, p. 3). The independent variable was years of experience and the dependent variable was teacher technology integration. Preliminary analysis was performed to assure that there were no violations with the variable of years of experience.

Additivity and linearity. A scatterplot with the regression line was created (Figure 3) to show a pictorial representation of the correlation between two variables (Gall et al., 2007, pp. 332-333). The straight line, or the line of best fit, indicated that the x-axis variable was accompanied by a unit of increment on the y-axis variable (p. 332) which supported the preceding assumptions for utilizing a linear regression test. The scatterplot demonstrates a straight line with no arc or curve, therefore supporting that the years of experience variable does not violate the assumption of additivity and linearity.

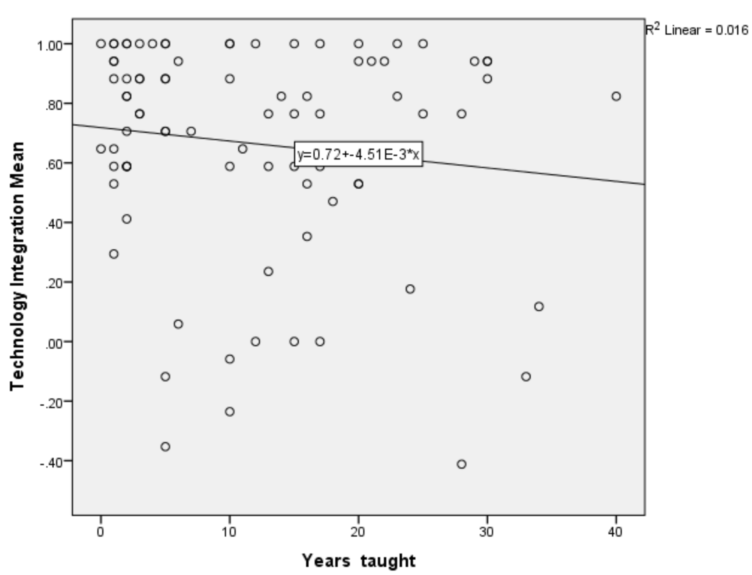

Figure 3. Scatterplot demonstrating linear relationship of years taught

Homoscedasticity. Homoscedasticity refers to where the variances along the line of best fit remain similar as you move along the line ("Princeton University Library: Data and Statistical Services,"). The assumption of homoscedasticity is that the residuals are approximately equal for all predicted dependent value (technology integration) scores. A scatterplot was analyzed for shape and direction and is considered to have a linear relationship. Figure 3, based on the shape, indicates that the assumption is tenable.

Normality. "Regression assumes that variables have normal distributions" (Osborne & Waters, 2002, p. 3). Normality for years of teaching variable was analyzed through the Normal Probability Plot. The normal plot line shown in Figure 4 is considered reasonably straight and is therefore viewed as acceptable.

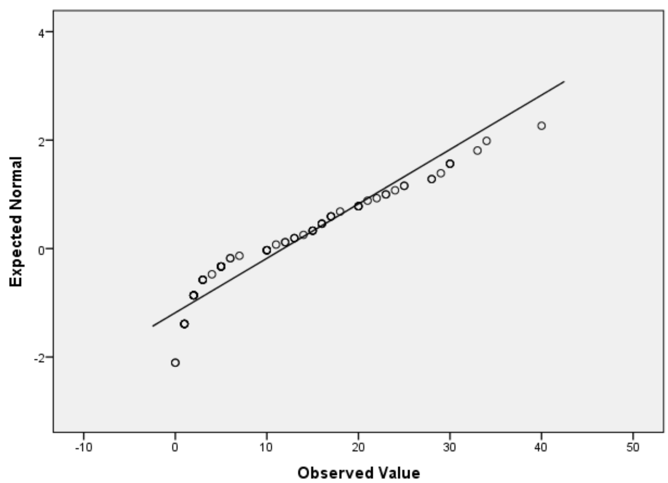

Figure 4. Normal Q-Q Plot demonstrating years taught

Data analysis for hypothesis H_02. The linear regression analysis determined there was not a significant relationship between a teachers' years of experience and the level of teachers' technology integration in the classroom (B = -.005, R2=0.015504, r=.125, p=.259). The descriptive statistics and regression coefficients are listed in Tables 6 and 7. The analysis showed the r value of .125 and the p value, of .259. Because the p value is greater than the acceptable significance level, the null hypothesis was not rejected at a significance level of 0.05, and one can conclude that there is no statistically significant relationship between teacher's years of experience and technology integration. The regression line is sloping downward which more specifically reinforces that the CTE teacher's years of experience was not a significant variable to determine a teacher's technology integration.

Table 6

Descriptive Statistics for Hypothesis 2: Technology Integration and Years Taught

	N	Mean	SD
Technology Integration	84	.6653	.36123
Years Taught	84	11.79	9.965

Table 7

Regression Coefficients for Hypothesis 2: Years Taught

Model		*Unstandardized Coefficients*		*Standardized Coefficients*		
		B	Std. Error	Beta	t	Sig.
	Years Taught	-.005	.004	-.125	-1.136	.259

Null Hypothesis Three

Research question one. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom? The third null hypothesis stated there would be no statistically significant relationship between a teachers' computer self-efficacy and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

Question eight, the independent variable, was related to teacher computer self-efficacy and individual means of participants responses to question 8 of the STNA were computed using SPSS 22.0. Question 8 of the STNA survey was the teacher computer self-efficacy survey items and for statistical analysis, all responses from question 8 were grouped together. The individual means were then averaged to create the single computer self-efficacy variable (M=.5881). Table 8 shows the composite survey items for the computer self-efficacy variable.

Table 8

STNA Computer Self-Efficacy Variable

Characteristic	N	Min	Max	M	SD
8(a). : I consult publications, online journals, or other resources to identify research-based practices	84	-1	1	.33	.523
8(b). : I identify, locate, and evaluate technology resources for use by my students, e.g., websites.	84	-1	1	.63	.510
8(c). : I apply performance-based student assessment to technology-enhanced lessons	84	-1	1	.69	.514
8(d). : I use technology regularly to collect and analyze student assessment data.	84	-1	1	.56	.588
8(e). : My lessons include technology-enhanced, learner-centered teaching strategies, e.g., project-based learning.	84	-1	1	.67	.499
8(f). : I apply policies and practices to enhance online security and safety.	84	-1	1	.70	.533
8(g). : I use technology to differentiate instruction for students with special learning needs.	84	-1	1	.63	.555
8(h). : I use technology to support and increase my professional productivity.	84	-1	1	.76	.456

8(i). : I use technology to communicate and collaborate with families about school programs and student learning.	84	-1	1	.62	.536
8(j). : I use technology to communicate and collaborate with other educators.	84	-1	1	.75	.488
8(k). : My lesson plans refer to both content standards and student technology standards.	84	-1	1	.54	.590
8(l). : I do research or action research projects to improve technology enhanced classroom practices.	84	-1	1	.40	.623
8(m). : I use multiple sources of data for reflecting on professional practice.	84	-1	1	.44	.588
8(n). : I use multiple sources of data to make decisions about the use of technology.	84	-1	1	.48	.591
8(o). : I use technology to participate in professional development activities.	84	-1	1	.62	.579
Composite				.5881	

The dependent variable was teacher technology integration, which was an average of the means of questions 9-11 of the STNA survey as shown previously in Table 3. A simple linear regression analysis was utilized to address Hypothesis 3. Linear regression attempts to "model the relationship between two variables by fitting a linear equation to observed data" (Lane, 2015, p. 463). Cohen et al. (2011) stated that the relationship between variables (i.e. teachers' computer self-efficacy and teachers' technology integration) are never perfect; therefore, linear regression not only provides a systematic way to make these predictions, it also provides specific information about how much better your predictions will be compared to random selections" (p. 255).

Assumption testing. The assumptions for linear regression include that there is additivity and linearity, equal variance of errors (homoscedasticity) and normality of errors. The independent variable was teacher computer self-efficacy and the dependent variable was teacher technology integration. Preliminary analysis was performed to assure that there were no violations with the variable of teacher computer self-efficacy.

Additivity and linearity. A scatterplot with the regression line was created (Figure 5) to show a pictorial representation of the correlation between two variables (Gall et al., 2007, pp. 332-333). The straight line, or the line of best fit, indicated that the x-axis variable was accompanied by a unit of increment on the y-axis variable (p. 332) which supported the preceding assumptions for utilizing a linear regression test. In Figure 5 below, the scatterplot demonstrates a straight line with no arc or curve, therefore supporting that the teacher computer self-efficacy variable does not violate the assumption of additivity and linearity.

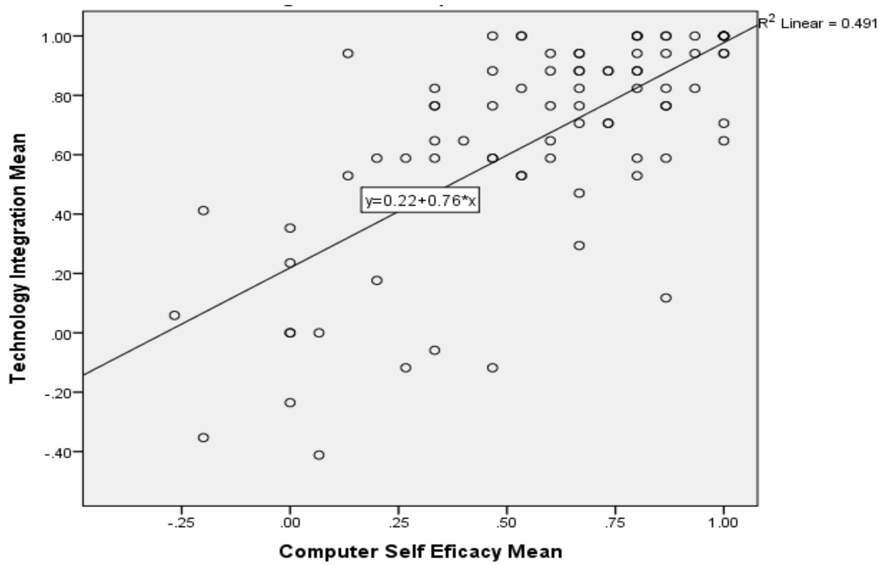

Figure 5. Scatterplot demonstrating linear relationship of computer self-efficacy

Homoscedasticity. Homoscedasticity refers to where the variances along the line of best fit remain similar as you move along the line ("Princeton University Library: Data and Statistical Services,"). The assumption of homoscedasticity is that the residuals are approximately equal for all predicted dependent value (technology integration) scores. A scatterplot was analyzed for shape and direction and is considered to have a linear relationship. Figure 5, based on the shape, indicates that the assumption is tenable.

Normality. "Regression assumes that variables have normal distributions" (Osborne & Waters, 2002, p. 3). Normality for years of teaching variable was analyzed through the Normal Probability Plot. The Normal plot line shown in Figure 6 is considered reasonably straight and is therefore viewed as acceptable.

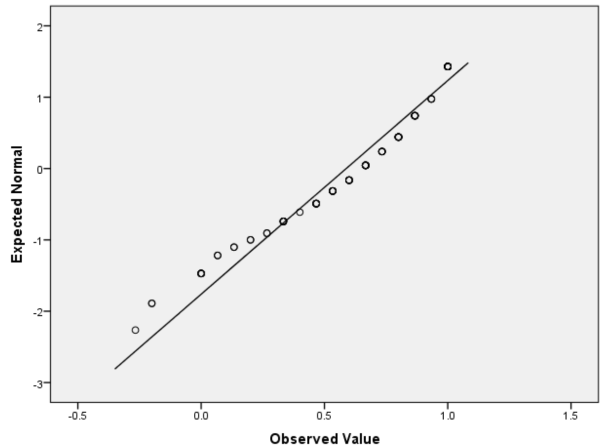

Figure 6. Q-Q Plot of Computer Self-Efficacy

Data analysis for hypothesis $H_0$3. The linear regression analysis determined there was a significant relationship between a teachers' computer self-efficacy and the level of teachers' technology integration in the classroom (B = -.005, R^2=0.4914, r=.701, p=.<.0001). The descriptive statistics and regression coefficients are listed in Tables 10 and 11. The analysis showed the t value of .758 and the p value, of .<.0001 which indicates a positive relationship. The coefficient of determination (R^2=.4914) showed effect size of computer self-efficacy explains 49.2% of the variance in teacher technology integration. Because the p value is so small and within the acceptable significance level, the null hypothesis was rejected at a significance level of 0.05, concluding there is a statistically significant relationship between teacher's computer self-efficacy and technology integration.

Table 9

Descriptive Statistics for Hypothesis 3

	N	Mean	SD
Technology Integration	84	.6653	.36123
Computer Self Efficacy	84	.5881	.33392

Table 10

Regression Coefficients for Hypothesis 3

Model	*Unstandardized Coefficients*		*Standardized Coefficients*	t	Sig.
	B	Std. Error	Beta		
Computer Self-Efficacy	-.005	.004	-.125	.758	.000

Null Hypothesis Four

Research question one. Is there a relationship between a teachers' gender, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom? The fourth null hypothesis stated there would be no significant relationship between a teachers' instructional technology training and the level of teachers' technology integration in the classroom as indicated by the School Technology Needs Assessment (STNA) results.

Question 12 from the STNA survey, the independent variable, was related to teacher professional development, and individual means of participants responses to question 12 were computed using SPSS 22.0. Question 12 of the STNA survey was all teacher professional development survey items and for statistical analysis, all responses from question 12 were grouped together. The individual means were then averaged to create the single professional development variable (M=.7132). Table 11 shows the composite survey items for the professional development variable.

Table 11

STNA Teacher Professional Development Variable

Characteristic	N	Min	Max	M	SD
12(a). : Research-based practices I can use in my teaching.	84	-1	1	.68	.541
12(b)....: Identification, location, and evaluation of technology resources	84	-1	1	.79	.517
12(c). : Performance-based student assessment of my students.	84	-1	1	.69	.580
12(d). The use of technology to collect and analyze student assessment data.	84	-1	1	.70	.533
12(e). Learner-centered teaching strategies that incorporate technology	84	-1	1	.79	.493
12(f)...: Online security and safety.	84	-1	1	.67	.545
12(g). The use of technology for differentiating instruction for students with special learning needs.	84	-1	1	.77	.499
12(h)..: Uses of technology to increase my professional productivity.	84	-1	1	.71	.593
12(i). Ways to use technology to communicate and collaborate with families about school programs and student learning.	84	-1	1	.68	.584
12(j)..: Ways to use technology to communicate and collaborate with other educators.	84	-1	1	.67	.588
12(k)..: Alignment of lesson plans to content standards and student technology standards.	84	-1	1	.70	.555

Valid N (listwise)	84				
Composite				.7132	

The dependent variable was teacher professional development, which was an average of the means of questions 12 of the STNA survey as shown previously in Table 3. A simple linear regression analysis was utilized to address Hypothesis 4. Linear regression attempts to "model the relationship between two variables by fitting a linear equation to observed data" (Lane, 2015, p. 463). Cohen et al. (2011) state that the relationship between variables (i.e. teachers' professional development and teachers' technology integration) are never perfect; therefore, linear regression not only provides a systematic way to make these predictions, it also provides specific information about how much better your predictions will be compared to random selections" (p. 255).

Assumption testing. The assumptions for linear regression include that there is additivity and linearity, equal variance of errors (homoscedasticity) and normality of errors. The independent variable was teacher professional development and the dependent variable was teacher technology integration. Preliminary analysis was performed to assure that there were no violations with the variable of teacher professional development.

Additivity and linearity. A scatterplot with the regression line was created (Figure 7) to show a pictorial representation of the correlation between two variables (Gall et al., 2007, pp. 332-333). The straight line, or the line of best fit, indicated that the x-axis variable was accompanied by a unit of increment on the y-axis variable (p. 332) which supported the preceding assumptions for utilizing a linear regression test. The scatterplot demonstrates a straight line with no arc or curve, therefore supporting that the teacher professional development variable does not violate the assumption of additivity and linearity.

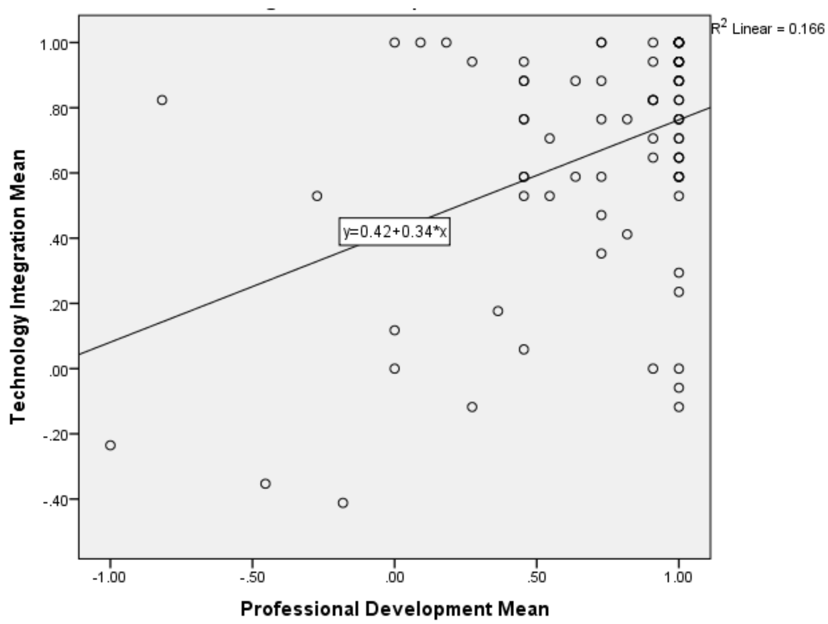

Figure 7. Scatterplot demonstrating linear relationship of professional development

Homoscedasticity. Homoscedasticity refers to where the variances along the line of best fit remain similar as you move along the line ("Princeton University Library: Data and Statistical Services,"). The assumption of homoscedasticity is that the residuals are approximately equal for all predicted dependent value (technology integration) scores. A scatterplot was analyzed for shape and direction and does not have a curved shape; therefore, is considered to have a linear relationship. Figure 7, based on the shape, indicates that the assumption is tenable.

Normality. "Regression assumes that variables have normal distributions" (Osborne & Waters, 2002, p. 3). Normality for years of teaching variable was analyzed through the Normal Probability Plot. The normal plot line shown in Figure 8 is considered reasonably straight and is therefore viewed as acceptable.

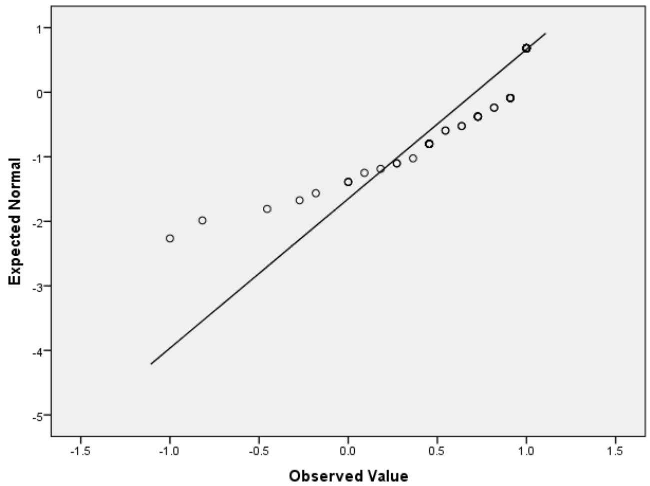

Figure 8. Q-Q Plot of professional development

Data analysis for hypothesis $H_0$4. The linear regression analysis determined there was a significant relationship between a teachers' professional development and the level of teachers' technology integration in the classroom (B = .341, R^2=.1663, r=.408, p=.0001). The descriptive statistics and regression coefficients are listed in Tables 12 and 13. The analysis showed the t value of 4.04 and the p value, of .0001, which indicates a positive relationship. The coefficient of determination (R^2=.1663) showed effect size of computer self-efficacy explains 16.63% of the variance in teacher technology integration. Because the p value is so small and within the acceptable significance level, the null hypothesis was rejected at a significance level of 0.05, concluding that there is a statistically significant relationship between teacher's professional development and technology integration.

Table 12

Descriptive Statistics for Hypothesis 4

	N	Mean	SD
Technology Integration	84	.6653	.36123
Professional Development	84	.7132	.43208

Table 13

Regression Coefficients for Hypothesis 4

	Unstandardized Coefficients		*Standardized Coefficients*		
Model	B	Std. Error	Beta	t	Sig.
Professional Technology Development	.341	.084	.408	4.045	.000

Null Hypothesis Five

Research question two. Does a relationship exist between the teachers' level of technology integration in the classroom and student achievement as measured by performance on end of course tests? The fifth null hypothesis stated that there would be no statistically significant relationship between the level of technology integration and student achievement as measured by performance on the post assessment state end of course tests as reported by the School Technology Needs Assessment (STNA).

Question seven of the STNA, the independent variable, asked participants to select their average of student post assessment scores. The student post assessment scores were coded as follows: “Does not meet (<70%) = 1”, “Does not meet (>=70% - <77%) = 2”, “Meets (>=77% - <85%) = 3”, “Meets (>=85% - <93%) = 4”, “Exceeds (>=93% - <101%) = 5”.

The dependent variable was teacher professional development, which was an average of the means of questions 12 of the STNA survey as shown previously in Table 3. A simple linear regression analysis was utilized to address Hypothesis 5. Linear regression attempts to “model the relationship between two variables by fitting a linear equation to observed data” (Lane, 2015, p. 463). Cohen et al. (2011) stated that the relationship between variables (i.e. student achievement as measured by post assessment scores and teachers’ technology integration) are never perfect; therefore, linear regression not only provides a systematic way to make these predictions, it also provides specific information about how much better your predictions will be compared to random selections" (p. 255). The linear regression analysis determined there was not a significant relationship between student achievement as measured by post assessment scores and the level of teachers' technology integration in the classroom ($B = -.007$, $R^2=.0002$, $r=.015$, $p=.8903$).

Assumption testing. The assumptions for linear regression include that there is additivity and linearity, equal variance of errors (homoscedasticity) and normality of errors. The independent variable was student post assessment scores and the dependent variable was teacher technology integration. Preliminary analysis was performed to assure that there were no violations with the variable of teacher professional development.

Additivity and linearity. A scatterplot with the regression line was created (Figure 9) to show a pictorial representation of the correlation between two variables (Gall et al., 2007, pp. 332-333). The straight line, or the line of best fit, indicated that the x-axis variable was accompanied by a unit of increment on the y-axis variable (p. 332) which supported the preceding assumptions for utilizing a linear regression test. The scatterplot demonstrates a straight line with no arc or curve, therefore supporting that the average post assessment score variable does not violate the assumption of additivity and linearity.

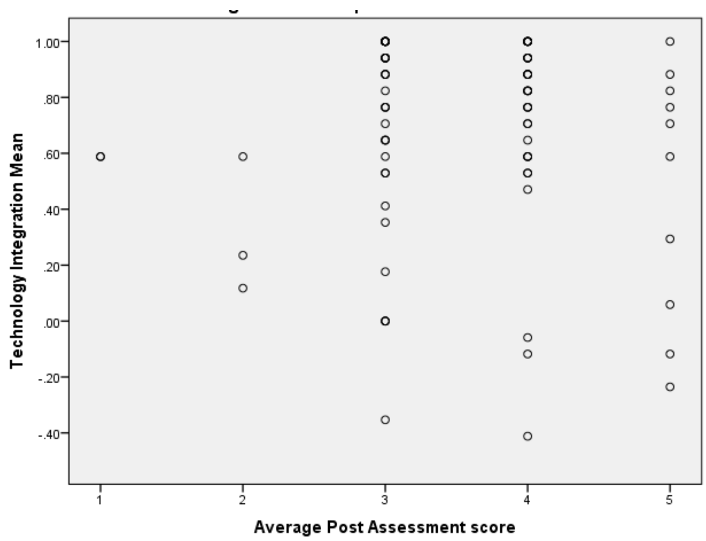

Figure 9. Scatterplot demonstrating linear relationship of average post assessment score

Homoscedasticity. Homoscedasticity refers to where the variances along the line of best fit remain similar as you move along the line ("Princeton University Library: Data and Statistical Services,"). The assumption of homoscedasticity is that the residuals are approximately equal for all predicted dependent value (technology integration) scores. A scatterplot was analyzed for shape and direction and is considered to have a linear relationship. Figure 9, based on the shape, indicates that the assumption is tenable.

Normality. “Regression assumes that variables have normal distributions” (Osborne & Waters, 2002, p. 3). Normality for years of teaching variable was analyzed through the Normal Probability Plot. The normal plot line shown in Figure 10. Figure 10 is considered reasonably straight and is therefore viewed as acceptable.

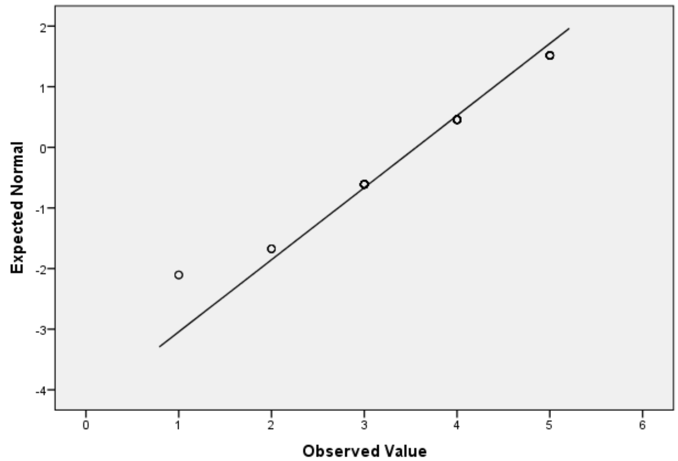

Figure 10. Q-Q plot of average post assessment scores.

Data Analysis Hypothesis H_05

The linear regression analysis determined there was not a significant relationship between average student post assessment scores and the level of teachers' technology integration in the classroom (B = -.007, R^2=.0002, r=.015, p=.8903). The descriptive statistics and regression coefficients are listed in Tables 12 and 13. The analysis showed the t value of -0.14 and the p value of .8903, which indicates no significance. Because of the negative t value the p value is so large and not within the acceptable significance level, we fail to reject the null hypothesis at a significance level of 0.05, and we conclude that there is not a statistically significant relationship between student average post assessment scores and technology integration.

Table 14

Descriptive Statistics for Hypothesis 5

	N	Mean	SD
Technology Integration	84	.6653	.36123
Average Post Assessment score	84	3.56	.841

Table 15

Regression Coefficients for Hypothesis 5

Model	*Unstandardized Coefficients*		*Standardized Coefficients*	t	Sig.
	B	Std. Error	Beta		
Professional Technology Development	-.007	.047	-.015	-.138	.890

Summary

The 84 CTE teachers who participated in the School Technology Needs Assessment Survey (STNA) encompassed a wide range of demographic characteristics, such as gender, age and years of experience. Research question one asks if there is a relationship between a teachers' gender, age, years of experience, computer self-efficacy and instructional technology training and the level of teachers' technology integration in the classroom. As supported by the research of Gall et al. (2007), a two-sample *t* test was used to test null hypotheses one in an effort to determine if there was a correlation with gender to teachers' integration of technology into classroom instruction. This test was chosen because this test is utilized when trying to examine questions about the means from two random sample populations (male and female) or groups and if they differ significantly on some single characteristic, in this case teacher technology integration (p. 440-441). The data for this hypothesis did not meet all of the assumptions for a *t* test but the sample size was large enough (more than 30) to support that it was still approaching normality. Though this is not the perfect fit for the t test, even if that was not the case, the t test shows the data for hypothesis one is not significant. The analysis failed to reject $H_0$1 at a significance level of ∞=.05. A linear regression analysis was conducted to analyze $H_0$2, $H_0$3 and $H_0$4. The independent variables of years of experience, computer self-efficacy and instructional technology training were tested against the dependent variable of teacher technology integration.

Each of the assumptions for linear regression analysis were met for the hypotheses and the data analysis failed to reject $H_0 2$ but supported rejecting $H_0 3$ and $H_0 4$. Chapter five will expound on the significant correlations.

Research question two asked does a relationship exist between the teachers' level of technology integration in the classroom and student achievement as measured by performance on end of course post assessment tests. Linear regression was used to test $H_0 5$. Meeting all of the assumptions for linear regression, the variables of teacher technology integration and student post assessment scores were analyzed at a significance level of .05. The research data failed to reject $H_0 5$ indicating that teacher technology integration did not show a significant relationship to student post assessment scores.

CHAPTER FIVE: DISCUSSION

Introduction

Most students today are familiar with technology tools through their use of the Internet, electronic games, cellular phones, mp3 players, tablets and computers (Cravey, 2008; Hertzler, 2010). Therefore, implementing technology tools in classrooms has long been recognized by schools as a potential way to appeal to learners, close achievement gaps, and help increase achievement levels in preparation for success in college and the workplace (Alsafran & Brown, 2012; Shapley et al., 2009). However, schools face a number of challenges in integrating technology in the classroom, including decreased federal funding, budget constraints, and teacher perceptions of the benefits of technology tools (Townsend et al., 2012).

While most states are attempting to integrate the use of technology as an instructional tool, the amount of technology infused in instruction by both teachers and students varies widely ("North Carolina State School Technology Plan," 2011). The overall goal of technology integration in the curriculum is to increase student engagement, to equip students with twenty-first century college and workplace skills, and to increase student achievement ("North Carolina Department of Public Instruction: Career and College, Ready, Set, Go!," 2011). The increased integration of technology in curriculums and classrooms has been set as a priority to accomplish this goal. Budgetary implications, public concerns, and research suggesting that successfully integrating technology into the curriculum can increase student achievement provide a rationale for researching this topic (Parker et al., 2008). This study examined instructional technology, the integration of technology within the classroom and its relationship to student achievement as measured by the state end of course post-assessment tests.

Summary of Findings

SPSS 22.0 was used to analyze the data for the two research questions in this study. The research questions and hypotheses were analyzed and answered by using a two-sample *t* test for hypothesis one and simple linear regression analysis for hypotheses two through four. Chapter 4 gives a detailed analysis of the research questions and hypotheses. The key findings of the analysis are also summarized below.

Results from the analyses (α =.05) indicated a significant relationship between two of the independent variables, computer self-efficacy and professional development. The analysis found a significant relationship with teacher technology integration and computer self-efficacy (t= 8.90, p=.000). The analysis also indicated a significant relationship between teacher technology integration and professional development (t=4.04, p=.0001). However, the analysis showed no significance between teacher technology integration and gender (r=.012, p=.912). The analysis for technology integration and years taught (t= -1.14 and p=.2591) as well as technology integration and post assessment scores (r-.015 and p=.890) also showed no significance at a confidence level of .05.

Discussion and Implication of Findings

The review of literature indicated that one focus in public education should be on technology, technology literacy and the integration of technology as a best practice and initiative for equipping students for the 21st century and increasing student achievement ("Partnership for 21st Century Skills: Framework for 21st Century Learning," 2011). The findings of the literature review and the previous research both support and conflict with many of the findings in this research study.

Research question one looks at possible relationships, if any, between teacher technology integration and variables, which included teacher gender, years of experience, computer self-efficacy and instructional professional development. Research question two looked at the possible relationship between student achievement as measured by student post assessment scores and teacher technology integration. Based on the data, two of the four null hypotheses ($H_0$1 and $H_0$2) were not rejected in research question one. There was no significant relationship found between teacher technology integration and gender ($H_0$1) and teacher technology integration and years of experience ($H_0$2).

However, data supported the rejection of two of the four null hypotheses for research question one. The first significant relationship found was between teacher technology integration and computer self-efficacy ($H_0$3). The study by Paraskeva et al. (2008) as well as (Iscioglu, 2011) support this research study. The Paraskeva et al. (2008) study asserted that teacher attitudes toward and beliefs about technology tools influenced their use and effective integration for school learning and engagement. The Iscioglu (2011) study also concluded that the teacher's comfort level with technology had a direct relationship on a teacher's ability and willingness to integrate technology in the curriculum. Similar to the Paraskeva and Iscioglu studies, the Career and Technology teachers that participated in this research study replied favorably to moderate to high comfort levels with technology tools and their use of technology for both professional and classroom integration.

In research question one, the results of this study also found a significant relationship between teacher technology integration and technology professional development ($H_0$4). Data from this research study support the literature of Matzen and Edmunds (2007). Much like the conclusion of the Matzen and Edmunds study, participant responses from this study reflected the need for not only professional development to teach technology skills but also to provide training on how teacher technology integration can connect with the content of the curriculum. The data from this study support the same recommendations from the International Society for Technology in Education (ISTE, 2012) and Vockley and Partnership for 21st Century (2007) studies that recommend technology professional development that will not only help upgrade teacher technology skills but help teachers foster environments in which classroom technology integration is infused throughout the classroom and school.

Research question two of this study seeks to understand if a relationship exists between teacher technology integration in the classroom and student achievement on high stakes tests (H_05). Data did not support a significant relationship and the study failed to reject the null hypothesis. This study found the relationship to technology integration and high stakes testing, or student test scores, consistent with the research of the Apple Classroom of Tomorrow study (E. Baker et al., 1994) and the Harold Wenglinsky study (Schacter, 1999). Wenglinsky found that there was no conclusive evidence that teacher’s integration of technology in the curriculum had any consistent direct influence on student test scores as measured by the National Assessment of Education Progress (NAEP). What he did conclude was that the teachers that integrated technology into the curriculum helped students develop higher order thinking skills and seemed more engaged in their learning. This study was also similar to the conclusions in the 1994 Apple Classroom of Tomorrow study by Baker, et. al, where evidence was found that instructional technology did have a perceived positive effect on student engagement though no direct evidence could be found to support a direct relationship between integration of technology and increased student test scores. The Apple Classrooms of Tomorrow study indicated that teacher technology integration not only helped students with higher level cognitive tasks but increased student initiative and engagement (E. L. Baker et al., 1990).

Research questions one and two of this study brought mixed results. However, the data from this study did support the notion that students were more engaged when teacher technology integration was utilized in classroom. Questions nine through eleven of the STNA survey focused specifically on teacher technology integration. The mean (M=.6652) showed more teachers believed that the teacher technology integration helped with student engagement in the classroom. These findings support the study by Grunwald and Associates (2010) that showed that based on teacher perception, teacher technology integration helped engage not only high achieving students but all types of learners including struggling and English language learners. The Grunwald and Associates study, as reiterated in this study, showed that at the secondary level, teachers placed an emphasis on technology due to the perceived benefits of developing 21st century skills. Teachers also had a positive perception of the importance of technology on student engagement and learning. The findings in this research also supported the research of Vockley and Partnership for 21st Century (2007), but was inconsistent with the research of eMints National Center (2011). The eMints study, unlike the previously mentioned studies, showed an actual statistically significant relationship with technology integration and advanced levels of student achievement. Though the information was inconsistent with the findings in this research study, the eMints study along with the previously mentioned studies all focused on the role of instructional technology integration as an important factor to help prepare students for 21st century and increase student learning. Each of these studies recognized, including the eMints study, to some degree, the positive response to technology use in the. Not only did the studies show a positive response to technology use but each of the studies showed that there was a perception that student engagement increased with the effective use of technology and the teacher's technology integration in the classroom ("eMints National Center," 2011; Grunwald & Associates, 2010).

Recommendations for Future Research

As shown in the review of literature, technology has expanded in many facets of schools. Technology has become a central focus in schools as a way to increase student engagement. As technology is a major expenditure to many school districts budgets, it has become increasingly important for school districts to focus its efforts and analyze the effectiveness integration of technology has on student engagement and achievement. Schools districts must understand the influence and factors, if any, that compel teachers to integrate technology and if that integration has an effect on student achievement.

The current study provides some new information about teacher's perceptions regarding integration of technology into the curriculum. The participants in this research study were all from the same field, Career and Technology Education. Additional research can help clarify the relationship between technology integration and other factors. More research could also explain the influence of teacher technology integration on student end our course test scores. The following are recommended for future research:

1. To extend the findings of this study, the researcher recommends that a follow up study be conducted using a larger population of secondary CTE teachers and an expanded geographic location to include more school districts. This expansion could provide different results.

2. Future research should include the acquirement of actual test scores from district personnel to more accurately report the correlation between teacher technology integration and student end of test scores.
3. Future research should include obtaining actual district requirements for teacher technology integration so that analysis can be made in regard to computer self-efficacy, professional development training and teacher technology integration.
4. A study should be conducted to expand to non - secondary CTE teachers versus secondary CTE teachers. This could provide different results.
5. Future research should explore middle and secondary CTE end of course post assessment scores.
6. A study should be conducted that focuses on how often instructional teacher technology integration is used in CTE classrooms and its effect on secondary CTE student end of course post assessment performance.
7. Future research should include a qualitative study in which observations and interviews are conducted to assess and focus if CTE teacher age and gender influence their use of technology in the classroom. This would allow for more analysis to see what factors influence the use of teacher technology integration in the content area.
8. And finally, a study should be conducted to assess the teacher's amount of technology professional development training and its influence on the amount of teacher technology integration.

Recommendations for Practice

In response to the No Child Left Behind Act (2001), North Carolina has established educational initiatives to strengthen students and better prepare them to be competitive in the global society, including adopting the National Common Core Curriculum Standards and implementing the Essential Standards Initiative ("North Carolina Department of Public Instruction Common Core State and NC Essential Standards," 2012). It is recommended for technology, an essential component of the standards, to be a top priority to help merge the cognitive process with both content and pedagogical knowledge ("North Carolina Department of Public Instruction Common Core State and NC Essential Standards," 2012).

School districts strive to provide and implement technology for teacher and student use. As students are considered *native digital users,* the importance of technology in classrooms has become essential to prepare students for twenty-first century (Prensky, 2001a). With the requirements for and emphasis on instructional technology, it is not only recommended that schools budget for increased investments in instructional technology tools as a way to engage students and increase student achievement but schools also need to provide the necessary instructional technology training for teachers to implement and integrate within their specific content area. Because this study found that there was a significant relationship with computer self-efficacy, professional development and teacher technology integration, educational leaders should not only encourage but provide the necessary environment to stimulate and encourage teachers to continue to refine technology skills and implement technology as a strategy to engage students and enhance student learning. *Learning for the 21st Century,* a report commissioned by the Partnership for 21st Century Skills, reiterates the necessity for integration of technology and technology use as a way to increase student engagement (Salpeter, 2003).

Limitations of the Study

The ability to generalize the findings of this study was limited due to the sample size of the study. All of the 100 Career and Technology Education teachers in Cabarrus County Schools were asked to participate in the study and 84 participated. All of the participants were from the same geographical region. So due to the sample size, the findings of this study may not be a representative reflection of the entire US. All of the data in the study were self-reported. The student end of course post assessment scores were self-reported and could have been inaccurately reported by the participants. The researcher did not directly observe teachers integrating technology into their daily instruction. Based on the limitations of student end of course post assessment scores and teacher technology integration, the findings of this study regarding the influence on teacher technology integration and student end of course post assessment scores cannot be generalized.

Summary

North Carolina has enacted policies and guidelines that challenge school districts to institute practices and policies in educational institutions that will better prepare the students ("North Carolina Department of Public Instruction: Career and College, Ready, Set, Go!," 2011). One initiative North Carolina has enacted is the focus on teacher technology integration in the classroom as a way to improve student achievement. Previous research has studied various factors that may contribute to teacher technology integration and its possible relationship to student achievement. The main purpose of this study was to examine the relationship between a Career and Technology education teachers' integration of technological tools in the classroom and their perceptions of its relationship to student achievement. Specifically addressed in this study were factors that could influence teacher technology integration including years of experience, gender, computer self-efficacy, instructional professional development and student test scores as measured by the post assessment state end of course tests.

The participants in this study were teachers in the secondary Career and Technology education program. There are 100 secondary Career and Technical education (CTE) teachers in the participating school district. Of the 100 teachers, 84 participated in the research study. Data from the participants was gathered and analyzed. Using SPSS 22.0, a two sample t test was used to test hypothesis one and a linear regression analysis was used to test the hypotheses two through five. The findings bought about mixed results. The analysis did find a relationship between teacher technology integration and computer self-efficacy. The data also found a relationship between teacher technology integration and instructional professional development. On the other hand, the analysis revealed no statistically significant relationship between teacher technology integration and the independent variables of teacher's age and gender. There was also no significant relationship found between teacher technology integration and student end of course post assessment scores. The findings of this study were consistent and supported by the Apple Classroom of Tomorrow study (E. Baker et al., 1994), Harold Wenglinsky study (Schacter, 1999), Grunwald and Associates (2010) and Khe Foon and Brush (2007) studies. The study was inconsistent with the literature and research of The Alabama Connecting Classrooms Educators and Students State-wide (ACCESS) program (Bielefeldt et al., 2010; Vockley & Partnership for 21st Century, 2007) and the eMints study ("eMints National Center," 2011; Vockley & Partnership for 21st Century, 2007).

The ability to generalize the findings of this study was limited due to the sample size of the study. Although the data for this study was all self-reported, the analysis of the data yielded several recommendations for practice by educational leaders. Schools should budget for increased investments in instructional technology tools as a way to increase student engagement. Along with the investments in instructional technology tools, schools also need to provide the necessary instructional technology training for teachers to implement and integrate within their specific content area.

The current study provides some new information about teacher's perceptions regarding integration of technology into the curriculum. Additional research can help clarify the relationship between technology integration and other factors. More research could also explain the influence of teacher technology integration on student end our course test scores. Some of the recommendations include a follow up study be conducted using a larger population of secondary CTE teachers and an expanded geographic location to include more school districts. This expansion could provide different results. Another recommendation is to expand to non - secondary CTE teachers versus secondary CTE teachers. This could provide different results. Based on the results of this study it is recommended that a study should be conducted to assess the teacher's amount of technology professional development training and its influence on the amount of teacher technology integration.

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APPENDICES

Appendix A IRB Approval

LIBERTY UNIVERSITY
INSTITUTIONAL REVIEW BOARD

December 19, 2014

Carla D. Holt
IRB Exemption 2051.121914: The Examination of Teacher Perceptions of the Relationship between Instructional Technology and Student Achievement

Dear Carla,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application and no further IRB oversight is required.

Your study falls under exemption category 46.101(b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

> (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
> (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054

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From: Lisa Conger <Lisa.Conger@Cabarrus.k12.nc.us>
Sent: Wednesday, March 26, 2014 1:48 PM
Subject: Permission to survey

Dear Ms. Holt,

You have permission to survey CTE teachers for the purpose of teacher perceptions and technology.

Lisa Conger
Lisa Conger
Director of Career & Technical Education
Cabarrus County Schools
Phone: 704-262-6167
Fax: 704-262-6200
4401 Old Airport Road
Concord, NC 28025
Lisa.conger@cabarrus.k12.nc.us

From: Katherine Propst <Katherine.Propst@Cabarrus.k12.nc.us>
Sent: Thursday, April 10, 2014 10:06 AM
Subject: Dissertation

Ms. Holt,

CCS will support your dissertation, "An examination of teacher perception of the relationship between instructional technology integration and student achievement." Support will be provided by disseminating the STNA survey and providing data collected for your research.

Kelly

Dr. Katherine Propst
Assistant Superintendent
Cabarrus County Schools
130 Cedar Drive, NW
Concord, North Carolina 28025
(704) 788-6100 Office
(980) 521-0078 Cell

On Wed, Jan 2, 2013 at 10:32 AM, Carla Holt <Carla.Holt@cabarrus.k12.nc.us> wrote:
Mr. Stanhope,

I am currently working on my dissertation and would like to request permission to utilize the STNA survey questions in my research. I am a student at Liberty University and am working on a EdD degree in Educational Leadership. I work in Cabarrus County Schools. Please advise on the process and procedures. If you need further information please let me know. Thank you again for your assistance.

Carla D. Holt, EdS.
Instructional Technology Facilitator
Mt. Pleasant High School
http://www.cabarrus.k12.nc.us/mphs

From: danstan06@gmail.com on behalf of Daniel Stanhope <daniel.s.stanhope@gmail.com>
Sent: Thursday, January 10, 2013 3:28 PM
Subject: Re: SNTA survey

Carla,

Thanks again for your patience. The only thing that we request is that you cite the validation study -- Corn, J. O. (2010). Investigating the Quality of the School Technology Needs Assessment (STNA) 3.0: A Validity and Reliability Study. Educational Technology Research And Development, 58(4), 353-376 -- and that you maintain the integrity of the STNA by not revising items, etc. Also, the scale reliability and validity work was done with the items and constructs as they are; thus, we request that you do not remove items from constructs when reporting at the construct level.

In terms of using the data from your district, that just needs to be OK'd by them.

Thanks,
Danny

Daniel S. Stanhope, M.S.
Doctoral Candidate (I/O Psychology)
North Carolina State University
- - -
Friday Institute for Educational Innovation
Specialized Professional
Raleigh, NC 27695

Appendix B. Permission to Reproduce

Hello in Cabarrus County!
Absolutely - permission granted. Good luck and let us know if we can be of further assistance!
Jeni

On Wed, Oct 28, 2015 at 10:37 AM, Daniel Stanhope <dsstanho@ncsu.edu> wrote:
Hi, Carla. A quick follow up to our recent phone call: I think Jeni needs to give permission for you to reproduce this because she authored the paper.

Jeni, do you see any issues with Carla reproducing the survey in her dissertation? And are you able to sign off?

Carla, congrats on getting this far and good luck pushing through to the finish line!

Danny

On Tue, Oct 27, 2015 at 11:46 AM, Carla Holt <Carla.Holt@cabarrus.k12.nc.us> wrote:

Hi,

I contacted you a couple of years ago requesting permission to use the STNA survey. Thank you for your assistance. I have included the email correspondence below.

I am contacting you again because I would like to ask permission to reproduce the STNA survey instrument in my Dissertation. After defending my Dissertation, my program requires me to submit it for publication in the Liberty University open-access institutional repository, the Digital Commons, and in the Proquest thesis and dissertation subscription research database. If you allow this, I will provide a citation of your work as follows:

Corn, J. O. (2010). Investigating the quality of the school technology needs assessment (STNA) 3.0: A validity and reliability study. *Educational Technology, Research and Development, 58*(4), 353-376. It will also state

"Reproduced with permission."

My district deployed the study and approved me using it. I just need to have permission that must explicitly grant permission to reproduce a copy in the published version of my submission.

Thank you for your consideration in this matter!

Carla D. Holt, Ed.D

Instructional Technology Facilitator

Mt. Pleasant High School

www.cabarrus.k12.nc.us/mountpleasanths

Daniel S. Stanhope, PhD
I/O Psychology
North Carolina State University

Consultant | Research Methodologist | Editor
daniel.s.stanhope@gmail.com

--
Jeni O. Corn, Ph.D.
Director of Evaluation Programs
Friday Institute for Educational Innovation
College of Education, NC State University
919-513-8527
http://www.fi.ncsu.edu/

Appendix C. Descriptive Statistics for School Technology Needs Survey (STNA) 4.0

Reproduced with permission

	N	Min	Max	M	SD
COMPUTER SELF-EFFICACY					
8(a). : I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology.	84	-1	1	.33	.523
8(b). : I identify, locate, and evaluate technology resources for use by my students, e.g., websites.	84	-1	1	.63	.510
8(c). : I apply performance-based student assessment to technology-enhanced lessons, e.g., student portfolios, student presentations.	84	-1	1	.69	.514
8(d). : I use technology regularly to collect and analyze student assessment data.	84	-1	1	.56	.588
8(e). : My lessons include technology-enhanced, learner-centered teaching strategies, e.g., project-based learning.	84	-1	1	.67	.499
8(f). : I apply policies and practices to enhance online security and safety.	84	-1	1	.70	.533
8(g). : I use technology to differentiate instruction for students with special learning needs.	84	-1	1	.63	.555
8(h). : I use technology to support and increase my professional productivity.	84	-1	1	.76	.456

8(i). : I use technology to communicate and collaborate with families about school programs and student learning.	84	-1	1	.62	.536
8(j). : I use technology to communicate and collaborate with other educators.	84	-1	1	.75	.488
8(k). : My lesson plans refer to both content standards and student technology standards.	84	-1	1	.54	.590
8(l). : I do research or action research projects to improve technology enhanced classroom practices.	84	-1	1	.40	.623
8(m). : I use multiple sources of data for reflecting on professional practice.	84	-1	1	.44	.588
8(n). : I use multiple sources of data to make decisions about the use of technology.	84	-1	1	.48	.591
8(o). : I use technology to participate in professional development activities, e.g. online workshops, hands-on training in a computer lab.	84	-1	1	.62	.579
TEACHER TECHNOLOGY INTEGRATION					
9(a). : Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.	84	-1	1	.80	.433
9(b). : Students use technology during the school day to communicate and collaborate with others, beyond the classroom.	84	-1	1	.60	.518

9(c). : Students use technology to access online resources and information as a part of classroom activities.	84	0	1	.81	.395
9(d). : Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery	84	-1	1	.40	.696
9(e). : Students work on technology-enhanced projects that approach real world applications of technology.	84	-1	1	.67	.545
9(f). : Students use technology to help solve problems.	84	-1	1	.76	.456
9(h). : Students use technology to create new ideas and representations of information.	84	-1	1	.69	.514
9(g). : Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.	84	-1	1	.75	.462
10(a). : My teaching is more student-centered and interactive when technology is integrated into instruction.	84	-1	1	.69	.537
10(b). : My teaching practices emphasize teacher uses of technology skills to support instruction.	84	-1	1	.73	.523
10(c). : My teaching practices emphasize student uses of productivity applications, e.g., word processing, spreadsheet.	84	-1	1	.68	.519
10(d). : My teaching practices emphasize student uses of technology as an integral part of specific teaching strategies, e.g., project-based or cooperative learning.	84	-1	1	.76	.456
11(a). . Technology has helped my students become more socially aware, confident, and positive about their future.	84	-1	1	.56	.628

11(b). . Technology has helped my students become independent learners and self-starters.	84	-1	1	.52	.685
11(c). . Technology has helped my students work more collaboratively.	84	-1	1	.58	.662
11(d). . Technology has increased my student's engagement in their learning.	84	-1	1	.71	.593
11(e). . Technology has helped my students achieve greater academic success.	84	-1	1	.60	.604
INSTRUCTIONAL TECHNOLOGY TRAINING					
12(a). : I would benefit from professional development on...: Research-based practices I can use in my teaching.	84	-1	1	.68	.541
12(b). : I would benefit from professional development on...: Identification, location, and evaluation of technology resources, e.g., websites that I can use with my students.	84	-1	1	.79	.517
12(c). : I would benefit from professional development on...: Performance-based student assessment of my students.	84	-1	1	.69	.580
12(d). : I would benefit from professional development on...: The use of technology to collect and analyze student assessment data.	84	-1	1	.70	.533
12(e). : I would benefit from professional development on...: Learner-centered teaching strategies that incorporate technology, e.g., project-based or cooperative learning.	84	-1	1	.79	.493

12(f). : I would benefit from professional development on...: Online security and safety.	84	-1	1	.67	.545
12(g). : I would benefit from professional development on...: The use of technology for differentiating instruction for students with special learning needs.	84	-1	1	.77	.499
12(h). : I would benefit from professional development on...: Uses of technology to increase my professional productivity.	84	-1	1	.71	.593
12(i). : I would benefit from professional development on...: Ways to use technology to communicate and collaborate with families about school programs and student learning.	84	-1	1	.68	.584
12(j). : I would benefit from professional development on...: Ways to use technology to communicate and collaborate with other educators.	84	-1	1	.67	.588
12(k). : I would benefit from professional development on...: Alignment of lesson plans to content standards and student technology standards.	84	-1	1	.70	.555
Valid N (listwise)	84				