ONE-TO-ONE MOBILE TECHNOLOGY AND STANDARDIZED TESTING:

A QUANTITATIVE EX POST FACTO STUDY

by

Aquil F. Bayyan, Sr.

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The Dissertation Committee for Aquil F. Bayyan, Sr. certifies approval of the following dissertation:

ONE-TO-ONE MOBILE TECHNOLOGY AND STANDARDIZED TESTING: A QUANTITATIVE EX POST FACTO STUDY

Committee: Linlin (Irene) Chen, EdD, Chair

Seth Langley, PhD, Committee Member

Jeremy Tutty, EdD, Committee Member

Irene Linlin Chen

Linlin (Irene) Chen

Seth Langley, Ph. D.

Seth Langley

[illegible], EdD.

Jeremy Tutty

Jeremy Moreland

Jeremy Moreland, PhD

Academic Dean, School of Advanced Studies
University of Phoenix

Date Approved: February 15, 2016

ABSTRACT

This quantitative, ex post facto study examined the impact a districtwide high school one-to-one mobile technology initiative had on the number of 10th grade students in the Forney Independent School District (ISD) (Texas) who passed their standardized TAKS tests during the 2010 academic year. The research study used annual public Forney ISD (Texas) data obtained from the Texas Education Agency (TEA) website. The study compared the 2009 academic year when 10th grade students (n=520) did not have one-to-one mobile technology and the 2010 academic year when 10th grade students (n=530) were able to use one-to-one mobile technology as their personal school and home device. Findings from the study determined if there was a statistically significant relationship between one-to-one mobile technology and the number of 10th grade students who passed their standardized TAKS tests during the 2010 academic year. With a chi-square critical value of 3.84 the results of the study showed a statistically significant relationship between the number of 10th grade students who passed their TAKS tests in 2010 with one-to-one mobile technology. In 2010, the number of 10th grade students who passed the English Language Arts test increased by 5% (92% to 97%) with a chi-square statistic of 12.86. The number of students who passed the Math test increased by 18% (65% to 83%) with a chi-square statistic of 44.39. The number of students who passed the Science test increased by 12% (70% to 82%) with a chi-square statistic of 21.04. The number of students who passed the Social Studies test increased by 6% (90% to 96%) with a chi-square statistic of 14.79. The number of 10th grade students who passed all of their TAKS tests increased by 18% (57% to 75%) with a chi-square statistic of 38.67. The theoretical framework was constructed by the dual coding theory of Alan Pavio and the multiple intelligence theory of Howard Gardner.

DEDICATION

I would like to dedicate this dissertation to my wife, Alemtsehay "Alem" and my two children, Aquil, Jr. "Mehari" and Baiza. I am forever indebted to you for your love, understanding, and sacrifice through this process. I appreciate my wife taking care of the familial duties and sacrificing some nights alone while I was conducting research and typing papers. I remember nights when my children told me that they did not want me to leave, when I had to go out and study. I also remember the night when my son told me at the age of five that he wanted me to study and work hard. It was not an easy time, but you stayed there with me and encouraged me to continue. I would also like to dedicate this to my mother, Ikhlas, and my father, Ramadan, Sr., who have been working in the field of education since the late 1970s and are still contributing to the field. They are also finishing Doctor of Education (Ed.D.) programs of their own. As an African-American male who was born in Philadelphia, PA (USA) in 1977, I would like to dedicate this work to people of all colors who sacrificed their lives through the Trans-Atlantic Slave Trade, Jim Crow Era, Civil Rights Movement, and various injustices that paved the way so I could have this opportunity.

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Introduction

The integration of technology in the classroom has affected both student-teacher engagement and the school environment (Laliberte, 2009). More specifically, mobile technology in school systems within the United States has been implemented at various education levels (Davies, 2011). However, the teachers' and students' ability to use this mobile technology can be obstructed by the lack of funding and/or staff members' unwillingness to learn how to implement new technologies that could be helpful to a school or school district (Bouterse, Corn, & Halstead, 2009). In some cases, the technology may be available and affordable, but a school may not provide professional development sessions for staff members to make the technology integration a reality (Gaytan & McEwen, 2010).

The Information Age has made mobile technology integration an important topic for educational stakeholders (Davies, 2011). As new technologies are being developed, it is important that school districts and schools have technology integration plans that can best meet the educational technology standards students and parents expect from their school districts (Davies, 2011). When teachers are able to integrate technology in the classroom, those students typically achieve more within the respective academic setting (Laliberte, 2009).

This quantitative, ex post facto study investigated whether the implementation of one-to-one mobile technology in the form of laptop computers had any impact on student outcomes at the high school education level. After gathering a macro view of how schools implemented one-to-one mobile technology at various levels, the research focused specifically on 10th grade student public high school academic performance data in the Forney Independent School District (ISD) in Forney, Texas, which implemented one-to-one mobile technology (laptops) for high school students to use in every class beginning in the 2010 academic year.

Background of the Problem

The U.S. is declining academically when compared to other developed nations (U.S. Department of Education, 2010). For example, standardized test scores in the U.S. education system have been a cause for concern. Other nations have continued to perform better than the U.S. on standardized reading, science, and math tests administered to 15 year olds globally (OECD, 2010; Schleicher & Davidson, 2013). According to Ally and Samaka (2013), implementing current mobile technology for students to use at all levels may influence student motivation and engagement. In Texas, researchers have measured student motivation and engagement by examining school and school district data of standardized test scores. With respect to schools implementing mobile technology, Bull (2010) found that:

> Despite advance knowledge of societal trends, schools have generally not anticipated or capitalized on this educational potential. Pew reports that most schools treat these devices as a disruptive force that educators must manage and exclude from the school and the classroom. (p. 1)

According to Norris and Soloway (2009), the technology that many students have access to on a daily basis needs to be matched in the classroom to meet student educational needs. Technological and computer proficiency is a trait that is required to be successful with the globalization of the work force (Burton, 2008). While other countries are improving their educational rankings, the U.S. has declined in science, reading, and math (Burton, 2008; Schleicher & Davidson, 2013).

Lacking one-to-one mobile technology in the classroom may influence student motivation and student engagement in the classroom, which may, in turn, adversely affect the number of high school students who pass standardized tests. Penuel (2006) found that “Hundreds of independent, parochial, and individual public schools are also implementing demonstration and large-scale projects that provide one-to-one, 24/7 access to computers and the Internet" (p. 1). Talk of educational reform has been an important topic for debate within the U.S. government. Republicans, Democrats, and Independents all have ideas of how to improve the U.S. educational system to keep pace with other countries. In 2001, Republican president George W. Bush implemented the No Child Left behind Act of 2001 (NCLB) to improve the U.S. education system at the primary and secondary school levels (U.S. Department of Education, 2011).

Every year, companies create new technologies that increase the efficiency of organizations and businesses. Implementing current mobile technology in high schools can enhance schools and school districts the same way it has enhanced businesses, government agencies, universities, and organizations (Santandreu & Shurden, 2004). In the field of engineering, some universities require students to purchase and use Windows-based tablet personal computers (PCs) to take notes in class, interact with the professor, and to complete homework (Thilmany, 2007).

The U.S. federal government requires public schools to integrate technology into the school curriculum because current research indicates that technology enhances the learning process (Davies, 2011). The International Society for Technology Education (ISTE) provides a list of National Educational Technology Standards (NETS) that are applied to learning, teaching, and leading in a technological society (ISTE, 2015). According to the ISTE (2015), simply being able to use technology is no longer sufficient. Today's students need to be able to use technology to analyze, learn, and explore. Digital age skills are vital for preparing students to work, live, and contribute to society. Nationwide, schools that are on the cutting edge of mobile technology have higher student engagement and are being modeled by other schools and school districts (Haag, 2010).

Problem Statement

Under the NCLB guidelines, schools and school districts in the U.S. have to meet Adequate Yearly Progress (AYP) standards (United States Department of Education, 2010). Many schools and school districts in the U.S. have not been able to meet the NCLB AYP standards each year (Hoff, 2009). A myriad of issues contributes to this lack of educational success in the U.S. For example, in the 21st century, new technologies have been developed which can enhance various facets of life and organizations. Unfortunately, the U.S. public education system has not taken full advantage of the technologies that are available to enhance student learning the way other developed and competing nations have done (Starkman, 2006).

The general problem is that public school districts in the United States are challenged to meet federal and state requirements, but they do not have one-to-one mobile technology available for every student to use in the classroom (Garland, 2014). The specific problem is that in 2009, Forney ISD (Texas) did not have a one-to-one mobile technology plan for 10th grade students and only 57% of those students passed all of the required Texas Assessment of Knowledge and Skills (TAKS) tests (Texas Education Agency, 2012). The required TAKS tests for 10th grade students consisted of English language arts, math, science, and social studies tests. Integrating one-to-one mobile technology may affect the number of 10th grade students who pass the standardized TAKS tests. The concept of one-to-one mobile technology requires that each student in the school have a personal laptop or tablet device with an Internet connection to use in every class throughout the school year. A literature gap exists on the effect that mobile devices have on student achievement, which is the reason for this study.

The U.S. is a first world nation with excellent infrastructure provided for most educational institutions. Some schools have taken advantage of these resources and have integrated technology at a high level (Davies, 2011). In comparison, there are developing and third world nations which are able to implement mobile educational technology at a high level even without the infrastructure and resources that the U.S. has (Agbatogun, 2011; Russell, 2012).

Prior research on the success and use of mobile technology in the education field focused on higher education with only limited research conducted at the primary and secondary education levels (Hlodan, 2010). With the consistent advancement of technology, the field of education at the primary and secondary school levels needs to be on the cutting edge of using and applying these technologies. Primary age students are currently known as digital natives because of their ability to use mobile devices at an early age (Bittman, Rutherford, Brown, & Unsworth, 2011). Soon these students will be in secondary schools and higher education, and their technological capacity will be primed to learn in a digital format (Bleich, 2009).

Lawmakers, school districts, and businesses have not been able to manufacture a solution for what needs to be accomplished to reform the public education system in the U.S. (News for Educational Workers, 2012). School district policy makers have a cumbersome job when it comes to making wholesale changes within the school district, and many times their task prevents them from the implementation of the needed technology for school districts (Gaytan & McEwen, 2010). Technology changes annually, so school districts need to have a mobile educational technology infrastructure and mediums that are able to adapt to these technological changes from year to year (Hartnett, 2012). The integration of one-to-one mobile technology in the classroom addresses many problems, which makes it an attractive option for educational stakeholders (Tech & Learning, 2005).

The research for this study was conducted through a quantitative, ex post facto design with an emphasis on the number of 10th grade students who passed the standardized English language arts, math, science, and social studies TAKS tests. Student public archival data from the 2009 and 2010 academic years was collected from Forney ISD in Forney, Texas. Forney ISD

(Texas) implemented one-to-one mobile technology for all high school students to use in all classes during the 2010 academic year.

Purpose Statement

High schools in Forney ISD (Texas) provided their students with Windows-based laptop computers to use in every class during the 2010 academic year. The purpose of this quantitative, ex post facto study was to investigate the impact that this one-to-one mobile technology had on the number of 10th grade students in Forney ISD (Texas) who passed the state required TAKS tests during the 2010 academic year. The study sought to find a statistically significant difference between the independent variable, the introduction of one-to-one mobile technology, and the dependent variables, the number of 10th grade students who passed each of the state required TAKS tests in English language arts, math, science, social studies, and all tests.

The researcher used a quantitative research method to examine the relationship among variables through statistical measures (Creswell, 2008). The variables were one-to-one mobile technology integration (i.e., independent variable) and the number of 10th grade students who passed the TAKS tests for each individual subject (i.e., dependent variables). The quantitative research method was most appropriate for this study because numerical public archival academic performance data from Forney ISD (Texas) was collected from the Texas Education Agency (TEA). The researcher analyzed numerical data statistically with the chi-square measure of association (LeBlanc, 2008). An ex post facto research design was used for the study; this design was chosen over quasi-experimental, experimental, action research, and survey designs because the data were collected from a previous occurrence.

The collected data may aid to the research of one-to-one mobile technology and how it can be integrated into Texas high schools and others across the U.S. This research may provide substantial and relevant findings to help fill the current literature gaps on one-to-one mobile technology in education. The research may be useful for public schools, private schools, charter schools, and homeschooled students in the U.S. and globally. Also, it may be useful to global education stakeholders and/or other countries that are interested in integrating one-to-one mobile technology at a one-to-one level.

Significance of the Study

The study may provide educational stakeholders with the information needed to raise student motivation, enhance technological literacy, and prepare students for global competiveness. The data gathered from this study will add to the information that supports the use of one-to-one mobile technology in schools and school districts to impact student performance. A byproduct of using mobile technology is the preservation of the global environment, because the schools that implement one-to-one mobile technology would use less paper for assignments and textbooks. The study supports research that encourages individuals to live in a "greener society" to preserve the environment. The data used in the study may provide insight into how using one-to-one mobile technology in a school or school district can be a cost-effective way for schools and school districts to operate. It is believed that schools will save money by switching from traditional paper textbooks to one-to-one mobile technologies with digital textbooks.

School districts and schools that want to improve their NCLB AYP status may benefit from this research. In the U.S. education system, there is an achievement gap between low income minority students and their peers. NCLB has instituted guidelines, according to which schools are rated on how all students perform; therefore, by implementing the findings from this research, it is possible to address some of these guidelines and fill some of the achievement gaps (Spellings, 2010).

Furthermore, this study may be significant in leadership practice because it examined how the stakeholders of a school district decided to be early adopters in implementing one-to-one mobile technology at the high school level. The study may be beneficial for schools and school districts in the U.S. that want to implement the same type of one-to-one mobile technology plan. This study may provide a resource and reference for educational reform and empower school districts, school leaders, and school communities to integrate one-to-one mobile technology throughout the schools to improve student motivation, engagement, and standardized test scores. The information provided by the data collected in this study will add to the study of mobile technology use in education and provide ideas for further study in the field of educational technology.

It is important to note that aspiring school leaders are often given projects to seek out ways in which technology can be implemented more effectively in the school or district where they work. Therefore, schools and school districts can benefit by drafting a technology plan that incorporates current educational technology needs and future educational technology needs (Martin, Wright, Arnold, Flanary, & Brown, 2005).

Nature of the Study

Over the years, technology has developed at a rapid pace. This growth has included different types of educational and mobile technologies that are available to teachers and students (Laliberte, 2009). Many schools have a computer lab, and many teachers are able to use a computer in their classroom. Unfortunately, many schools have not allowed students to use one-to-one computer technology throughout the school day in each class with the option of taking the technology home. However, incorporating one-to-one mobile technology on that basis may improve student participation and test grades.

This research examined what impact one-to-one mobile technology integration has had on 10th grade students in Forney ISD (Texas). The academic years examined were 2009, when Forney ISD (Texas) high school students did not have one-to-one mobile technology, and 2010, the first year Forney ISD (Texas) high school students received access to one-to-one mobile technology. The Forney ISD (Texas) high school student population consisted of 10th grade student standardized TAKS test data from the 2009 and 2010 academic years. Data was collected for the study by using a quantitative, ex post facto design. Ex post facto studies examine interventions that have happened in the past and how the variables interact (McMillan, 2011; Onyia, 2012).

Overview of the Research Method

The quantitative research method relied on data collected from school district public archival sources. More specifically, the high school student academic performance data was collected from the TEA Academic Excellence Indicator System (AEIS). Quantitative data was analyzed using a chi-square test to examine the relationship between the variables. Quantitative research tests objective theories by relating variables that can be measured with instruments that produce numerical data that can be statistically analyzed (Creswell, 2008). The independent variable was the use of one-to-one mobile technology by the 10th grade students (i.e., for 2009 – no technological implementation; for 2010 – technological implementation). The dependent variables were the number of 10th grade students who passed each standardized TAKS test. The control for the study was the number of 10th grade students who passed the standardized TAKS tests during the 2009 academic year without one-to-one mobile technology.

Overview of the Design Appropriateness

The quantitative research design used in the study was an ex post facto design that utilized public archival data. In reference to the ex post facto design, McMillan (2011) stated, “In ex post facto research the investigators decide whether one or more different preexisting conditions have caused subsequent differences when subjects who experienced one type of condition are compared to subjects who experienced a different condition" (p. 194). A qualitative study would not have been appropriate in this case because qualitative data takes the form of generalizations, perceptions, and/or the "why" of the study without concrete numerical data to support the study. Qualitative research examines a human or social problem that collects data to determine interpretations and themes (Creswell, 2008). Grounded theory, ethnographic, and case studies are research designs that are appropriate for qualitative research (Hutchinson, 2011).

The quantitative, ex post facto study was appropriate for this research since the researcher analyzed numerical public archival data to determine how the integration of one-to-one mobile technology affected the number of 10^{th} grade students who passed the TAKS tests. Furthermore, it was appropriate to use the quantitative, ex post facto design because the research examined variable connections and data on phenomena that happened in the past (McMillan, 2011).

Research Questions

The purpose of this quantitative, ex post facto study was to examine how the use of one-to-one mobile technology affected the number of 10^{th} grade students who passed the required TAKS tests in Forney ISD (Texas) during the 2010 academic year. The research examined 10^{th} grade student information obtained from public archival data. The research questions were:

1. Is there a statistically significant difference between 10^{th} grade students who passed the TAKS English Language Arts test during the 2010 academic year with access to one-to-one mobile technology and 10^{th} grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
2. Is there a statistically significant difference between 10^{th} grade students who passed the TAKS Math test during the 2010 academic year with access to one-to-one mobile

technology and 10^{th} grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

3. Is there a statistically significant difference between 10^{th} grade students who passed the TAKS Science test during the 2010 academic year with access to one-to-one mobile technology and 10^{th} grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
4. Is there a statistically significant difference between 10^{th} grade students who passed the TAKS Social Studies test during the 2010 academic year with access to one-to-one mobile technology and 10^{th} grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
5. Is there a statistically significant difference between 10^{th} grade students who passed all of their TAKS tests during the 2010 academic year with access to one-to-one mobile technology and 10^{th} grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

Hypotheses

The hypotheses included null and alternative hypotheses that determined how one-to-one mobile technology integration has affected the number of 10^{th} grade students who passed the TAKS tests during the 2010 academic year. The null (H_0) and alternative (H_A) hypotheses were:

H_{01}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A1}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

H_{02}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A2}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

H_{03}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A3}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

H_{04}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A4}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

H_{05}: There is no statistically significant difference in the number of 10^{th} grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

H_{A5}: There is a statistically significant difference in the number of 10^{th} grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

Addressing each aforementioned hypothesis and research question was important because it allowed the researcher to determine whether there were any associations between 10th grade students using one-to-one mobile technology and 10th grade students who passed their TAKS tests in Forney ISD (Texas) during the 2010 academic year.

Theoretical Framework

The two theoretical frameworks which grounded this study were the dual coding theory and the multiple intelligence theory (Franzoni, Assar, Dafude, & Rojas, 2009; Gardner, 2006). The dual coding theory supports the belief that learners use two pathways to receive and process information through auditory and visual means (Franzoni et al., 2009). Mobile technology can provide a way for students to receive information in a way that applies the dual coding learning theory (Frazoni et al., 2009). The multiple intelligence theory emphasizes the idea that eight different learning styles exist. These learning styles are: visual-spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, linguistic, naturalistic, and logical-mathematical (Gardner, 2006). The multiple intelligence learning theory can be applied to analyze the use of mobile technology in the classroom and how it can meet the needs of students with different learning styles (Students learn in many ways, 2002).

Dual Coding Theory

The dual coding theory was developed by psychology professor Allan Paivio in 1969. He claimed that individuals are able to receive and process information via seeing and listening (Paivio, 1991). The dual coding theory applies the belief that students are able to receive information in these two manners. According to Paivio (1991), the dual coding theory is a multiple coding theory, with a special emphasis on the fundamental importance of the verbal/nonverbal symbolic contrast. The sense of hearing and the sense of seeing are the two dominant ways in which individuals receive information. This concept is integral in the education field because teachers are presenting information that students are to receive through auditory or visual means (Efrani, 2012).

The dual coding theory emphasizes the idea that instructors should not focus on one type of teaching style or teaching method to pass information to students; instead, instructors should make sure both pathways of sending and receiving information are employed (Franzoni et al., 2009). The dual coding theory can be applied through the implementation of educational technologies and, more importantly, mobile educational technologies in the classroom. The dual coding theory states that information is processed through two channels that are independent of each other. One channel processes text and audio while the other channel processes objects, such as images, animations, and diagrams (Franzoni et al., 2009).

The current study may enhance existing literature regarding the dual coding theory because mobile technology can enhance and provide well-rounded learning. Mobile technology integration at a one-to-one level may also offer students a way to receive information through auditory and visual means. Implementing the dual coding theory in the classroom may be correlated to the number of students who pass standardized tests. In this study, the researcher examined how meeting the auditory and visual learning needs of each student influenced the number of students who pass standardized tests. The simultaneous presentation of verbal and visual information through the dual coding theory can allow students to make problem solving transfer which can lead to academic success (Mayer & Sims, 1994; Figure 1).

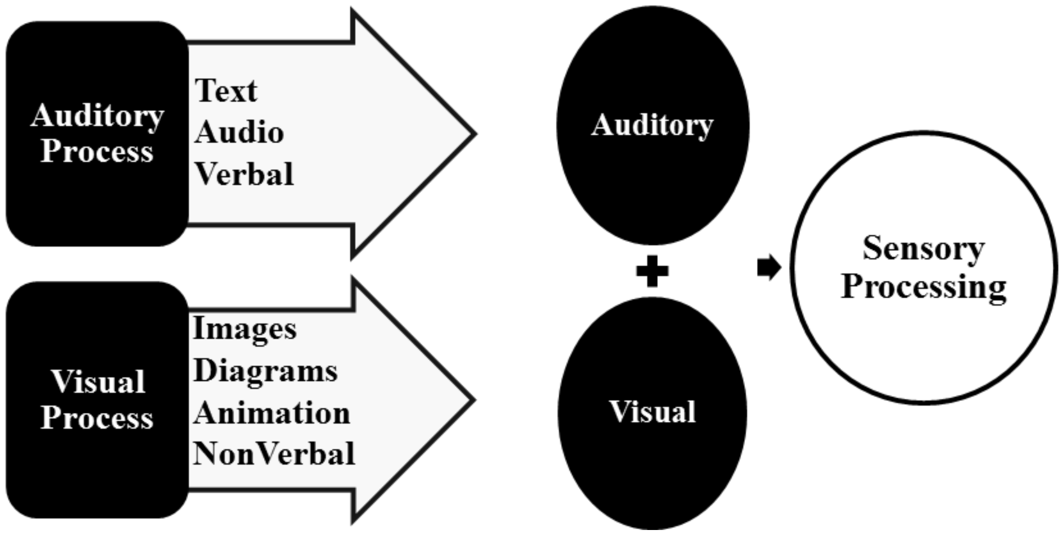

Figure 1. *Dual coding theory*

The dual coding theory has important implications for the education field and has been used to prove various learning theories and phenomena. The dual coding theory has been applied to spatial abilities and has been used in various cognitive studies that include problem solving, mnemonics, concepts, and language (Culatta, 2012).

Multiple Intelligence Theory

Psychology professor Howard Gardner developed the multiple intelligence theory in 1983; Gardner argued that each learner has his or her own learning style (Soleimani, Moinnzadeh, Kassaian, & Ketabi, 2012). Each person is born with characteristic differences, even if he or she has an identical twin. This fact makes the multiple intelligence theory a credible one that pertains to the way various individuals learn. The multiple intelligence theory contrasts with traditional teaching methods in the U.S. public school system. Many educational institutions do not understand the individual differences that exist among learners, which account for different learning styles (Franzoni et al., 2009).

The multiple intelligence theory is essential to the integration of one-to-one mobile technology. Gardner (1993) stated, “computers offer a useful way to think about the marshaling of intelligences to master educational goals, the potential utility of computers in the process of matching individuals to modes of instruction is substantial" (p. 391). Educational software and applications are available to school districts, schools, teachers, and students, and these technologies can enhance the learning capability of all students with various learning types. Worldwide, cultures and educational systems use the multiple intelligence theory to enhance problem solving and invent products that can be useful to that culture or society to enhance student learning capabilities (Tirri, 2009). The multiple intelligence theory consists of linguistic, logical/mathematical, spatial, musical, kinesthetic, intrapersonal, interpersonal, and naturalistic learning styles (Gardner, 1993). Gardner also considered expanding the multiple intelligence theory by adding the existentialistic learning style that entails a person's beliefs in life, death, love, and being (Gardner, 2006).

This study may enhance existent literature on multiple intelligence theory as one-to-one mobile technology can meet the various learning styles of each student (Figure 2). By meeting the various learning styles, mobile technology may have a positive effect on the number of students who pass standardized tests. Therefore, this research assessed whether any associations existed between the implementation of one-to-one mobile technology and the number of students who pass standardized tests.

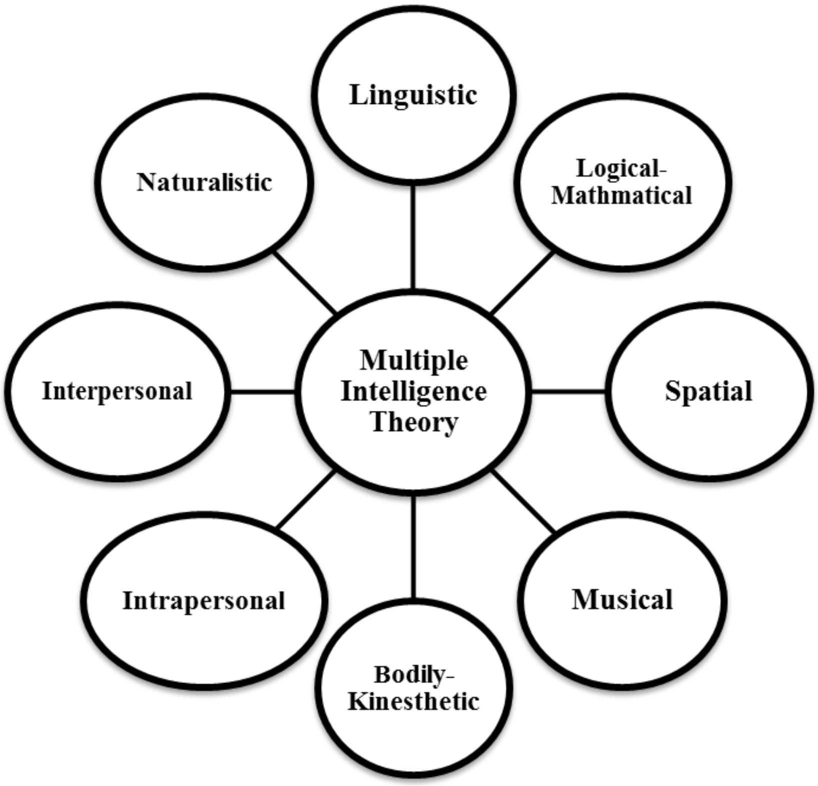

Figure 2. *Multiple intelligence theory*

Davis, Christodoulou, Seider, and Gardner (2008) defined the different types of intelligence of the multiple intelligence theory in the following manner:

- Linguistic - An ability to analyze information and create products involving oral and written language such as speeches, books, and memos.
- Logical-Mathematical - An ability to develop equations and proofs, make calculations, and solve abstract problems.
- Spatial - An ability to recognize and manipulate large-scale and fine-grained spatial images.
- Musical - An ability to produce, remember, and make meaning of different patterns of sound.

- Bodily-Kinesthetic - An ability to use one's own body to create products or solve problems.
- Intrapersonal - An ability to recognize and understand his or her own moods, desires, motivations, and intentions.
- Interpersonal - An ability to recognize and understand other people's moods, desires, motivations, and intentions.
- Naturalistic - An ability to identify and distinguish among different types of plants, animals, and weather formations that are found in the natural world (p. 6-7).

Definition of Terms

With research in the field of educational technology and, more specifically, mobile educational technology, it is important that the terminology used throughout the study be clear and understood. The definitions for commonly used terms within the quantitative study appear below:

A*mazon Kindle*: A tablet device developed by Amazon, Inc. that allows one to access e-books and other media. Many versions exist, and some versions contain the Android operating system. The Kindle application can also be downloaded to Smartphones, tablets, and computers (Kindle, 2015; Amazon.com, 2015).

Archival Data: Data that was collected as a primary or secondary source prior to the beginning of a research study and can be linked to individuals for research purposes (University of Virginia, 2015).

Android: Touchscreen Smartphone and tablet operating system created by Android, Inc. and owned by Google, Inc. (Android.com, 2015).

Barnes & Noble Nook: A tablet device developed by Barnes & Noble, Inc. that allows e-books and other media to be accessed. Many versions exist and some versions contain the Android operating system. The Nook app can also be used on iOS, Android, Windows 8, and the web (BarnesandNoble.com, 2015).

Blackberry: A smartphone and tablet operating system created by Research In Motion, Inc. in 1999 (Blackberry.com, 2015).

Blackberry Playbook: A Blackberry tablet based on the Blackberry operating system. (Blackberry Playbook, 2015).

Chromebook: A small personal computer with the Google Chrome based operating system. The device needs an Internet connection to be functional and uses the Google Documents, Sheets, Slides, Drive, Contacts, Calendar, Mail, Books, Music, Chrome Browser, and other Google based tools to make the device fully functional (Chrome.com, 2015).

ESL: Students who learn English as a second language and are classified as English as a Second Language learners (ESL, n.d.).

General Education: Student classification for students who do not fall under the special education guidelines (Texas Education Agency, 2013).

iOS: Operating system created by Apple, Inc., in 2007 that runs on the iPhone, iPod Touch, and iPad devices (Apple.com, 2015; iOS, 2015).

iPad: Tablet device created by Apple, Inc. in 2010 that uses the iOS operating system (iPad, 2015).

iPhone: Smartphone operating system created by Apple, Inc. in 2007 (iPhone, 2015).

iPod Touch: Mobile device similar to the iPhone created by Apple, Inc. in 2007, without the ability to make phone calls or access the Internet without WiFi (Apple.com, 2015).

Mobile Learning: Activities that allow an individual to consume information and be productive via a portable electronic device (Elmorshidy, 2012).

Mobile Technology: A computer based device that is portable and can be used to send and disseminate information (McCarty, 2012).

Mobile Educational Technology: Computing technology such as a laptop, tablet, Smartphone, or Internet device that is given to students for use in class and/or at home for learning activities (Hosny, 2013).

P-16: The U.S. preschool education grade level through the college level (Garza, 2011).

Palm OS: A handheld operating system developed by Palm, Inc. in 1996 and later used on Smartphone devices. The operating system was discontinued in 2007 and replaced by WebOS (Niccolai & Gohring, 2010).

PDA (Personal Digital Assistant): A small palm-sized electronic device used to store data and transfer data between individuals (PDA, 2015).

Primary Schools: U.S. schools from grade K-6th (Primary Schools, n.d.).

Secondary Schools: U.S. schools from grades 7th-12th (Secondary Schools, n.d.).

Social Networking: The ability of individuals to connect and communicate through the use of a website or web database that stores user information. This information can also be accessed through a mobile device (TechTerms, 2015).

Special Education: Student classification for students with various learning disabilities (Nichcy, 2010).

Symbian: A PDA and Smartphone operating system developed in 1998 by Psion and used on Nokia, Ericsson, Fujitsu, Sharp, Mitsubishi and Motorola manufactured devices (TechCrunch.com, 2013).

STAAR: State of Texas Assessments of Academic Readiness program that was developed in 2012 and requires Texas students from grades 3rd-11th to take exams in reading, writing, social studies, science, and math. In high school the tests are called EOC (End of Course) exams. The STAAR program replaced the TAKS program (Texas Education Agency, 2013).

Student Engagement: When students are attentive, participate in the learning process, and are motivated to learn (Reyes, Brackett, Rivers, White, & Salovey, 2012).

Student Motivation: A student's desire to participate and be successful in the learning process (Afifi, 2010).

Tablet or Tablet PC: A small computer device with a touch screen that allows for data to be transferred in various ways. Tablets have been created with various operating systems (TechTerms, 2015).

TAKS: The Texas Assessment of Knowledge and Skills, which was a series of tests administered to Texas students from grades 3rd-11th in the areas of math, science, social studies, English, and reading. The test was replaced by the STAAR/EOC test in 2012 (Texas Education Agency, 2011, 2013).

WebOS: A smartphone and tablet operating system created by Palm, Inc. to replace the original Palm OS (Niccolai & Gohring, 2010).

Windows 8: A personal computer and tablet operating system developed by Microsoft, Inc. in 2012 (Windows.Microsoft.com, 2013).

Windows Mobile: A smartphone operating system developed by Microsoft in 2000 and replaced by Windows Phone in 2010 (Windows Mobile, 2015).

Windows Phone: A smartphone operating system developed by Microsoft to replace Windows Mobile in 2010 (Windows Phone, 2015; Windowsphone.com, 2015).

Assumptions

There were multiple assumptions in this study. Firstly, it was assumed that the quantitative research method would answer the research questions. Secondly, it was assumed that the public archival data would be relevant to the topic and the research method, and that the non-parametric chi-square test would provide the data analysis needed to answer the research questions. Thirdly, it was assumed that there would be a positive relationship between the number of 10^{th} grade students who passed the standardized TAKS tests when a school district integrated one-to-one mobile technology in comparison to the 10^{th} grade students who did not have access to one-to-one mobile technology the year before. The fourth assumption was that the research study would enhance the field of educational technology and build on the developing field of mobile educational technology. Finally, it was assumed that the research would provide information to address the current literature gaps that pertain to the field of mobile educational technology.

Scope

The scope of the study was an exploration of how 10^{th} grade students in Forney ISD (Texas) were affected when the school district implemented one-to-one mobile technology for student use. Information gathered from this specific data set can set an example for all U.S. public schools and school districts with respect to implementing one-to-one mobile technology at the high school level.

Limitations

The researcher conducted the study in one school district in Forney, Texas, that has two high schools. Further, the study was limited to only 10^{th} grade high school students in the school district. The study did not include participants from other school districts or participants from an urban school district. Validity of the study was limited to the public archival data and the non-parametric chi-square test. Generalizability of the study was limited due to the population being derived from two schools in one school district that use one-to-one mobile technology in the classroom. The use of quantitative data and not combining it with qualitative data also could have affected the generalizability of the study.

The researcher decided not to use elementary school (K-6th grade), middle school (7th-8th), 9th, 11th, and 12th grade student data that could have been obtained from public archival data. Furthermore, the researcher did not use college level data in the study; thus, the applicability of the results to other grade levels remains uncertain. Thus, the selected population (10th grade students) limited the scope of the study. In addition, there were potential limitations to the quantitative research methodology and design**.**

Delimitations

Despite existing delimitations, the data compiled from the research can be valuable to teachers and administrators at the high school level who want to implement one-to-one mobile technology in the classroom. From the critical analysis and examination of high schools integrating one-to-one mobile technology to engage students, this research may lend itself to future research opportunities that involve mobile educational technology.

Summary

The current research examined whether the implementation of one-to-one mobile technology at the high school level affected the number of 10th grade students who passed their standardized tests in Forney ISD (Texas). The U.S. education system is falling behind other developed nations (Cooper, Hersh, & O'Leary, 2012). Implementing one-to-one mobile technology in high schools may close the educational gap that is developing between the U.S. and other nations. When teachers have these tools available, they are able to design curriculums that meet student needs and allow them to connect to the 21st century way of learning and interacting (Spellings, 2010). Educational technology is constantly changing and growing with the development of many new technologies. High schools should take advantage of those possibilities by implementing one-to-one mobile technology (Bull, 2010). On a global scale, mobile technology manufacturers are waiting for the educational stakeholders to make the decision to implement district and school-wide mobile technology at a one-to-one student level. Several businesses that manufacture tablets have been targeting the education field, with Apple, Inc. taking the most interest in producing education products (Manjula, 2012).

The relevant literature on mobile educational technology and the ability of mobile educational technology to engage students is reviewed in the following chapter. Chapter 2 explores and provides explanations as to why this study is needed. Perspectives include title searches, historical views, and literature gaps. Chapter 2 also includes the development of policies, U.S. government legislation, theoretical framework, research methodology, and research findings related to the study of mobile educational technology. The literature review provides information that encompasses the concept of mobile educational technology. Literature pertaining to the research methodology and theoretical framework is also included. In chapter 3, the researcher explains the research design and research methodology for this study. Chapter 4 displays the results of the study and how the data were analyzed. Chapter 5 concludes the research with recommendations for future studies.

Chapter 2

Literature Review

This literature review summarizes previous studies, which relate to how mobile technology influences the educational environment of students at various educational levels with the focus being on high schools. The researcher provides historical evidence concerning the growth of computer, educational, and mobile technology through the years (Donlevy, 2002). Limitations to using mobile technology in high schools are discussed as well as the school staff members' resistance to using mobile technology in high schools. The negative possibilities of one-to-one mobile technology integration are also addressed.

Title Searches, Articles, Research Documents, and Journals

In conducting the research, various resources and databases were used to gather the literature. The research included published books, published journal articles, textbooks, websites, magazines, blogs, theses, government documents, government laws, and dissertations relevant to the topic. Specifically, EBSCOhost, ProQuest, Gale Power Search, and Goggle Scholar databases were used to find peer-reviewed journals, books, articles, and magazines. The search terms used for those databases included the following: multiple intelligence, dual coding, ex post facto, chi-square, quantitative, computer technology, mobile technology, educational technology, mobile educational technology, one-to-one computing, one-to-one mobile technology, personal digital assistant (PDA), tablet, tablet PC, laptop, mobile educational technology, standardized tests, computer, Smartphone, Windows, Microsoft, Windows Mobile, Windows Phone, Palm OS, iPhone, iPad, Google, Android, Apple, iOS, WebOS, Android, educational tablet, educational laptop, Blackberry, student engagement, digital divide, No Child Left Behind, NCLB, US student achievement, student engagement, ESL technology, ELL students, students with disabilities laptop, special education technology, 504 classification, and technology resistance. The ProQuest database was used to focus on dissertations, academic journals, and article searches while Gale Power Search was use to focus on academic journals. EBSCOhost was used to help conduct the search in academic journals, news, and articles.

History of Computer Technology

Dating back to the 1950s, engineers and scientists worked on developing computers to provide a greater accessibility to more information (Hurlburt & Voas, 2011). Some have connected the computer to earlier forms of technology dating back to Roman numerals, abacus-counting systems, and calculators (Livingston, 1990). The first computers were very large machines that used the space of an entire room while today's computers are portable and highly networked (Hurlburt & Voas, 2011). Computers started out with punch cards and binary analog code that could take hours to process and load (Gladwell, 2008).

In the early stages of computer use, since they were so large, few individuals could have access to a computer at home. Only the government and organizations were able to access mainframe computers (Lu, Sebe, Hytnen, & Tian, 2011). As computer scientists and computer aficionados began to use the large computers more frequently, technology was developed that could make these large machines smaller and faster. Currently, individuals have access to Microsoft/Windows-based personal computers (PCs), Apple/Mac-based personal computers, Google Chrome-based personal computers, or Linux-based personal computers that can be used in the home or away from the home. This process of going from larger and slower to smaller and faster was gradual; decades passed until computers were packaged and sold in much smaller containers and at much more affordable prices (Hurlburt & Voas, 2011).

Microsoft Disk Operating System (MS-DOS) and Apple computers were the only computer technologies that many were familiar with during the 1980s (Crandall & Jackson, 2011; Fischer, 2011). These two computer technologies (i.e., Microsoft and Apple) continued to be competitive through the years and are currently the leading personal computer operating systems (OS) globally (Yoder, 2009).

The computer technology surge can be attributed to three men: Bill Joy, Bill Gates, and Steve Jobs (Gladwell, 2008). Bill Joy was the cornerstone to developing the Internet, Bill Gates started the company Microsoft and created the Windows OS, while Steve Jobs founded Apple Computers and is responsible for Macintosh computers, iOS devices (e.g., iPod, iPhone, and iPad), and iTunes (Gladwell, 2008). These technologies continue to build on one another and are available in many different shapes and sizes, depending on the needs of the consumer, school, business, organization, or government agency (Goldsborough, 2009).

As of 2015, computer technology consists of various types of technologies that can be classified into hardware and software. The hardware of a computer consists of the processor, motherboard, graphics cards, hard drive, and anything that is built into the body of the desktop or laptop. Hardware also consists of the monitor, keyboard, mouse, and any peripheral device that can be connected to a desktop or laptop computer. The software consists of any program that is loaded on the computer and can coincide with the OS. According to Castelluccio (2009), the history of computing has been a complex journey of development of software, processors, and memory devices that have been useful in all areas of human entertainment, work, and development.

A computer can have an OS without any extra software loaded onto the computer, and the OS by itself is also considered software. Software applications loaded onto the OS vary in functionality and size; new software is constantly being created and updated to enhance the user experience on the computer. The combination of computer technology and media devices has been a monumental development that allows individuals to use video conferencing software to communicate through a camera, microphone, and a computer screen. This development has allowed businesses and organizations to conduct meetings worldwide while also allowing teachers, students, and schools to converse and meet with other classes in other countries, states, or cities. In addition, many users find the use of video conferencing for personal time an engaging experience when wanting to converse with family and friends (Matei, Faiola, Wheatley, & Altom, 2010).

The various types of computer technology allow developers to grow the technologies to meet more consumer, educational, and organizational demands. These technological advancements have been able to influence a plethora of products that are used in everyday life. Automobiles, education, sports, criminal justice, aircraft, video games, home appliances, home entertainment, medical fields, architecture, and many other entities or products have been enhanced by the development and growth of computer technology (Sebastian, 2012). The education field has been one of the most consistent benefactors of the growth of computer technology (Kirkscey, 2012). The developers and researchers who produce and invent computer technologies often come from well-educated backgrounds and are always thinking and working on the cutting edge to produce the next technology that will change how we interact (Computer Associates, 2000).

One of the most influential inventions for computer technology was the development of the Internet. Once the Internet became accessible for personal use, its possibilities became nearly infinite. The benefit of the Internet is that it can store an infinite amount of information, and one does not have to physically carry that information. This development has allowed computer technology to grow exponentially when compared to the earlier days when computers did not provide access to the Internet. The development of the Internet led to the invention and use of email. The use of email has allowed individuals to communicate in ways that were previously only available through the act of physically writing a letter or talking on the phone. The use of email has allowed individuals to share information to one person or hundreds of people with the click of a button.

Document creation and sharing have been another monumental invention for computer technology. The ability to create and edit a document without producing a physical copy has enhanced society (Heim, 1999). Microsoft Word, Apple Pages, Corel Word Perfect, and Google Docs are document creation computer applications that allow consumers to type up a document, save it, and send it electronically. The technology of the typewriter was great for the time when it was invented, but computer software that has been developed through the years has made the use of the typewriter obsolete and has decreased the amount of time it takes to create and edit documents.

An aspect of document creation that has been enhanced by computer technology is the development of the Adobe Acrobat PDF software. This software allows individuals to view any type of document in a digital format on a computer or mobile device. For example, books, papers, magazines, files, and applications can be scanned and converted into a PDF format to be viewed in digital form and transmitted electronically. Smartphone and tablet application developers have created applications that allows an individual to take a picture of a document and convert the document into a PDF file on the Smartphone or tablet (Smith, 2011). The use of electronic books (eBooks) is growing, and eBooks allow individuals to store books digitally on their computer, Smartphone, tablet, or media device.

Cloud computing is a technology that has developed over the last several years. Cloud computing allows individuals to save whatever they want on the Internet. For example, an individual can back up all the information on his or her computer on the Internet through a service called Carbonite for a monthly fee (Kennedy, 2012). Individuals can also use a technology called Dropbox that allows them to save Microsoft Office documents, Adobe PDF files, pictures, music, movies, and other files on the Internet in his or her Dropbox account (Gavigan, 2012).

Dropbox allows users to have 2GB of storage for free, and they can pay a monthly fee to increase the storage space. Also, Dropbox enhances the users' experience by creating the ability to sync information across multiple computers and mobile devices. An individual can create a file on his or her desktop computer at home and save the file into the Dropbox folder that immediately syncs with the online Dropbox account. When that individual leaves home and wants to access the file, the individual can use another computer or mobile device as long as it has Internet access. With the development of Smartphone technology, the Dropbox account user can also access the Dropbox account from various Personal Digital Assistants (PDA), Smartphones, or tablets. As of 2015, other companies have created online storage options to rival Dropbox. Google and Microsoft have created a free and paid version of Google Drive and Microsoft One Drive that allow users to store documents and data online and across multiple devices.

The growth of computer technology is beneficial for the environment as well. The ability to read and transfer information without printing it on paper allows users to operate in an environmentally efficient capacity. With the use of video conferencing, users do not have to travel by plane, train, or automobile to meet and converse. The various mobile technology mediums may save paper through the use of email, mobile newsletters, eBooks, etc. In addition, the use of video conferencing for mobile learning may lower automobile emissions and vehicle pollution. When researching the impact of one-to-one mobile technology on student standardized testing, it is important that the history of computer technology be presented and understood, so that past, present and future ideas and concepts can be analyzed.

History of Educational Technology

As technology has improved and developed through the years, the education field has been able to benefit from these advancements. From a hardware perspective, the overhead projector was used heavily by the U.S. military in the 1940s during WWII to train soldiers and disseminate information (Zafra, 2009). After the overhead projector proved to be successful in the military, they started mass producing them for the U.S. education system. The overhead projector allowed a teacher to use a transparency sheet and write on the illuminated stand that would project what the teacher was writing on to a wall, board, or screen. Some lesson plans were produced in transparency form, so the teacher could display the lesson on the transparency and not have to write as much.

The overhead projector was very successful in the education field from 1950 to the early 2000s, but they have been replaced by various enhanced technologies that can outperform overhead projectors (Betrus, 2012). Some of these technologies involve computers and a Liquid Crystal Display (LCD) projector and screen, a document camera used with an LCD projector and screen, and the interactive whiteboard (Betrus, 2012).

Most recently, a computer used with an LCD projector and screen has become the expected and most commonly used classroom technology (Oyedele, Rwambiwa, & Mamvuto, 2013). This allows the teacher to display whatever appears on a computer screen directly onto a central pull down screen or a white board for the entire class to see. This technology set up allows the teacher to show Microsoft Word documents, Microsoft Excel spreadsheets, Microsoft PowerPoint presentations, DVDs, and the full display of Internet websites (Swift, 2012). Furthermore, the document camera is a technology that was developed in the late 1990s and can allow the educator or presenter to zoom into a document that displays through an LCD projector (Prunuske, Batzli, Howell, & Miller, 2012).

The document camera can be used in conjunction with the computer, LCD projector, and pull down screen in the classroom. Instead of using a transparency along with the overhead projector, with a document camera, a teacher can write on a piece of paper that sits in the visual area of the camera; whatever the teacher writes down is shown on the screen for the class to see (Prunuske et al., 2012).

The interactive whiteboard technology was developed in the early 2000s and gives the teacher and students many options in the classroom. One example of this technology was developed by Smart Technologies in 1991. The SmartBoard (i.e., interactive whiteboard) allows the teacher to write on the screen with a virtual marker and choose different colors as if the teacher were writing on a traditional white board with a dry erase marker (Wolfe, 2010). The teacher can save those notes as a file and flip to a blank page. The teacher can also use an onscreen keyboard to type notes, surf the Internet, or add objects to a document that could be used in a class. The teacher also has the option of using the computer keyboard to type information for the students to see. The interactive whiteboard technology allows for the teacher to save all that he or she has done that day into separate slides that can be saved and used again. The functions of the interactive whiteboard are limitless, and many companies are developing this product (Mercer, 2010).

From a software perspective, computer OS development has determined the use and growth of technology in the classroom. With the advancement of the computer OS, software developers have decided to create technologies that can be used by teachers and students. Some of the earliest educational software technologies were PLATO (1960), BASIC (1963), and LOGO (1967). Currently, universities, colleges, school districts, and schools worldwide use thousands of educational software programs (Kirkscey, 2012). The Garland Independent School District (GISD) in Garland, Texas, gives teachers and administrators access to about 20 different educational programs, software, and databases that can be accessed from GISD computers or personal computers (GISD, 2015). Some applications can be accessed from any computer with Internet access, and teachers have the ability to access their GISD account information and database from a remote location by using special remote desktop software (GISD, 2015).

During the early 21st century, educational technology added a new aspect to learning that allowed students and teachers to be in different locations during instruction (Guha & Maji, 2008). This type of learning became known as online learning, distance education, virtual, or satellite learning, depending on the school, program, or organization (McFarlane, 2011). This type of educational technology has continued to grow as technological resources and mediums have kept expanding.

Much confusion exists with respect to the concept of distance learning. Computers are the tools that promote and facilitate learning through distance, online, electronic, virtual, and mobile (McFarlane, 2011). This educational technology medium can be used through asynchronous or synchronous methods which means that students and faculty can be in a virtual class setting at the same time (i.e., synchronous) or at different times throughout the day, week, month, or semester (i.e., asynchronous) (Guha & Maji, 2008).

The history of educational technology is important to the research of one-to-one mobile technology and the effect of technology on student standardized testing. Scholars need to understand which technologies have worked in the classroom and how the technologies have evolved through the years. Allowing students to use one-to-one mobile technology can add to the history and growth of educational technology and allow new ideas and trends to emerge.

History of Mobile Technology

Mobile technology is a broad term that can be used to cover various technological modalities (Fiaidhi, Chou, & Williams, 2010). The history of mobile technology began with the development of devices that could be transported from one place to another by an individual. The supercomputers of the 1950s would not have been considered mobile technology, but the first laptop computer can be defined as mobile technology. Mobile technology is not just for computer use. Portable media devices, such as cameras, mp3 players, and CD players can be classified as mobile technologies; the same is true for devices that combine computer functions and media capabilities, such as Smartphones and tablet computers. The United States military was one of the first adopters of various types of mobile technologies during wartime (Kim, 2006). These technologies had to be tested during times of peace, but they were used in times of war, so that the U.S. and its allies could have the best chance to win their respective wars. One technology that stood out during the Vietnam War was the use of mobile phone technology for soldiers to communicate with one another from different locations (Kim, 2006).

Mobile technology for the consumer began with media devices and the personal computer in the early 1980s. These products became smaller and faster as time went on and as technology changed. The invention of the laptop allowed users to use the functions of the desktop PC in any location they liked. The laptop brought a flexibility and functionality that consumers and users were not used to. As laptops became more commonplace, technology developers in the early 1990s decided to invent a device that could give a user some of the technologies of a laptop and fit those technologies in the palm of the person's hand.

IBM developed the concept of the PDA phone/Smartphone in 1992. The first Smartphone device developed by IBM allowed the user to make phone calls, send emails and faxes, use a calendar, store contacts, use a world clock; among many other things, it was a touch screen device with a stylus. This device, called the Simon, was released to the public in 1993, but it did not sell well (Silverman, 1994). In 1996, Nokia released the Nokia Communicator line, which was a palmtop computer. Nokia collaborated with HP to make Nokia's first Smartphone, the

Nokia 9110 running DOS software. Unfortunately, IBM and Nokia were not able to capitalize on these technologies, but they initiated the idea and concept. The Nokia 9300 Smartphone's description (2005) stated, "Nokia's Communicator set the benchmark for Smartphones before the niche even had a name" (p. 1).

Palm, Inc. developed the Palm Pilot (Palm OS) in the early 1990s; Palm Pilot was one of the first handheld devices known as the Personal Digital Assistant (PDA) (Niccolai & Gohring, 2010). The development of the PDA allowed individuals to store data on the go and back up that data onto a desktop or laptop computer to be saved. These devices had the ability to store contact information, create calendar events, save to do lists, save email, play games, use reference software, store Bibles, and use various apps for things such as business, medicine, education, and travel. The PDA became a technological enhancement for those early adopters in the 1990s. One of the early Palm OS developers left Palm, Inc. and started his own company and called it Handspring, Inc. (Niccolai & Gohring, 2010). Handspring created Palm OS devices in various formats, and other companies, which saw the usefulness of the Palm OS, started developing Palm OS devices with their own company branding and hardware.

The development of mobile Internet allowed some Palm OS devices to connect to the Internet and transfer email and data. The Palm VII was one of the first devices in 1999 with this capability (Niccolai & Gohring, 2010). While the Palm OS became more popular, Microsoft decided to create a PDA as well. These Pocket PC devices were created in the late 1990s by various manufactures; they were running on Windows Embedded Compact (CE) 3.0 software (Microsoft, 2012).

In 2000, Sony Ericsson created the first Symbian OS Smartphone called the R380. In 2001, one of the first Palm OS phones developed was the Kyocera 6035 that gave the user all the functionality of the Palm OS and the ability to send text messages, send email, surf the web, and make phone calls (Freeman, 2010). This mobile device was the breakthrough device that showed the world what a Smartphone could do (Freeman, 2010). Charles Quinn, a pioneer in the adoption and expectations of mobile technology, envisioned the average mobile device as being a handheld with an array of applications, color screen, stylus, keyboard, Internet connectivity, and camera (Quinn, 2000). The description of Charles Quinn's concept device resembles those of many of the mobile devices/Smartphones created in the mid to late 2000s.

In 2001, Microsoft developed their first Smartphone running the Pocket PC software (McCarthy, 2001). In 2001, Nokia released its first Symbian OS phone and produced various lines of Symbian OS Smartphones that have been very popular worldwide. In 2002, Handspring developed the Treo series Palm OS phones with full hardware keyboards, applications, and Internet access. In 2002, the Blackberry was created by RIM and became the first Smartphone optimized for wireless email. These mobile OS Smartphone competitors; Palm, Windows, Symbian, and Blackberry, battled for market share and viability in the first half of the 2000s and lost ground to Apple's iOS and Google's Android mobile OS in the late 2000s (Gupta & Prinzinger, 2013).

The second half of the 2000s produced two other Smartphone platforms that have changed the Smartphone and mobile computing landscape for the foreseeable future. In 2007, Steve Jobs, the CEO of Apple Computing released the iPhone which happened to capitalize on the success and failures of the Smartphone manufactures of the past (Gupta & Prinzinger, 2013). The iPhone was more than a PDA; it was a PDA and a great media device that also took pictures. This invention caused other Smartphone manufactures to re-evaluate their OS to compete with the iPhone.

In 2005, Google bought the rights to the Android Smartphone software and began creating the first Google phone (Courrier, 2010). Google decided to collaborate with hardware phone manufactures to create Google Android OS phones rather than build the hardware and maintain the software like RIM, Palm, and Apple. The first Google Android phone became available in 2008, and, along with the iPhone, it has dominated the market share of Smartphones in the U.S. (Keating, 2011).

Palm and Windows completely changed their mobile OS interface to compete with the iPhone and Android software. The Palm OS interface became WebOS in 2008 and then stopped being supported in 2011 because it lost its market share to the Apple iPhone and Google Android platforms. Windows Mobile became Windows Phone and also lost market share to the Apple iPhone and Google Android platforms. Blackberry has slowly lost its market share as more businesses have adopted iPhone and Android devices (Castelluccio, 2009). This Smartphone boom has opened up an avenue for tablet computers that operate Smartphone software.

The tablet PC was a device created in the early 2000s that gave the user a laptop/desktop experience in a 10-inch form, with a touch screen, and a stylus (Shostak, 2001). This concept was not widely adopted, but Apple created the iPad, which is a 10-inch iPhone without the phone options (Smart, 2010). Google has collaborated with hardware manufactures to create Android OS tablets with various screen sizes (Smart, 2010). Blackberry has produced a 7-inch tablet called the "Playbook" (Blackberry Playbook, 2013). Palm, Inc., which was bought out by Hewlett-Packard (HP), has created a 10-inch Web OS tablet called the HP Touchpad (Madway, 2011). Microsoft created a tablet and personal computer OS called Windows 8 that offers the consumer the same interface on a Windows 8 OS laptop, desktop, or tablet (Windows.Microsoft.com, 2013). As of 2015, Windows 8 has been upgraded to Windows 10. The growth of the tablet device has given consumers and organizations another option when looking at technology. Matei et al. (2010) stated:

> In the future, designers of multi-functional devices should investigate easy-to-use physical affordances, while optimizing their size, location, and interrelationship with groups of functions. Another key issue to be explored is the users' ability to configure new or revised mental models that allow them to switch between various purposes and functions of multiple physical affordances. We recommend that a strong balance be struck between intelligent interfaces and hardwired controls to assist users in the adoption of multifunctional devices. (p. 16)

The growth of mobile technology is changing the need and use of libraries globally. A new term has been created for the use of a digital based library. Prince (2009) observed, "M-libraries, a shortening of the phrase 'mobile libraries' are libraries that accommodate the needs of clients using mobile platforms, such as mobile phones, personal digital assistants (PDAs), tablet PCs, and any other portable communication technology" (p. 1).

The history of mobile technology is relevant to the research because if a school or school district decides to implement one-to-one mobile technology for students to enhance standardized testing, the stakeholders need to know the history and patterns of mobile technology development, so they can analyze and foresee the potential setbacks of investing in a mobile technology medium that may become obsolete in a few years.

Schools Using One-to-One Mobile Technology

With the development of mobile technology in the last decade, more schools and school districts are implementing different types of mobile technology at different levels. At the beginning of the 21st century, Charles Quinn described mobile learning as learning through the use of wireless handheld devices (Zelkowski, 2011). Howard and Rennie (2013) stated, "The goal of most 1:1 device programs are to provide young people and teachers with access to up-to-date learning tools that will support the development of critical thinking and information skills" (p. 359).

In 2010, a Minnesota High School gave all students and teachers iPads to use in the classroom and at home (Minnesota students, teachers find iPad becoming go-to tool, 2010). New Tech High School in Coppell, Texas, gives each student a laptop to use on a daily basis. The campus supplies Apple or PC laptops to every teacher and student to use at their convenience with wireless Internet connections (New Tech High School, 2011). The Denver School of Science and Technology in Denver, Colorado gives each student a laptop to use on a daily basis. Other schools have decided to keep the laptops in a lab/classroom and allow the students to use the laptops while in that particular lab/classroom.

On a smaller scale, some schools have given their students iPod touch devices to use in the classroom. Some school districts and universities have provided school administrators with various types of mobile technologies ranging from Blackberries, iPhones, iPod touch devices, and iPads to use on a day-to-day basis to enhance their daily job activities. According to Hlodan (2010), Abilene Christian University, Duke University, and the University of Texas-San Antonio gave or subsidized iPod Touch devices to students and staff to increase academic engagement.

The Performing Arts Charter School in Philadelphia, PA, gave their 250 middle school students iPad devices to use in school and at home at the beginning of the 2013 academic year. These devices are used by 6^{th}, 7^{th}, and 8^{th} graders, and their parents have to sign a voucher in order for the students to have access to the devices (Takiff, 2012). The iPads allow students to access traditional, reading, math, social studies, and scientific curricula as well as music, dance, and art curricula (Takiff, 2012). The San Diego, CA Unified School District, has a one-to-one iPad program for their students. The initiative cost the school district 15 million dollars and the devices are used by students at the primary and secondary grade levels. This has been one of the largest academic iPad deployments in the U.S. (San Diego District Is Buying 25,700 iPad2s, 2012).

Grandview High School in Hillsboro, Missouri, decided to start the 2012 academic year by giving students Android tablets to use instead of traditional textbooks. The students were given the Coby Kyros Internet touch screen Android OS tablets that they could keep throughout high school (Thorsen, 2011). Students were allowed to take the tablets home and use them to download textbooks, take notes, take tests, and conduct research (Thorsen, 2011). The students were connected to the Moodle educational website that allowed them to interact with the teacher outside of the classroom to complete assignments (Thorsen, 2011). The tablets cost the school $64,000 for 400 tablets, but the school would have had to pay $100,000 for textbooks over a four-year period (Thorsen, 2011).

Grandview High School was not the only school in Missouri implementing one-to-one mobile technology in the classroom. The Climax Springs School District in Missouri gave all of their high school students Lenovo netbooks during the 2012 school year to supplement the textbooks (Thorsen, 2011). In 2012, the Wentzville school district in Missouri used an anonymous $500,000 donation to provide Android tablets for students and teachers, so they could access the school-based digital eBook system and the county library system. The teachers were also able to use the tablets in conjunction with the classroom SmartBoards (Education Digest, 2012).

In other countries, the concept of using mobile technology in the classroom is becoming more of a reality as well. The government in Thailand initiated a $76 million educational tablet project that supplied one million Android OS devices to schools throughout the country (Russell, 2012). In parts of Africa, the idea of using mobile technology to enhance learning has grown. Educational and nonprofit organizations have conducted studies that indicate the importance of expanding the concept of mobile technology in the classrooms to make it a reality. UNESCO (2012) stated:

> The majority of the region's mobile learning projects focus on formal education in primary and secondary schools, with a high concentration of projects in South Africa, Kenya and Uganda. Most of these projects use mobile phones to support the improved delivery of teaching and learning within classrooms, or to promote improved learner performance in ways that consider both formal classroom settings and informal learning environments. (p. 14)

Google, Inc. outfitted three U.S. school districts with 27,000 Chromebooks in 2012 (Shankland, 2012). The Chromebook is a netbook/laptop-like device that allows a user to use a keyboard, mouse, and web browser to access information. The OS on a Chromebook does not use the Windows OS or Mac OS; it was separately designed by Google, Inc. and requires the user to have access to the Internet in order for the Chromebook to work. Chromebooks present fewer security issues because the OS is based on web software which costs less than traditional Windows and Mac computers (Claburn, 2011). This access allows the user to be connected to his or her Google Documents/Drive, Google Calendar, Google Chrome Browser, Google Contacts, and Google Email while using the device (Claburn, 2011). Google does not make the hardware of the Chromebook. Samsung has been the largest manufacture of the Chromebooks as Google outsources their OS to hardware manufacturers the same way they do with the Android phone and tablet OS (Claburn, 2011).

The states that were involved in the 2012 Chromebook initiative were Iowa, Illinois, and South Carolina. A total of 41 states within the U.S. have set up Chromebook use in at least one classroom (Shankland, 2012). The Chromebook is a device that has not been adopted by many in the consumer or organizational market and has a look that may not be familiar to individuals.

The Plano ISD Academy High School (2015) stated, "With open access to resources, learners become self-directed and responsible seeking knowledge on their own… Learners will receive a Google Chromebook provided by the school" (p. 1).

For students who are making the transition from high school education to college education, Seton Hall University, located in Orange, New Jersey, gave out Windows Phone Smartphones in 2012 (Pine, 2012). The Smartphone was the Nokia Lumia 900 and had access to the AT&T mobile and data network (Pine, 2012). Seton Hall decided to use the Windows Phone OS because it provided a seamless transition and access to the Windows and Microsoft Office university resources. Each Nokia Lumia 900 device had a freshman experience app and a Nokia Data Gathering tool that tracked student and staff usage for research purposes (Pine, 2012).

Samsung Electronics America, Inc. is one of the leaders when it comes to the production and manufacturing of laptops, Smartphones, and tablet devices (PR, 2012). With the growing demand and use of tablet computing for personal, educational, and organizational use, Samsung has decided to make different variants of their tablet to meet the needs of the various market segments. In 2012, Samsung tailored one of their Google Android OS 7 inch tablets, so it could meet the needs of students at all levels. PR (2012) stated, "Students will realize substantial benefits from the bundle, which will add a physical keyboard to the device as well as a USB adapter that supports plugging in USB thumb drives as well as peripherals such as USB mice" (p. 1). The tablet was pre-loaded with Microsoft Office software, so that students could create presentations and work on documents that were created on a Windows OS or Mac OS computer. Samsung believes that students should be able to access the PC-like set up wherever they may be without having to pay the price of a PC (PR, 2012).

Some in the educational technology community have coined the term "mobile learning" when speaking about mobile educational technology. The concept of mobile learning does not imply that it would replace traditional learning, but that it would enhance the traditional learning experience (Parker, 2011). Due to the increase in schools using mobile technology in the classroom, technology companies have been able to develop software and infrastructure that allow schools to implement the needed protections because they allow students to use such high-powered devices. Unwired developed a way to track all activity that takes place on a mobile computing device and block apps and websites that are not approved (Takiff, 2012).

In India, the government has backed an initiative to provide government funds for one-to-one mobile technology initiatives. Manjula (2012) stated, “The government, on top of this, is proposing a 50% subsidy on the tablet for educational institutions. There is also an ambitious plan that the tablet be offered to above 220 million students around the country” (p. 1). A middle school in the United States implemented a one-to-one mobile technology program, and Maninger and Holden (2009) found in their research that, “The implications for this campus can best be described as ‘the sky's the limit.’ Data from this study indicated that the campus developed a more communicative, collaborative and supportive school environment, as a result of the one-to-one initiative” (p. 18).

One-to-one mobile technology may also be beneficial for students who are under the homeschool curriculum. Homeschooled students have an independence and autonomy that their public and private school counterparts do not have. With the technological advancements, homeschooled students can receive their curriculum in a mobile format that can be accessed from a computer, tablet, or Smartphone. The A Beka Academy is a homeschool organization that allows students to video stream class content. When students are enrolled in the A Beka Academy, they are issued a user name and log-in so they can view archived lessons (A Beka Academy, 2015).

The use of one-to-one mobile technology in classrooms has been researched on a small scale. By looking at a data set, Ellington, Wilson, and Nugent (2011) found, “Survey responses support these anecdotal findings. Of the 32 respondents, 26 (81%) agreed or strongly agreed that they felt more comfortable presenting their problem strategies and solutions on the tablet PC than on the whiteboard in front of the class” (p. 99).

The literature pertaining to schools using one-to-one mobile technology is relevant to the present research because if a school or school district decides to implement one-to-one mobile technology for students to enhance standardized testing, the stakeholders need to know what other schools and school districts have done nationally and worldwide to enhance student outcomes with one-to-one mobile technology.

Students with Disabilities and Mobile Technology

In the United States, there are students who fall under different guidelines than the general education students. The Individuals with Disabilities Education Act of 1975 (IDEA) added language and requirements that school districts and schools must follow to meet the needs of all students regardless of their physical, mental, or social hindrance in the least restrictive environment. Students who fall into this category are classified as special education students. According to Nichcy (2010), schools are required to meet the needs and the academic standards of the 6 million students who are covered under the IDEA guidelines.

Another important piece of legislation that applies to students with disabilities classifies students as 504. This legislation falls under the Rehabilitation Act of 1973 Section 504. According to the U.S. Department of Labor (2012):

> No otherwise qualified individual with a disability in the United States, as defined in section 705 (20) of this title, shall, solely by reason of his or her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination

> under any program or activity receiving Federal financial assistance or under any program or activity conducted by any Executive agency or by the United States Postal Service. (p. 1)

These two laws have similarities and differences with respect to the rights students have while they are in the classroom. Section 504 is a federal law that differs from IDEA because each student under the 504 classification is not required to have an individualized educational program (Conners, 2012).

The development of educational and computer technology through the years has allowed schools and school districts to meet these special education and 504 needs in a more efficient manner. The usage of one-to-one mobile technology has been able to help meet the needs of students who qualify under the special education or 504 classifications. Raymond (2012) concluded that "Children with communication disorders such as autism are now learning how to share their wants and needs through augmentative and alternative communication (AAC) tablet apps" (p. 1). There has not been full nationwide implementation of one-to-one mobile technologies to meet the needs of special education and 504 students. However, it is clear that mobile technology allows students to communicate in ways they would not have been able to communicate in the past while saving schools and school districts money on expensive devices that can be duplicated by mobile applications (Raymond, 2012).

A 2009 study was conducted at a school that integrated one-to-one mobile technology, and the study yielded positive results on special education students and the use of such technology. Maninger and Holden (2009) found:

> The teachers also mentioned the tablets' benefits to students with special needs, specifically dysgraphia. Their observations are significant in that the students who needed

keyboards to better attend to their learning had the technology without feeling out of place, because everyone else had a tablet as well. (p. 19)

The literature pertaining to students with disabilities and mobile technology is relevant to the present research due to the number of students with disabilities enrolled in public schools. If a school district adopts a one-to-one mobile technology plan, administration will have to consider the needs of students with disabilities and create lesson plans to incorporate those students into the one-to-one mobile technology curriculum.

ESL Students and Mobile Technology

The demographic makeup of the U.S. encompasses multiple cultures and individuals from other counties. This diversity is evident in the many languages that are spoken in the country. Families that have migrated to the U.S. often speak English as their second language. Many schools and school districts around the country enroll students and classify them as English as a Second Language (ESL) students; however, these students are still required to progress through the same curriculum as the native English speaking students.

Descriptive statistical analysis has proved that when students are classified as ESL and have access to Online Learning Discussions (OLD) via Facebook, they are able to communicate in English in a more efficient manner (Omar, Mohamed, & Yunus, 2012). ESL students can benefit from the use of one-to-one mobile technology because of the common ground that technology creates when individuals speak a different language. A school in Nigeria is using one-to-one mobile technology to help students understand the English language with Personal Response Systems (PRS). Agbatogun (2011) stated:

> While there is an abundance of anecdotal information that advocates the use of clickers to improve student achievement in school subjects, the outcomes of this study claim

> that ESL teachers irrespective of some teacher's factors are positively disposed to the integration of PRS into their lessons. (p. 16)

The literature pertaining to ESL students utilizing mobile technology is relevant to the present research due to the number of ESL students who are enrolled in public schools. If a school district adopts a one-to-one mobile technology plan, administration will have to take into account the needs of ESL students and create special lesson plans to integrate those students into the one-to-one mobile technology curriculum.

Social Media and Mobile Technology

The development of social media has created communication pathways and variables that did not exist prior to its creation. Many social media companies, such as MySpace, Facebook, Twitter, Google+, Instagram, and Pintrist, have been able to net millions and/or billions of dollars due to consumer and advertiser demand. Some school districts and schools have experimented with the use of social media in the classroom or for the dissemination of school district or school information. Twitter can be a valuable tool for students and teachers because it permits online collaboration and asynchronous learning (Weaver, 2010).

Social media websites like Edmodo are geared towards teacher and student interaction; they allow teachers to post assignments and discussions, so students can interact inside or outside of the classroom. Students and teachers can interact through Edmodo’s use of file sharing, messages, and forums that can be accessed through the Internet and mobile applications (Lamb & Johnson, 2012). One-to-one mobile technology can enhance the use of educational social media by giving students the ability to access educational social media at all times. The improvement of student interaction with educational social media may have an impact on student standardized test scores because students will have the opportunity to be more involved with the curriculum through social media.

Resistance to One-to-One Mobile Technology in Schools

Technology is an interesting topic, because depending on what is being implemented, some within the educational system will be averse to using the new technology while others will embrace the new technology. Kamen (2009) stated, “Technology is moving a lot faster than people's willingness to change…every field of technology is moving faster. At the same time, our society is becoming more and more conservative, risk averse and fearful of technology” (p. 1).

Some educational stakeholders claim that one-to-one mobile technology does not have a positive impact on student achievement (Sauers & Mcleod, 2012). Those who more easily embrace new technologies in the school or school district tend to belong to the younger generation. Hlodan (2010) stated:

> Some skeptics refer to m-learning as "e-learning lite" because they think it delivers only snippets of coursework. But its potential is growing. Rural students in Arkansas riding three hours to school in the Sheridan school district are given iPods or laptops to study science on school buses that are equipped for wireless Internet access. (p. 1)

While they have many advantages, new technologies can bring about problems and roadblocks that may not have been considered prior to the technology being implemented. The addition of mobile technologies to an organization can open the door for policy changes or additions to that organization. Mobile learning policies are complex and require engagement from the government, trade, industry, commerce, and education sectors (UNESCO, 2012).

Resistance to implementing one-to-one mobile technology may also stem from a school or a school district being content with the systems that have worked through the years. If a school or school district has experienced academic success without the use of one-to-one mobile technologies, the stakeholders in that school or school district may not want to add one-to-one mobile technology to their school or school district. Veteran teachers with over a decade of teaching experience more than likely did not use advanced computing technology when they studied mathematics (Zelkowski, 2011). Educators with many years of experience can view the implementation of one-to-one mobile technology as providing a way out for students and would require the teachers to revamp the lesson plans they have been using for many years (Zelkowski, 2011).

The Information Age has also created an opportunity for students to access negative and inappropriate content on websites with the click of a button. Some educational stakeholders have concerns about giving students devices that will allow them to have access to such content. When a middle school decided to implement a one-to-one iPad program, Takiff (2012) found, "If the school didn't set up digital barricades, there could be hell to pay from the feds, thanks to the Children's Online Privacy Protection Act of 1998, established to ensure the privacy and safety of children under 13" (p. 2). The development of online blogs and social media websites, such as Facebook, Twitter, Instagram, and others, creates a possibility for students to be bullied or taken advantage of in ways that did not exist prior to the creation of such technologies. The possibility that students could damage, lose, or have the mobile technology stolen creates another problem that educational stakeholders would have to address prior to launching a one-to-one mobile technology initiative.

The researcher considered the negative externalities and the possible drawbacks of implementing one-to-one mobile technology for high school students to use. The possibility exists that implementing one-to-one mobile technology in a high school could have a negative impact on students.

Student Motivation, Engagement, and Standardized Test Scores

Student engagement and standardized test scores have suffered in many school districts across the nation. This downward spiral may be attributed to the lack of student motivation. The Program for International Student Assessment's (PISA) Organization for Economic Cooperation and Development (OECD) global research study on 15-year-old students showed that students from the U.S. did not perform as well as they have in past years (Zeitvogel, 2010). Autio, Hietanoro, and Ruismäki (2011) stated, "Motivation has been viewed as the primary determinant of students' learning and school success. Motivation is critical not only to current academic functioning, but also to students' beliefs in their future success as students" (p. 361). In 2009, 15-year-old students from the U.S. ranked 17th overall in the global PISA results of math, reading, and science tests. These students were ranked behind Shanghai-China, Korea, Finland, Hong Kong-China, Singapore, Canada, New Zealand, Japan, Australia, Netherlands, Belgium, Norway, Estonia, Switzerland, Poland, and Iceland (OECD, 2010). In 2012, out of 34 nations, these U.S. 15-year-old students ranked 27th in math, 17th in reading, and 20th in science during the global PISA tests (Schleicher & Davidson, 2013).

In 1955, the U.S. decided to make the study of science and math a priority for all U.S. schools. That standard and motivation for this were a reaction to being in competition with the former Soviet Union during the early stages of the Cold War. The Soviets launched Sputnik in 1957, which was the first earth-space satellite (Johanningmeier, 2010). The fear of losing out to the Soviet Union in the area of science and math prompted nationwide motivation to achieve more academically (Johanningmeier, 2010).

After the U.S. won the Cold War in the early 1990s and the threat of communism waned, academic motivation and vigor also waned (Garrett, 2008). During the past two decades, nations have excelled academically by sending their students to U.S. colleges. These students have taken advantage of the technological advancements by majoring in computer science, computer engineering, electrical engineering, medicine, and other math and science fields (Spellings, 2010).

The increased accessibility of information and technological resources has allowed students to become familiar with technology outside of the classroom. When students are using technology on a regular basis outside of the classroom, it is important that classrooms be able to meet the need of that intellectual learning style to keep students motivated. Providing one-to-one mobile technology can give students the opportunity to connect to curriculum-based essential learning outcomes outside of the classroom. Zelkowski (2011) stated, "In the age of high stakes assessment and accountability, classroom teachers have clear concerns about students being distracted or communicating outside the realm of classroom material" (p. 41).

According to Norris and Soloway (2011), school districts that have integrated mobile learning devices have seen a standardized test score improvement of up to 30%. Maninger and Holden (2009) documented examples of how student motivation was affected when one-to-one mobile technology was implemented:

> When teachers made themselves available in the evenings to answer questions about homework submitted via e-mail, the assignments appeared to become more meaningful for the students, and the quality of work improved. When teachers began e-mailing students about missed assignments, turnaround time on make-up work decreased significantly. Communication is the key to any successful endeavor, and this campus provides an example for the mutually beneficial relationship between communication and a one-to-one laptop initiative. (p. 20)

It is important to research the relationship between student engagement, student motivation, one-to-one mobile technology, and standardized test scores. Students have to be motivated and engaged with the learning objectives if they are going to be successful at passing the required standardized tests. Therefore, it is possible that one-to-one mobile technology can be a catalyst for that motivation and engagement.

High School Graduation Rates

When students enter high school, the goal of the stakeholders is for each student to graduate high school within four years. The Education Trust High School appraisal service found that 25% of U.S. high school students will not graduate in four years and that they are less likely to graduate high school when compared to their parents (Hoogeveen, 2009). When compared to the 1980s, the high school dropout rate in the U.S. has increased by 3% (Jordan, Kostandini, & Mykerezi, 2012). In Texas, students cannot graduate if they do not pass the required standardized tests. This guideline connects standardized testing to the high school graduation rate. When a high school has a one-to-one mobile technology infrastructure, there could be a correlation between one-to-one mobile technology and student graduation rates. It is important to research the high school graduation rate because standardized testing in Texas is directly related to the high school graduation rate. Thus, implementing one-to-one mobile technology may increase the number of students who pass standardized tests, which may improve the graduation rate.

College Readiness

College readiness has traditionally been measured by high school GPA, college application essays, college entrance exams, and high school activities (Estévez, 2008). The National Center for Education Statistics (NCES) created a college readiness index that rates students with five college readiness levels (Estévez, 2008). In 2003, the Manhattan Institute for Policy Research reported that only 32% of U.S. students graduate high school with the skills to attend a four-year college (Estévez, 2008). In 2008, Texas adopted the College and Career

Readiness Standards that measures student performance in English, math, science, social studies, and cross-disciplinary standards (The State of Texas, 2009).

It is important to research high school student's college readiness because students are rated by their performance on standardized tests. When a school or school district has a one-to-one mobile technology infrastructure that raises the number of students who pass their required standardized tests, there could be a correlation between one-to-one mobile technology and college readiness.

Forney ISD (Texas) One-to-One Mobile Technology Program

At the beginning of the 2010 academic year, Forney ISD (Texas) decided to implement a one-to-one mobile technology program for 9th-12th grade high school students under the Forney ISD (Texas) E-Book laptop program (Forney First, 2008). The one-to-one mobile technology the students received was a Windows OS-based Dell or Lenovo laptop computer with Microsoft Office and wireless Internet connectivity. In a pilot program, the 7th and 8th grade students were given laptops to use during the 2009 academic year, followed by the 9th-12th grade students during the 2010 academic year (Forney First, 2008). The laptops could be optionally covered by a comprehensive $700 insurance plan with a $25 deductible that cost $45 each school year. The laptops were used for every class and the textbooks were presented in a digital format. It was important for the researcher to provide the intricate details of the one-to-one mobile technology initiative that was implemented by Forney ISD (Texas).

Quantitative Ex Post Facto Design

The quantitative, ex post facto design aims to collect numerical quantitative data on phenomena that happened in the past (Onyia, 2012). According to McMillan (2011), in ex post facto research, there is no active manipulation of the independent variable because it has already occurred with two or more intact groups, but the comparison of group differences on the dependent variable is the same. When a study does not allow for true experimental research to be conducted, ex post facto research can be ideal since the hypotheses, cause-and-effect relationships, and variables can be analyzed without manipulation of the variables (Simon & Goes, 2013).

Basler (2012) posited, “in an ex post facto design, observations of relationships between naturally occurring variables are made, and then the researcher attempts to determine if a grouping that the researcher has no control over makes an impact on a specific outcome” (p. 49). Collecting quantitative data retrospectively allows the researcher to use independent and dependent variables contained within data from a previous occurrence. A drawback of implementing a quantitative, ex post facto design is the potential for extraneous variables to have an impact on the data (McMillan, 2011). An ex post facto design can also have limited generalization since the sample selected cannot be considered random (Simon & Goes, 2013). It was important to provide detail about the researcher’s method and design that was used.

Dual Coding Theory

Psychology professor, Allan Paivio in 1969, developed the dual coding theory. Paivio (1991) claimed, “The theory assumes an orthogonal relation between symbolic systems and specific sensorimotor systems. Verbal and nonverbal systems symbolically represent the structural and functional properties of language and the nonlinguistic world, respectively” (p. 257). According to Chiu-Jung and Pei-Lin (2012), the dual coding theory maintains that learning can be facilitated when materials that involve both verbal and visual systems are utilized simultaneously.

The dual coding theory is important to the study of education because learners who have the ability to hear and see can receive information in two forms, visually and auditory. The dual coding theory should be taken into account when constructing educational technology because content can be distributed and delivered through multiple mediums that are processed through the dual coding theory (Linebarger, Moses, Garrity Liebeskind, & McMenamin, 2013). The dual coding theory can be applied through the implementation of educational technologies and, more importantly, one-to-one mobile technologies in the classroom. The application of the dual coding theory may influence the number of 10^{th} grade students who pass the standardized TAKS tests in Forney ISD (Texas) through the integration of one-to-one mobile technology.

Multiple Intelligence Theory

Psychology professor Howard Gardner developed the multiple intelligence theory in 1983. According to Gardner (2006), the multiple intelligence theory consists of linguistic, logical/mathematical, spatial, musical, kinesthetic, intrapersonal, interpersonal, and naturalistic learning styles. As a cognitive researcher, Gardner realized that redefining the traditional approach of intelligence outside of the standardized IQ score would help educators meet the learning needs of students (Hassan, Sulaiman, & Baki, 2011). According to Gardner (1993), the majority of Western cultures only teach linguistic and logical/mathematical learning styles while neglecting the other learning styles.

The multiple intelligences are autonomous but also interactive (Gardner, 1993). In general, students have relative strengths and weaknesses across the intelligences. Technology enhanced learning applies the multiple intelligence theory and allows learners of different styles to be successful by adapting the instruction to the needs of each learner (Kelly, 2008). The multiple intelligence theory can be applied through the implementation of educational technologies and more importantly, one-to-one mobile technologies in the classroom. The application of the multiple intelligence theory may influence the number of 10^{th} grade students who pass the standardized TAKS tests in Forney ISD (Texas) through the integration of one-to-one mobile technology.

Similar Research Findings

The peer-reviewed literature that exists regarding the use of one-to-one mobile educational technology is limited due to the limited quantity of schools and school districts that implement this technology (Sheng, Siau, & Nah, 2010). In 2011, Keengwe, Schnellert, and Mills conducted a study that consisted of gathering quantitative survey data from the students and teachers of a Midwestern high school (Keengwe, Schnellert, & Mills, 2011). The survey data provided descriptive statistics that were analyzed and supported the theory that one-to-one laptop technology enhanced student learning outcomes (Keengwe et al., 2011).

Gaps in Research Literature

The use of mobile technology in high school is a new medium that many educational institutions have not had the opportunity to implement. This large-scale lack of implementation has allowed for literature gaps because information on high schools using mobile technology is limited. The use of mobile educational technology can be traced back to the 1990s when the first laptop was introduced to the educational setting. There is also a lack of studies on the correlation of the implementation of mobile technology and the number of students who pass standardized tests. Manjula (2012) stated:

> Some surveys had indeed shown the positive impacts of tablet-learning such as increased high order thinking skills and inquiry based learning yet there are many gaps and the tablet will have to go through some more generations of customised innovations before an entire school can reside inside a tablet. (p. 1)

The U.S. public school districts are required to use standardized test score data to make sure they meet the requirements of NCLB (United States Department of Education, 2010). This guideline potentially makes the implementation of one-to-one mobile technology as a secondary priority when school districts are making decisions. If NCLB made one-to-one mobile technology a requirement when comparing student standardized test scores and pass rates, more literature could become available. Lastly, the use of mobile technology on a one-to-one basis at the high school level has been limited resulting in a lack of scholarly material on the question.

Summary

The focus of the literature review for this chapter was to highlight the development of technology through the years and the importance of integrating mobile technology at a one-to-one student level in high schools. For Texas, this literature illustrates that 48% of Texas schools did not meet the NCLB AYP standards in 2012 due to low performance in school rating criteria that included student performance on standardized tests (Texas Education Agency, 2012). This information is important because students in the U.S. need to keep pace with global peers (Cooper et al., 2012). With so many technological options being created each year, schools have to choose carefully which technologies to implement and not implement to make the most efficient use of time, money, training, and efforts to ensure students get the best educational experience (Teclehaimanot, Hamady, & Arter, 2010). In response to this, various high schools and school districts in the U.S. are integrating mobile technologies ubiquitously (Norris & Soloway, 2011). Some of these technologies are in tablet form like the iPad, some of these technologies are in PDA form such as iPod Touch devices, some are in eReader form like the Amazon Kindle/Barnes and Noble Nook, and others are giving students laptop computers to use daily in school and at home (Scott, 2011; Zucker, 2009).

Chapter 3

Method

The purpose of this quantitative study was to explore whether there is a difference in student outcomes between 10th grade high school students in Forney ISD (Texas) who did not have access to school provided one-to-one mobile technology in 2009 (control group) and 10th grade high school students in Forney ISD (Texas) who had access to school provided one-to-one mobile technology in 2010 (experimental group). The current research examined public archival data to answer the research questions. The independent variable was the one-to-one mobile technology and the dependent variables were the number of 10th grade students who passed each individual TAKS test (English language arts, math, science, social studies, and all tests). This chapter provides information detailing aspects of the study that include the research method, the research design, appropriateness of the design, research questions, hypotheses, geographic location of the study, instrumentation, data collection, data analysis, validity, and reliability of the research conducted.

Research Method and Design Appropriateness

Research can be conducted in various formats. The three major formats for conducting educational research are quantitative, qualitative, and mixed method designs (Creswell & Plano-Clark, 2011). Following quantitative and qualitative designs, the mixed method design has been categorized as the third research methodology (Borrego, Douglas, & Amelink, 2009). A quantitative method was used to examine how the integration of one-to-one mobile technology in the Forney ISD (Texas) affected the number of 10th grade students who passed the English language arts, math, science, and social studies standardized TAKS tests during the 2010 academic year.

A quantitative, ex post facto design was used because the numerical data collected was gathered from a public archival data source. Basler (2012) stated, “Ex post facto is a Latin phrase meaning ‘from after the fact’ and relies on observation of relationships among phenomena as they occur naturally without intervention from the researcher” (p. 49). The quantitative data used included 10^{th} grade student data and comprised the results from the 2009 and 2010 academic years. The research examined Forney ISD (Texas) 10^{th} grade student data when one-to-one mobile technology was not used during the 2009 academic year (control group) and when one-to-one mobile technology was provided by the school district for 10^{th} grade and high school student use during the 2010 academic year (experimental group).

Potential extraneous variables such as pedagogical change, increased parental involvement, intrinsic student motivation, student population change, and annual standardized testing interventions could have influenced the dependent variables of the study. To reduce the chance for statistical error and to increase validity, the researcher sampled the entire Forney ISD (Texas) 10^{th} grade student population from the 2009 (n=520) and 2010 (n=530) academic years.

A qualitative study was not appropriate for this research because only numerical data was available to answer each research question. The attributes of qualitative research are based on the description of various human realities to understand a phenomenon (Melissa, 2006). According to Hutchinson (2011), the qualitative approach was not appropriate for this study because qualitative research would have provided descriptive results with a focus on meaning, process, and descriptions based on words.

The goal of this research study was not to seek a detailed understanding of a process through building on a theory but to examine and explain the relationship that exists between dependent and independent variables (Hutchinson, 2011). When a researcher conducts an ex post facto study, subjects are selected that are as similar as possible with the only difference being the independent variable or variables (McMillan, 2011). An ex post facto design clearly identifies dependent and independent variables from a historical context (Samyn, 2013). Carroll (1989) stated, “Ex post facto research is a systematic empirical inquiry in which the investigator does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable” (p. 1). Non-experimental studies investigate the status of past or current events (McMillan, 2011). Ex post facto research has similarities with experimental research, but the difference is that in ex post facto research, the independent variable cannot be controlled because the implementation happened after the fact (Basler, 2012). Using this approach, the researcher conducted a statistical data analysis on collected data through a non-parametric chi-square test with crosstabulation to analyze the data for significance.

Research Questions

The purpose of this quantitative, ex post facto study was to examine how the use of one-to-one mobile technology has influenced the number of 10th grade students who passed the required TAKS tests in Forney ISD (Texas) during the 2010 academic year. The research examined 10th grade student information obtained from public archival data. The research questions were:

1. Is there a statistically significant difference between 10th grade students who passed the TAKS English Language Arts test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
2. Is there a statistically significant difference between 10th grade students who passed the TAKS Math test during the 2010 academic year with access to one-to-one mobile

technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

3. Is there a statistically significant difference between 10th grade students who passed the TAKS Science test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
4. Is there a statistically significant difference between 10th grade students who passed the TAKS Social Studies test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
5. Is there a statistically significant difference between 10th grade students who passed all of their TAKS tests during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

From 2003-2011, the TAKS tests were administered to Texas public school students in grades 3rd to 11th. The public secondary archival TAKS test data for this study consisted of 10th grade students from the 2009 and 2010 academic years. The 10th grade students were required to take the English language arts, math, science, and social studies tests. The TAKS tests were replaced by the STAAR tests in 2012.

Hypotheses

The hypotheses included null and alternative hypotheses that determined how one-to-one mobile technology integration has affected the number of 10th grade students who passed the TAKS tests during the 2010 academic year. The null (H_0) and alternative (H_A) hypotheses were:

H_{01}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A1}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

H_{02}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A2}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

H_{03}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A3}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

H_{04}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A4}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

H_{05}: There is no statistically significant difference in the number of 10th grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

H_{A5}: There is a statistically significant difference in the number of 10th grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

Population

The population of this study consisted of 10th grade students in Forney ISD (Texas) from the 2009 (n=520) and 2010 (n=530) academic years. The P-12th grade population for the 2009 academic year was 7,413 students and the P-12th grade population for the 2010 academic year was 7,795 students. The researcher obtained the archival data of the population from the TEA website. The data consisted of the school district AEIS information from the Forney ISD (Texas) academic years of 2009 and 2010.

Sampling Frame

Through nonprobability sampling, the population chosen for this study comprised of 10th grade student data during the 2009 and 2010 academic years in Forney ISD (Texas). For this study, the researcher obtained public archival data from Forney ISD (Texas) to collect quantitative sample data. The population included Forney ISD (Texas) 10th grade school student data from the 2009 and 2010 academic years. The population of the control group for each research question consisted of Forney ISD (Texas) 10th grade students from the 2009 academic year (n=520). The population of the experimental group for each research question consisted of Forney ISD (Texas) 10th grade students from the 2010 academic year (n=530).

The researcher collected the quantitative data through public archival data. According to Borrego et al. (2009), researchers use quantitative sampling, so that the findings can be projected objectively on a larger population. Hutchinson (2011) concluded that, “effect sizes for a chi-square goodness of fit and contingency table are small if they are .1, medium if they are .3, and large if they are .5” (p. 95). To control for a Type 1 error, a $p < 0.05$ significance level was used for the chi-square test. According to Hutchinson (2011), a value of $p < 0.05$ corresponds to a 95% probability the statistical findings for the null hypotheses are true.

Informed Consent

Prior to conducting research, a researcher needs to obtain informed consent from the participants who are to be used in the study (Laliberte, 2009). Voluntary participation in this study was not required since human subjects were not contacted. The nature of the study and the use of public archival data did not require the researcher to obtain Informed Consent from participants. Since the researcher used public archival data about Forney ISD (Texas) for the study, the Director of Technology of Forney ISD (Texas) was contacted to obtain approval and the signature for the Data Access and Use Permission form (Appendix A).

Confidentiality

Due to the nature of the study, only public archival data about Forney ISD (Texas) was obtained through the research. The data used was anonymized, so as not to be connected to an individual. No students, teachers, or school administrator names figured the study. In addition, there was no need to let participants know that they have the option of participating or withdrawing from the study. The collected anonymized data was stored on the password-protected computer of the researcher and will be kept there for three years. Due to the post-hoc nature of the study, it did not carry any physical, social, or psychological risks for any individuals.

Geographic Location

The data obtained for the study was from Forney ISD (Texas), which is a suburb of Dallas, Texas, in the U.S. Dallas is a large city with a population of approximately 1.2 million people located in north central Texas. The pubic archival data were obtained from Forney ISD (Texas), which is east of Dallas in Kaufman County. In Forney, Texas, the city where the school district is located, there is a population of approximately 15,000 people.

Data Collection

Quantitative data collection consists of gathering numeric or objective data (Creswell, 2005). For this quantitative, ex post facto study, data were collected by gathering existing numerical archival data through nonprobability sampling. This data is publically available and was accessed through the TEA website; it corresponded to the 2009 (control group) and 2010 (experimental group) AEIS reports of Forney ISD (Texas). The TEA webpage for the 2009 AEIS report can be found in Appendix B and the TEA webpage for the 2010 AEIS report can be found in Appendix C.

Once the websites were accessed the researcher chose the search criteria for question number one that stated: What type of report format would you like? HTML or PDF. Question number two stated: How do you wish to search? District Name, District Number, District by County Name, or District Region Number. Question number three stated: Enter the appropriate name or number. The researcher selected HTML for question number one, District Name for question number two, and typed Forney for question number three. Once the criteria were entered for each website, a 2009 and 2010 TEA AEIS report was produced for Forney ISD (Texas).

The 2009 data collected concerned the control group of students who did not have access to school provided one-to-one mobile technology. The 2010 data collected concerned the experimental group who had access to school provided one-to-one mobile technology. The 2009 and 2010 AEIS data provided the percentage and number of students in 10th grade who passed and did not pass the TAKS test for English language arts, math, science, and social studies, and all tests.

The 2009 Forney ISD (Texas) AEIS data were accessed from the TEA website. The researcher obtained the 2009 10th grade student TAKS test passing percentage rate for English language arts, math, science, social studies, and all tests. Next, the researcher accessed the 2010 Forney ISD (Texas) AEIS data from the TEA website and collected the 10th grade student TAKS test passing percentage rate for English language arts, math, science, social studies, and all tests. The collected data allowed the researcher to determine the number of 10th grade students in Forney ISD (Texas) who passed and did not pass each TAKS test during the 2009 and 2010 academic years. Once the number of students who passed and did not pass each test during each academic year was determined, the numbers were placed in a 2x2 crosstabulation chi-square test to answer each research question. The results of the chi-square test allowed the researcher to determine if there were any significant associations between the number of 10th grade students who passed the required TAKS tests and access to one-to-one mobile technology. During the 2009 academic year (control group) 10th grade students did not have access to one-to-one mobile technology and during the 2010 academic year (experimental year) 10th grade students had access to one-to-one mobile technology.

Instrumentation

The researcher accessed public archival data for data collection and used a 2x2 crosstabulation chi-square test to test for significance between the variables. The data source used for the research has been a valid Texas education data source since 1990 and presented a myriad of annual school district and school information that included standardized testing, graduation rate, college readiness, taxes, budgets, expenditure per student, socioeconomic status, and student/staff demographics (Texas Education Agency, 2012). The Texas Education Agency (2012) stated, “Through its Public Education Information Management System (PEIMS), the TEA annually collects a broad range of information on over 1,200 districts (including charters), more than 8,000 schools, 320,000+ educators, and over 4.9 million students” (p. 1). The TEA AEIS reports are used to measure each Texas school with the NCLB guidelines and are in compliance with the AYP standards (Texas Education Agency, 2010).

The AEIS data, which can be located via Appendix B and C was presented in a table that shows the percentage of students in each grade that passed the required TAKS tests for each academic year. For the purposes of this study, only 10th grade student TAKS test data from Forney ISD (Texas) during the 2009 (control group) and 2010 (experimental group) academic years were used. The table contains the AEIS data in percentage format that shows the percentage of students that passed the TAKS test for English language arts, math, science, social studies, and all tests in the 10th grade. The scoring range of the TAKS test was from 1000-3400 depending on the test. In order to receive a passing score for each TAKS test, a student had to score 2100 (Met Standard) on each test. Additionally, the AEIS data provided the number of students in 10th grade for each academic year, so the student data could be viewed numerically and used to calculate the significance of the independent variable for the chi-square test.

Validity

When conducting research, a study’s validity is most essential. This research study was validated through a quantitative, ex post facto design where the quantitative data were collected through public secondary archival data. According to Creswell and Plano-Clark (2011), two factors, internal and external, can influence the validity of a study. Internal validity is the cause and effect relationship of a study (Shuttleworth, 2009). The internal validity of the current quantitative, ex post facto study was supported by the occurrence of the cause and effect relationship of one-to-one mobile technology and student outcomes that happened in the past. The current study did not have a threat of participants dropping out of the study or potential participants not choosing to participate in the study. The validity of the TEA improved internal validity because the data source that was used has been used to be an accurate indicator of student, school, and school district academic performance.

Creswell and Plano-Clark (2011) stated, “external validity means that correct inferences can only be drawn from features of other persons, settings, and past and future situations if certain aspects of the design are considered by the investigator” (p. 134). According to Endsley (2014), if the results of a study are generalizable to a larger population, a study is externally valid. Using this study to compare the cause and effect relationship between one-to-one mobile technology and student outcomes in a different school district in the future can externally validate the current study. The design of the study may validate the assumptions and research questions.

Reliability

When conducting research, a researcher needs to assure the reliability of a study. A study can prove to be reliable if the researcher can reproduce the results of the study at different times under the exact same conditions with the same results (Shuttleworth, 2008). The reliability of the study was further enhanced by making sure the data collected was accurate and relevant to the study. The data that were collected for the ex post facto study already existed and the tests occurred in the past. The data source was a reliable data source that has been used by the state of Texas to rate schools and school districts by tracking student performance with federal guidelines. The cause and effect relationship between the independent and dependent variables used during the study would produce the same results if the chi-square test for significance was applied to the collected data at different times.

Data Analysis

The 2009 and 2010 Forney ISD (Texas) AEIS data provided student information from the early childhood education level to the 12th grade, student demographics, staff demographics, budget information, and test information about all grades. For the purposes of this study, the researcher only used 10th grade student TAKS test data from the 2009 and 2010 academic years. When the data were collected, the quantitative data underwent computer-generated analysis through the Statistical Package for the Social Sciences (SPSS, version 22.0) software to find the descriptive statistical data. The SPSS software is widely used by social scientists to conduct quantitative investigations (Chen, 2012).

The non-parametric test used in SPSS was the chi-square test with crosstabulation to determine if a statistically significant difference existed between the number of 10th grade students who passed the TAKS tests in Forney ISD (Texas) while not having access to one-to-one mobile technology during the 2009 academic year (control group) and Forney ISD (Texas) 10th grade students who had access to one-to-one mobile technology during the 2010 academic year (experimental group). The researcher used the 2x2 crosstabulation chi-square test consisting of the dependent variables (e.g., pass/not passed), control group (i.e., 2009 results), and experimental group (i.e., 2010 results) to answer each research question and hypotheses. The number of students who passed and did not pass each TAKS test (English language arts, math, science, social studies, and all tests) was analyzed.

According to Michael (2013), the chi-square test is based on an approximation that works best when the expected frequencies are fairly large. The researcher analyzed the relationship between two variables, so the chi-square test for independence was used instead of the chi-square test for goodness of fit, which measures frequency distribution (Wingate, 2013). The independent variable was the usage of one-to-one mobile technology, and the dependent variables were the number of 10^{th} grade students who passed or did not pass the English language arts, math, science, social studies, and all standardized TAKS tests.

According to Creswell and Plano-Clark (2011), the quantitative data analysis proceeds from descriptive analysis to inferential analysis, and multiple steps in the inferential analysis build a greater refined analysis. The results of the quantitative data were replicated in a narrative and numerical format that reported the results of the chi-square test, percentages, and frequencies. The findings were related to the literature from prior studies and may influence literature for future studies.

Summary

When conducting a research study, researchers may decide to choose a quantitative, qualitative, or mixed method design (Samyn, 2013). The nature of the topic, specific problem, and the nature of the study led the researcher to choose the most appropriate method and design for the research study. Therefore, the data collected for the current research study used quantitative public archival data. The data collected may provide insights into how the integration of one-to-one mobile technology at the high school level influences the number of 10^{th} grade students who pass the standardized TAKS tests in Forney ISD (Texas).

Chapter 4

Results

The previous chapters described the methodology and data design used to complete this quantitative, ex post facto study. The study examined public archival TEA data of Forney ISD (Texas) 10^{th} grade student's standardized test score data to determine if there was a statistically significant difference in the number of 10^{th} grade students who passed their standardized tests during different academic years with one-to-one mobile technology in 2010 (experimental group) and without one-to-one mobile technology in 2009 (control group). The chi-square test served to determine if there was a significance statistical difference between the variables.

Data Collection

Data collection for this study was from public anonymized secondary sources provided by the Texas Education Agency that can be found in Appendix B and Appendix C. The study did not require an Informed Consent since individuals were not contacted and individual data were not used. The data needed for the study concerned the number of 10^{th} grade students in Forney ISD (TX) during the 2009 and 2010 academic years that passed and did not pass the English language arts, math, science, social studies, and all TAKS tests. The data reported the percentage of students who passed each test. The percentage of students who passed each test during the 2009 and 2010 academic years was multiplied by the total number of students in the 10^{th} grade during the 2009 (n=520) and 2010 (n=530) academic years. Once the multiplied figure was obtained for each test and all tests the figures were used for the 2 x 2 crosstabulation chi-square test to test for significance.

Data Analysis

The data were analyzed with a 2 x 2 crosstabulation chi-square test to determine if there was a significant statistical difference in the number of 10th grade students who passed their TAKS tests in 2010 with one-to-one mobile technology access and 10th grade students who passed their TAKS tests in 2009 without one-to-one mobile technology access. With a 0.05 significance level and one degree of freedom (Df = 1) the chi-square statistic had to be greater than 3.48 (critical value) for there to be a significant statistical difference. Figure 3 shows the formula used for the chi-square test for independence.

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}}.$$

Figure 3. *Chi-Square Test for Independence*

Testing of the Hypotheses

The null hypotheses asserted that the integration of one-to-one mobile technology did not have a statistically significant difference on the number of 10th grade students who passed their standardized tests. The alternative hypotheses asserted that the integration of one-to-one mobile technology did have a statistically significant difference on the number of 10th grade students who passed their standardized tests.

Null and Alternative Hypotheses for 10th Grade English Language Arts TAKS Tests

H_{01}: There is no statistically significant difference in the number of 10th grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A1}: There is a statistically significant difference in the number of 10th grade students who passed the TAKS English Language Arts test during the 2010 academic year when provided with one-to-one mobile technology.

The results of the chi-square test (N=1050) presented in Table 1 produced an expected count of 491 for the number of 10^{th} grade students who passed the TAKS ELA test in 2009 without one-to-one mobile technology. The actual count for the number of 10^{th} grade students who passed the TAKS ELA test in 2009 without one-to-one mobile technology was 478. The chi-square test produced an expected count of 501 for the number of 10^{th} grade students who passed the TAKS ELA test in 2010 with one-to-one mobile technology. The actual count for the number of 10^{th} grade students who passed the TAKS ELA test in 2010 with one-to-one mobile technology was 514. The chi-square test produced an expected count of 29 for 10^{th} grade students who did not pass the TAKS ELA test in 2009 without one-to-one mobile technology. The actual count for 10^{th} grade students who did not pass the TAKS ELA test in 2009 without one-to-one mobile technology was 42. The chi-square test produced an expected count of 29 for 10^{th} grade students who did not pass the TAKS ELA test in 2010 with one-to-one mobile technology. The actual count for 10^{th} grade students who did not pass the TAKS ELA test in 2010 with one-to-one mobile technology was 16. The chi-square statistic was 12.868 with a 95% confidence level as shown in Table 2. This resulted in a significant statistical difference between the expected and observed results, which allowed the researcher to reject the null hypotheses (H_{01}) and accept the alternative hypotheses (H_{A1}).

Table 1

Chi-Square Crosstabulation: 10^{th} Grade English Language Arts TAKS test

TAKS_ELA * Mobile_Tech_1to1 Crosstabulation					
			Mobile_Tech_1to1		
			Yes (2010)	No (2009)	Total
TAKS_ELA	Passed	Count	514	478	992
		Expected Count	501	491	992
	Not Passed	Count	16	42	58
		Expected Count	29	29	58
Total		Count	530	520	1050
		Expected Count	530	520	1050

Table 2

Chi-Square Results: 10^{th} Grade English Language Arts TAKS test

Chi-Square Results					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.868	1	.000		
Continuity Correction	11.917	1	.001		
Likelihood Ratio	13.292	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	12.855	1	.000		
N of Valid Cases	1050				

Null and Alternative Hypotheses for 10^{th} Grade Math TAKS Tests

H_{02}: There is no statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A2}: There is a statistically significant difference in the number of 10^{th} grade students who passed the TAKS Math test during the 2010 academic year when provided with one-to-one mobile technology.

The results of the chi-square test (N=1050) in Table 3 produced an expected count of 385 for the number of 10^{th} grade students who passed the TAKS Math test in 2009 without one-to-one mobile technology. The actual count for the number of 10^{th} grade students who passed the TAKS Math test in 2009 without one-to-one mobile technology was 338. The chi-square test produced an expected count of 393 for the number of 10^{th} grade students who passed the TAKS Math test in 2010 with one-to-one mobile technology. The actual count for the number of 10^{th} grade students who passed the TAKS Math test in 2010 with one-to-one mobile technology was 440. The chi-square test produced an expected count of 135 for 10^{th} grade students who did not pass the TAKS Math test in 2009 without one-to-one mobile technology. The actual count for 10^{th} grade students who did not pass the TAKS Math test in 2009 without one-to-one mobile technology was 182. The chi-square test produced an expected count of 137 for 10^{th} grade students who did not pass the TAKS Math test in 2010 with one-to-one mobile technology. The actual count for 10^{th} grade students who did not pass the TAKS Math test in 2010 with one-to-one mobile technology was 90. The chi-square statistic was 44.39 with a 95% confidence level as shown in Table 4. This resulted in a significant statistical difference between the expected and observed results, which allowed the researcher to reject the null hypotheses (H_{02}) and accept the alternative hypotheses (H_{A2}).

Table 3

Chi-Square Crosstabulation: 10th Grade Math TAKS test

TAKS_Math * Mobile_Tech_1to1 Crosstabulation					
			Mobile_Tech_1to1		
			Yes (2010)	No (2009)	Total
TAKS_Math	Passed	Count	440	338	778
		Expected Count	393	385	778
	Not Passed	Count	90	182	272
		Expected Count	137	135	272
Total		Count	530	520	1050
		Expected Count	530	520	1050

Table 4

Chi-Square Results: 10th Grade Math TAKS test

Chi-Square Results					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	44.399	1	.000		
Continuity Correction	43.465	1	.000		
Likelihood Ratio	45.056	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	44.357	1	.000		
N of Valid Cases	1050				

Null and Alternative Hypotheses for 10th Grade Science TAKS Tests

H_{03}: There is no statistically significant difference in the number of 10th grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A3}: There is a statistically significant difference in the number of 10th grade students who passed the TAKS Science test during the 2010 academic year when provided with one-to-one mobile technology.

The results of the chi-square test (N=1050) in Table 5 produced an expected count of 396 for the number of 10th grade students who passed the TAKS Science test in 2009 without one-to-one mobile technology. The number of 10th grade students who passed the TAKS Science test in 2009 without one-to-one mobile technology was 364. The chi-square test produced an expected count of 403 for the number of 10th grade students who passed the TAKS Science test in 2010 with one-to-one mobile technology. The number of 10th grade students who passed the TAKS Science test in 2010 with one-to-one mobile technology was 435. The chi-square test produced an expected count of 124 for 10th grade students who did not pass the TAKS Science test in 2009 without one-to-one mobile technology. The actual count for 10th grade students who did not pass the TAKS Science test in 2009 without one-to-one mobile technology was 156. The chi-square test produced an expected count of 127 for 10th grade students who did not pass the TAKS Science test in 2010 with one-to-one mobile technology. The actual count for 10th grade students who did not pass the TAKS Science test in 2010 with one-to-one mobile technology was 95. The chi-square statistic was 21.04 with a 95% confidence level as shown in Table 6. This resulted in a significant statistical difference between the expected and observed results, which allowed the researcher to reject the null hypotheses (H_{03}) and accept the alternative hypotheses (H_{A3}).

Table 5

Chi-Square Crosstabulation: 10th Grade Science TAKS test

TAKS_Science * Mobile_Tech_1to1 Crosstabulation					
			Mobile_Tech_1to1		
			Yes (2010)	No (2009)	Total
TAKS_Science	Passed	Count	435	364	799
		Expected Count	403	396	799
	Not Passed	Count	95	156	251
		Expected Count	127	124	251
Total		Count	530	520	1050
		Expected Count	530	520	1050

Table 6

Chi-Square Results: 10th Grade Science TAKS test

Chi-Square Results					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	21.041	1	.000		
Continuity Correction	20.382	1	.000		
Likelihood Ratio	21.196	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	21.020	1	.000		
N of Valid Cases	1050				

Null and Alternative Hypotheses for 10th Grade Social Studies TAKS Tests

H_{04}: There is no statistically significant difference in the number of 10th grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

H_{A4}: There is a statistically significant difference in the number of 10th grade students who passed the TAKS Social Studies test during the 2010 academic year when provided with one-to-one mobile technology.

The results of the chi-square test (N=1050) in Table 7 produced an expected count of 484 for the number of 10th grade students who passed the TAKS Social Studies test in 2009 without one-to-one mobile technology. The actual number of 10th grade students who passed the TAKS Social Studies test in 2009 without one-to-one mobile technology was 468. The chi-square test produced an expected count of 493 for the number of 10th grade students who passed the TAKS Social Studies test in 2010 with one-to-one mobile technology. The actual number of 10th grade students who passed the TAKS Social Studies test in 2010 with one-to-one mobile technology was 509. The chi-square test produced an expected count of 36 for 10th grade students who did not pass the TAKS Social Studies test in 2009 without one-to-one mobile technology. The actual count for 10th grade students who did not pass the TAKS Social Studies test in 2009 without one-to-one mobile technology was 52. The chi-square test produced an expected count of 37 for 10th grade students who did not pass the TAKS Social Studies test in 2010 with one-to-one mobile technology. The actual count for 10th grade students who did not pass the TAKS Social Studies test in 2010 with one-to-one mobile technology was 21. The chi-square statistic was 14.79 with a 95% confidence level as shown in Table 8. This resulted in a significant statistical difference between the expected and observed results, which allowed the researcher to reject the null hypotheses (H_{04}) and accept the alternative hypotheses (H_{A4}).

Table 7

Chi-Square Crosstabulation: 10th Grade Social Studies TAKS test

TAKS_Social_Studies * Mobile_Tech_1to1 Crosstabulation					
			Mobile_Tech_1to1		
			Yes (2010)	No (2009)	Total
TAKS_ Social_Studies	Passed	Count	509	468	977
		Expected Count	493	484	977
	Not Passed	Count	21	52	73
		Expected Count	37	36	73
Total		Count	530	520	1050
		Expected Count	530	520	1050

Table 8

Chi-Square Results: 10th Grade Social Studies TAKS test

Chi-Square Results					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.791	1	.000		
Continuity Correction	13.872	1	.000		
Likelihood Ratio	15.218	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.777	1	.000		
N of Valid Cases	1050				

Null and Alternative Hypotheses for 10th Grade All TAKS Tests

H_{05}: There is no statistically significant difference in the number of 10th grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

H_{A5}: There is a statistically significant difference in the number of 10th grade students who passed all of their TAKS tests during the 2010 academic year when provided with one-to-one mobile technology.

The results of the chi-square test (N=1050) in Table 9 produced an expected count of 344 for the number of 10th grade students who passed all of their TAKS tests in 2009 without one-to-one mobile technology. The actual number of 10th grade students who passed all of their TAKS tests in 2009 without one-to-one mobile technology was 296. The chi-square test produced an expected count of 350 for the number of 10th grade students who passed all of their TAKS tests in 2010 with one-to-one mobile technology. The actual number of 10th grade students who passed all of their TAKS tests in 2010 with one-to-one mobile technology was 398. The chi-square test produced an expected count of 176 for 10th grade students who did not pass all of their TAKS tests in 2009 without one-to-one mobile technology. The actual count for 10th grade students who did not pass all of their TAKS tests in 2009 without one-to-one mobile technology was 224. The chi-square test produced an expected count of 180 for 10th grade students who did not pass all of their TAKS tests in 2010 with one-to-one mobile technology. The actual count for 10th grade students who did not pass all of their TAKS tests in 2010 with one-to-one mobile technology was 132. The chi-square statistic was 38.67 with a 95% confidence level as shown in Table 10. This resulted in a significant statistical difference between the expected and observed results, which allowed the researcher to reject the null hypotheses (H_{05}) and accept the alternative hypotheses (H_{A5}).

Table 9

Chi-Square Crosstabulation: 10th Grade All TAKS tests

TAKS_All_Tests * Mobile_Tech_1to1 Crosstabulation					
			Mobile_Tech_1to1		
			Yes (2010)	No (2009)	Total
TAKS_ All_Tests	Passed	Count	398	296	694
		Expected Count	350	344	694
	Not Passed	Count	132	224	356
		Expected Count	180	176	356
Total		Count	530	520	1050
		Expected Count	530	520	1050

Table 10

Chi-Square Results: 10th Grade All TAKS tests

Chi-Square Results					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	38.675	1	.000		
Continuity Correction	37.868	1	.000		
Likelihood Ratio	38.998	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	38.638	1	.000		
N of Valid Cases	1050				

Summary

The discussion in Chapter 4 includes data collection, data analysis, and the results of the five hypotheses. The researcher rejected all five of the null hypotheses and accepted all five of the alternative hypotheses. The results of the data showed a significant statistical difference in the number of 10^{th} grade students who passed the TAKS tests in 2009 without one-to-one mobile technology and 2010 with one-to-one mobile technology. Each of the five chi-square test results indicated that a positive relationship existed between the number of 10^{th} grade students who passed the standardized TAKS tests and one-to-one mobile technology. A chi-square statistic with a 95% confidence level and one degree of freedom has to be greater than the critical value of 3.84 to be statistically significant. Each of the five chi-square statistics in this study were greater than 3.84. The researcher will further discuss the results, limitations, implications, recommendations, and conclusions of the study in Chapter 5.

Chapter 5

Conclusions and Recommendations

The purpose of this quantitative, ex post facto study was to determine whether the implementation of one-to-one mobile technology had an impact on the standardized TAKS test scores of 10th grade students in Forney ISD (Texas) during the 2010 academic year. Texas schools and school districts are required to meet federal and state guidelines that are rated by student standardized test performance. These schools and school districts are also expected to have the technology available for students to use so the students can be prepared for the 21st century. During the 2009 academic year, 57% of 10th grade students in the Forney ISD (Texas) passed all of the required TAKS tests (Texas Education Agency, 2009). The research questions for the study were:

1. Is there a statistically significant difference between 10th grade students who passed the TAKS English Language Arts test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
2. Is there a statistically significant difference between 10th grade students who passed the TAKS Math test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
3. Is there a statistically significant difference between 10th grade students who passed the TAKS Science test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

4. Is there a statistically significant difference between 10th grade students who passed the TAKS Social Studies test during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?
5. Is there a statistically significant difference between 10th grade students who passed all of their TAKS tests during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year?

The research questions were answered with the results of the chi-square test. The answer to each research question was positive. The researcher discovered a significant statistical difference between 10th grade students who passed the English language arts, math, science, social studies, and all TAKS tests during the 2010 academic year with access to one-to-one mobile technology and 10th grade students who did not have access to one-to-one mobile technology during the 2009 academic year. The results of the study are positive because it showed that when 10th grade students in Forney ISD (Texas) received an opportunity to use one-to-one mobile technology their standardized test scores improved across the board. In each chi-square test, the results of the expected outcome and the actual outcome accepted all five alternative hypotheses and answered all five research questions with the answer of yes. When calculating the chi-square test, the expected number of passing 10th grade students was always higher than the actual number of passing 10th grade students in 2009 without one-to-one mobile technology. The expected number of passing 10th grade students was always lower than the actual number of passing 10th grade students in 2010 with one-to-one mobile technology.

The researcher has provided graphical data that supports the results of the chi-square test. Figure 4 displays graphical data that supports the chi-square result (12.86) for RQ1. The TAKS

ELA (English Language Arts) pass rate increased by 5% (92% to 97%) for 10th grade students in 2010 when one-to-one mobile technology was implemented.

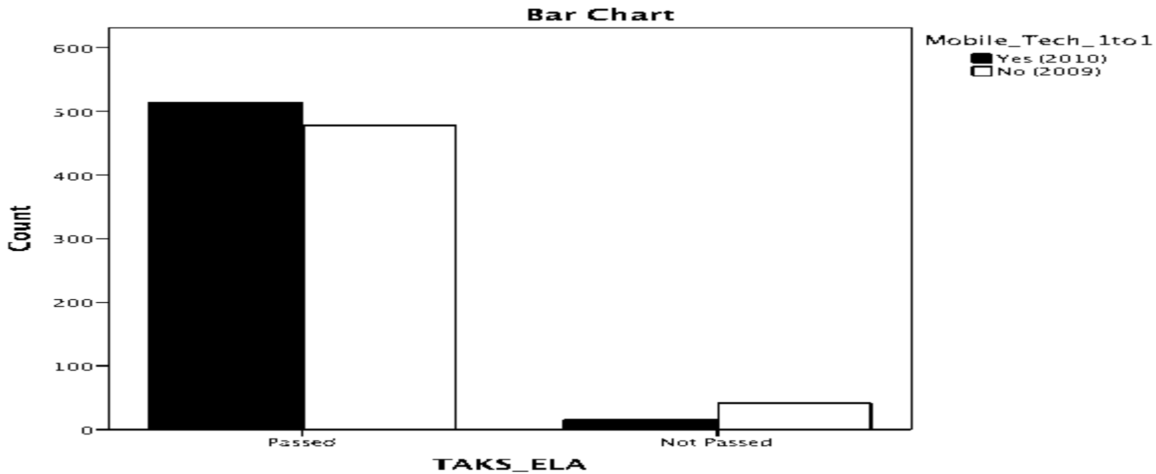

Figure 4. *Pass vs. Not Passed: 10th Grade English Language Arts TAKS test*

Figure 5 displays graphical data that supports the chi-square statistic (44.39) for RQ2. The TAKS Math pass rate increased by 18% (65% to 83%) for 10th grade students in 2010 when the schools implemented one-to-one mobile technology.

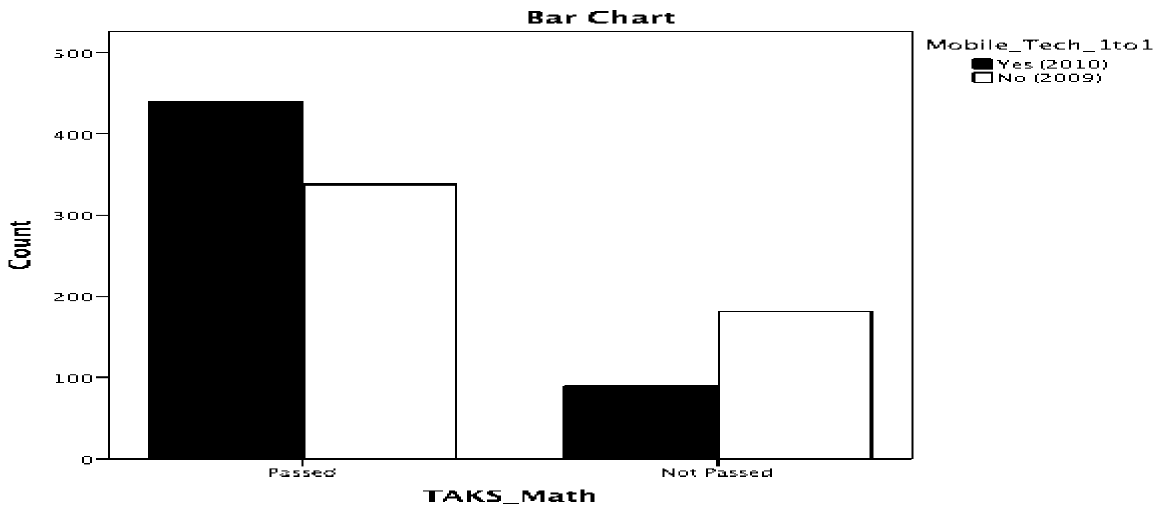

Figure 5. *Pass vs. Not Passed: 10th Grade Math TAKS test*

Figure 6 displays graphical data that supports the chi-square statistic (21.04) for RQ3. The TAKS Science pass rate increased by 12% (70% to 82%) for 10th grade students in 2010 when the schools implemented one-to-one mobile technology.

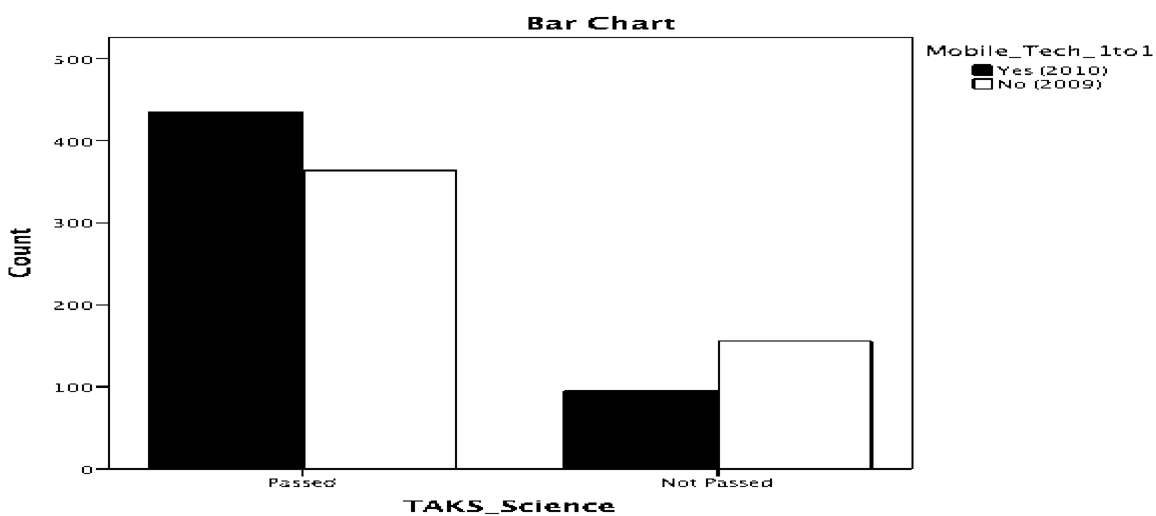

Figure 6. *Pass vs. Not Passed: 10th Grade Science TAKS test*

Figure 7 displays graphical data that supports the chi-square statistic (14.79) for RQ4. The TAKS Social Studies pass rate increased by 6% (90% to 96%) for 10th grade students in

2010 when one-to-one mobile technology was implemented.

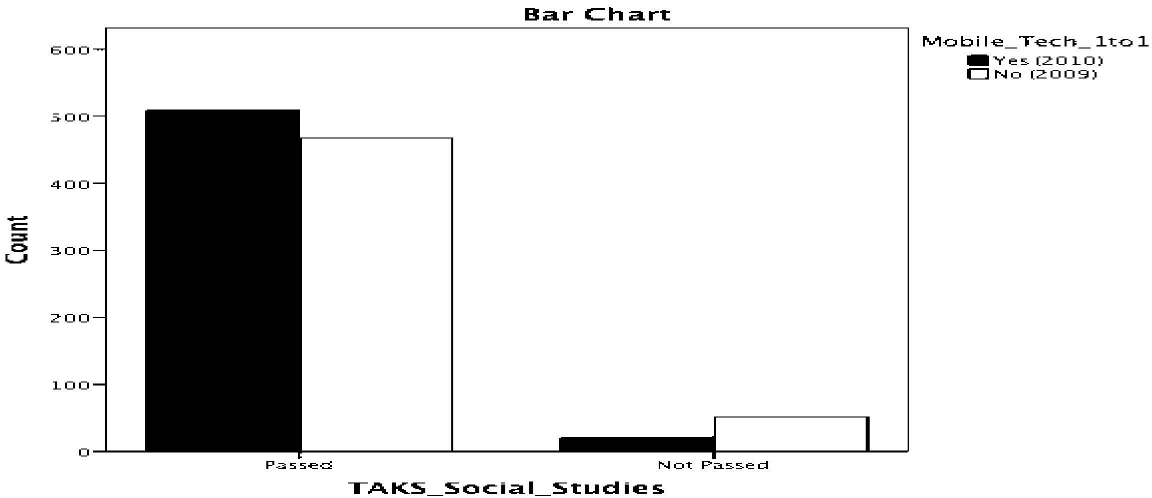

Figure 7. *Pass vs. Not Passed: 10th Grade Social Studies TAKS test*

Figure 8 displays graphical data that supports the chi-square statistic (38.67) for RQ5. The TAKS pass rate for students who passed all tests increased by 18% (57% to 75%) for 10th grade students in 2010 when one-to-one mobile technology was implemented.

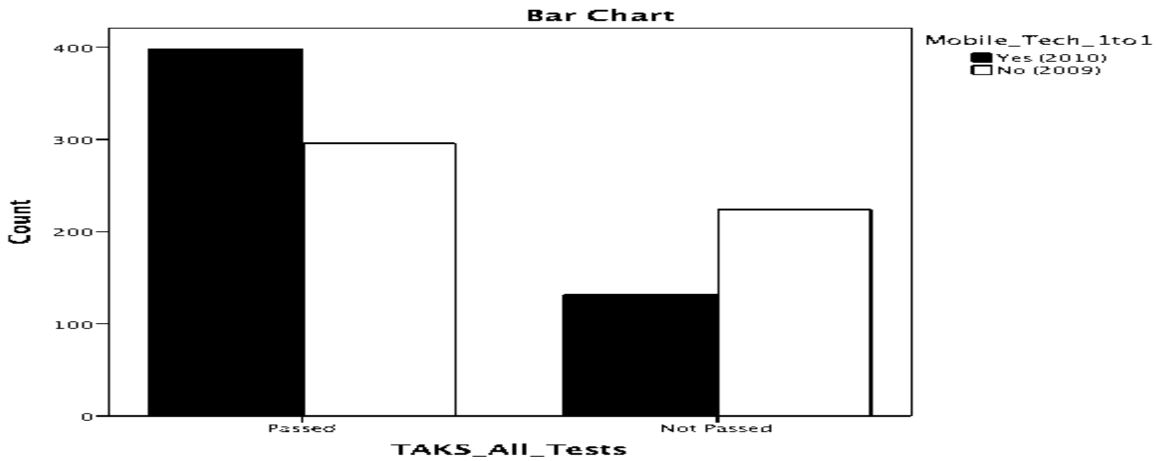

Figure 8. *Pass vs. Not Passed: 10th Grade All TAKS tests*

A summary of the results with the percentage change in the number of students who passed the TAKS tests from 2009 (control group) to 2010 (experimental group) and the corresponding chi-square statistic can be found in Table 11.

Table 11

2009 & 2010 10th Grade TAKS Testing Results Summary

TAKS Test	Percentage change in 10th Graders that passed between 2009 and 2010	Chi-Square Statistic Df = 1 Critical Value = 3.84
English Language Arts	92% to 97% (+ 5%)	12.86
Math	65% to 83% (+ 18%)	44.39
Science	70% to 82% (+ 12%)	21.04
Social Studies	90% to 96% (+ 6%)	14.79
All Tests	57% to 75% (+ 18%)	38.67

Limitations

A number of factors limited the findings of the study. These factors were population change, exploring only one grade level, possible curriculum improvement, only looking at two years of student data, and qualitative factors. The study was also limited to 10th grade student populations from the same school district and not multiple school districts.

There could have been a distinct difference in the types of students that were compared in 2009 and 2010 that may not have had anything to with one-to-one mobile technology implementation. Since the study examined two different sets of 10th grade students there could have been standardized testing interventions provided by Forney ISD (Texas) that the 2010 10th grade students received while they were in the 9th and 10th grade that the 2009 10th graders did not receive while they were in the 9th and 10th grade. Since standardized testing performance is often related to socio-economic data, there could have been a socio-economic difference in the 2009 and 2010 10th grade student populations that could have changed the standardized test performance data.

Since only one grade level was used for the study, applying the study to more grade levels could have produced a different outcome. There was a significant statistical difference in the standardized test performance of 10th grade students with and without one-to-one mobile technology but that difference may not have existed with 7th, 8th, 9th, 11th, and 12th grade students. All students in grades 7th to 12th could have been analyzed to see if a statistically significant difference existed in the student standardized test scores in the years they did not have one-to-one mobile technology and the years that they did have one-to-one mobile technology.

The school district could have implemented other changes within the curriculum that could have caused each school to improve their standardized test scores, and this change may not have correlated with the implementation of one-to-one mobile technology. United States schools and school districts conduct professional development and implement student interventions that are directed at improving the number of students who pass standardized tests.

Multiple school districts in the state of Texas or in the United States could have been used for the study that could have provided more information about one-to-one mobile technology and standardized testing. With the study being limited to two high schools in one school district, the population could have been larger if a bigger school district was chosen or if multiple school districts were used where there could have been district comparisons or triangulation.

There also could have been non-measurable qualitative factors that could have influenced the positive standardized test score increase for 10th grade students from 2009 to 2010 that did not correlate with the implementation of one-to-one mobile technology. The 2010 10th grade students could have had a more positive attitude towards standardized testing, the 2010 10th grade students could have had increased motivation, and/or the 2010 10th grade students could have had a higher collective IQ than the 2009 students.

Implications and Recommendations

The implications for leadership of this study show that school districts may need to put an emphasis on increasing the one-to-one mobile technology availability to all students to improve the standardized test achievement gap. The findings derived from this study may help leaders and educational stakeholders understand how increasing the access of technology for students can have a positive impact on the most important indicator that school districts and schools are rated and judged by – standardized test scores. It is recommended that national, state, and local leaders explore ways to increase one-to-one mobile technology access for all students at all grade levels to improve the standardized test scores across the nation. As stated in the research study, the United States has not scored well in recent standardized tests when compared with other developed nations. In 2012, 15-year-old students from the United States ranked 27th in math, 17th in reading, and 20th in science during the global PISA tests (Schleicher & Davidson, 2013).

The results and findings of the study are also aligned with the theoretical framework of the study that supports the idea that student access of one-to-one mobile technology supports the dual coding theory and the theory of multiple intelligence. The theoretical framework of these two theories explains that students learn differently. The dual coding theory supports the belief that students learn via auditory and/or visual means, which are met when a student uses one-to-one mobile technology. The multiple intelligence theory supports the belief that students can learn in several ways. The dynamics of one-to-one mobile technology can allow students to learn in different ways. Implementing one-to-one mobile technology can help meet the need for this student learning differentiation, which in turn can increase standardized test scores.

According to Grant, Tamim, Brown, Sweeney, Ferguson, and Jones (2015), there has been increased usage of mobile computing devices at the K-12 school level throughout the United States and Canada, but the usage is not where it needs to be. The researcher recommends that future research on the implementation of one-to-one mobile technology examine how one-to-one mobile technology influences other areas of school life such as grade point average, college readiness, graduation rate, student motivation, etc. Future research can also examine larger sample sizes of one-to-one mobile technology such as elementary schools, middle schools, entire schools, entire school districts, private schools, charter schools, an entire state, college level, graduate level, etc. Qualitative studies can also be conducted to find common themes that may exist when one-to-one mobile technology is implemented at the school level. A mixed method study could also be conducted to explore the common themes that may exist from the qualitative research findings and the quantitative research findings.

Summary

The research study examined how effective one-to-one mobile technology can be when it comes to the number of students who pass standardized tests. With students having this technology access at all times, the data showed a significant improvement in the number of 10^{th} grade students who passed their tests from one year to the next. Technology is constantly changing, so the results of study do not focus on one specific type of one-to-one mobile technology, but making sure that students have the access to one-to-one mobile technology at their convenience while in school and at home. The key is making sure that students have access to word processing, digital textbooks, applications, and Internet access. The literature gaps and miniscule amount of research that existed on the relationship between one-to-one mobile technology and standardized testing posed a challenge to the study.

The goal of this research study was to establish the relationship between one-to-one mobile technologies and standardized testing at the 10th grade level in Forney ISD (Texas). The results of the study and findings support the belief that one-to-one mobile technology does have a positive impact on 10th grade student standardized test scores. In 2009, only 57% of 10th grade students in Forney ISD (TX) passed all of their TAKS tests and in 2010 with one-to-one mobile technology, 75% of 10th grade students in Forney ISD (TX) passed all of their TAKS tests. The statistical findings and the overall growth of the number of students who passed was significant enough to support the belief that each school district should consider a one-to-one mobile technology initiative for all students. There will be barriers to full implementation, but it is important that stakeholders find creative and sound ways to make one-to-one mobile technology a realization.

Conclusion

Schools and school districts can improve their secondary student standardized test scores when afforded the opportunity to use one-to-one mobile technology in the public school setting. Results from this study confirmed the significant role that technology can play in a school district when each student is allowed to use that technology at all times. The expectation for all students to pass all standardized tests is something that all school districts have to be accountable for due to federal and state regulations such as NCLB. If a school district implements one-to-one mobile technology, there is a significant financial cost that school districts would have to face.

However, school districts spend millions of dollars on textbooks and supplies that could be replaced with one-to-one mobile technology. Since the United States government has upheld these standardized testing standards, the government should be able to provide more funding for the public education sector to make one-to-one mobile technology a reality.

The socio-economic gap which can be related to the digital divide is also a potential hindrance to student achievement and student standardized test scores. If school districts are able to allocate resources to make one-to-one mobile technology a reality for all students, the academic potential and impact can be very powerful while potentially closing the gap of the digital divide. The schools that are able to deploy these initiatives will be better suited to meet the requirements of NCLB and develop students to become 21st century learners. As more schools are able to make one-to-one mobile technology a reality the schools that do not have one-to-one mobile technology may be considered as the schools that were left behind.

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Appendix A

Data Access and Use Permission

University of Phoenix®

DATA ACCESS AND USE PERMISSION

[redacted]

Name of Facility, Organization, University, Institution, or Association

Please check mark any of the following statements that you approve regarding the study and data described below:

☑ I hereby authorize Aquil F. Bayyan, a student of University of Phoenix who is conducting a research study titled or described as follows Mobile Technology in Secondary Schools: A Quantitative Ex Post Facto Study access to, and use of, the non-identifiable archival data described as follows: [redacted] Academic Excellence Indicator System (AEIS) Reports provided by the Texas Education Agency (TEA) from 2008-2012 for use in the aforementioned research study. In granting this permission, I understand the following (please check mark each of the following as applicable):

☑ The data will be maintained in a secure and confidential manner.

☑ The data may be used in the publication of results from this study.

☑ This research study must have IRB approval at the University of Phoenix before access to the data identified here is provided to Aquil F. Bayyan

☑ Access to, and use of, this data will not be transferred to any other person without my/our express written consent.

☑ The source of the data may be identified in the publication of the results of this study.

☑ Relevant information associated with this data will be available to the dissertation chair, dissertation committee, school as may be needed for educational purposes.

[redacted] [redacted]

Print Name Date

[redacted]

Signature

Researcher Signature/Acknowledgement

[redacted]

Date

[redacted]

Current version 032012

Appendix B

TEA 2008-2009 AEIS Forney ISD Search Page

http://ritter.tea.state.tx.us/perfreport/aeis/2009/district.srch.html

TEXAS EDUCATION AGENCY

Home | District Locator | Index A-Z | Divisions | School Directory

SEARCH Funding Testing/Account Curriculum Reports News

2008-09 Academic Excellence Indicator System
District Reports

This search will produce the Academic Excellence Indicator System (AEIS) reports for a selected district. You may choose either an HTML report to view online or a print-ready PDF file which can easily be saved to a computer's hard drive, or to any portable media and printed.

If you do not already have it, you will need **Adobe Acrobat Reader** to access a PDF report; we recommend the latest version. If you have any difficulties with accessing these reports, please refer to our **help page**.

1. What type of report format would you like?

- (•) **A)** HTML
- ( ) **B)** PDF - *This format provides a BLANK page after the AEIS cover page to allow for proper double-sided printing.*

2. How do you wish to search?

- (•) District Name (full or partial name)
- ( ) District Number
- ( ) District by County Name (full or partial name)
- ( ) District by Region Number

3. Enter the appropriate name or number:

When entering the district name, do not include the type of district (ISD, CISD). For example, enter Houston, not Houston ISD.
When entering the county name, do not include the word "county."
When entering the region number, use two digits, for example, enter 03 for region 3.
Do not use commas, apostrophes, periods or other symbols when entering text, as this may result in an error.

Enter name or number:
Forney

Continue Clear All

AEIS Glossary | **2008-09 AEIS** | **Performance Reporting**

Texas Education Agency
1701 N. Congress Avenue
Austin, Texas, 78701
(512) 463-9734
Map | Site Policies | TEA Jobs

Complaints
Fraud Hotline
Compact with Texans
Frequently Asked Questions

ESCs
State of Texas
Texas Legislature
Homeland Security
TRAIL

Military Families
Where Our Money Goes
Governor's Committee on People with Disabilities

Appendix C

TEA 2009-2010 AEIS Forney ISD Search Page

http://ritter.tea.state.tx.us/perfreport/aeis/2010/district.srch.html

2009-10 Academic Excellence Indicator System District Reports

This search will produce the Academic Excellence Indicator System (AEIS) reports for a selected district. You may choose either an HTML report to view online or a print-ready PDF file which can easily be saved to a computer's hard drive, or to any portable media and printed.

If you do not already have it, you will need **Adobe Acrobat Reader** to access a PDF report; we recommend the latest version. If you have any difficulties with accessing these reports, please refer to our **help page**.

1. What type of report format would you like?

- (•) **A)** HTML
- ( ) **B)** PDF - *This format provides a BLANK page after the AEIS cover page to allow for proper double-sided printing.*

2. How do you wish to search?

- (•) District Name (full or partial name)
- ( ) District Number
- ( ) District by County Name (full or partial name)
- ( ) District by Region Number

3. Enter the appropriate name or number:

When entering the district name, do not include the type of district (ISD, CISD). For example, enter Houston, not Houston ISD.
When entering the county name, do not include the word "county."
When entering the region number, use two digits, for example, enter 03 for region 3.
Do not use commas, apostrophes, periods or other symbols when entering text, as this may result in an error.

Enter name or number:
Forney

Continue | Clear All

AEIS Glossary | **2009-10 AEIS** | **Performance Reporting**