ATTITUDE TOWARDS ONE-TO-ONE TECHNOLOGY AMONG STUDENT ACADEMIC ACHIEVEMENT IN NINTH GRADE STEM CLASSES

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

Liberty University

2019

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APPROVED BY:

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ABSTRACT

The use of technology is an essential element in the world in which we live. This study is important because schools around the world spend hundreds of thousands of dollars on one-to-one technology integration in the classroom. The purpose of this quantitative correlational study was to determine if a predictive relationship exists between the attitudinal level towards one-to-one technology and student academic achievement of ninth-grade students. A bivariate regression analysis was used to determine if there was a predictive relationship between student academic achievement as measure by EOC scores Algebra 1 and Biology 1 and the attitudinal test scores measured by the PATT-SQ. The attitudinal survey was distributed to 195 participants via Google Docs. The participants for this study were drawn from a convenience sample of one high school located in rural northwest South Carolina who were enrolled in either Algebra 1 or Biology 1, during the spring of the 2018-2019 school year. The regression analysis revealed that attitudinal scores did not predict student academic achievement in Algebra 1 nor Biology 1.

Keywords: technology integration, students' attitudes, one-to-one technology, student academic achievement

Dedication

This dissertation is dedicated to my Lord and Savior Jesus Christ, without Him, I do not exist. I also would like to dedicate this to all of my forefathers, and foremothers who marched, protested, were arrested, and endured countless injustices, so that a black woman such as myself could have an equal chance at opportunities, like any other American. I dedicate this to the Patterson family (my family of origin), the Ishmael family (my in-laws) who have poured into me and made me the person I am today. Last, and certainly not least, this dissertation would not have happened without the support of Gregory- my husband of 24 years, and my two children- Cassius and Breon. These guys always encouraged me and allowed quiet time so that I could complete my studies.

Acknowledgment

First, I would like to thank Dr. Vivian Jones, my dissertation chairperson. The guidance and direction she provided throughout this process made me a more effective researcher. Secondly, I thank Dr. Scott Watson who provided guidance and direction that led to the dissertation phase of my program. Also, Dr. Watson, encouragement made me feel better about this entire doctoral process. Dr. Lisa Foster was another pivotal person along this journey. She took her time and made quantitative research a little less intimidating. When I did not understand, she took time to work with me one-on-one. Dr. John Bartlett left an indelible mark on me from taking his intensive class during Summer 2017. He is the type of principal I hope to be in the very near future. All the professors I had the pleasure of being in your class, I acknowledge your part in my journey. My fellow administrators at Indian Land High School, you ROCK! My church family, Sanctuary Charlotte Church led by Reverend Dr. Percival Reeves, who always encouraged and supported me. Dr. Adrian Mingo, whose simple words "You may as well do it!" gave me that extra motivation to begin this journey. Thanks to all the people who allowed me to interview them for my classes- Dr. Rosa Ishmael, Dr. Lisa Johnson, Dr. Gene Moore, Butch Dutton, Don McCorkle, and David Shamble.

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List of Abbreviation

Assistive Technology (AT)

Bring Your Own Device (BYOD)

Conditional Standard Error of Measure (CSEM)

End of Course Examination Program (EOCEP)

EOC (End of Course)

Information and Communication Technology (ICT)

Individual Education Plan (IEP)

Pupil's Attitude Towards Technology – Short Questionnaire (PATT-SQ)

South Carolina Department of Education (SCDE)

Standard Error of Measure (SEM)

Science Technology Engineering and Mathematics (STEM)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this quantitative correlational study was to determine if a relationship existed between the attitudinal level towards one-to-one technology and student academic achievement of ninth-grade students. The participants in this study were drawn from a convenience sample of ninth-grade students enrolled in Algebra 1 and Biology 1 at a high school in northern South Carolina during the spring 2018-2019 school year.

Background

Technology integration has been occurring in schools since the invention of technology. More recently, however, the implementation of one-to-one technology in schools has become very prevalent (Zargari and MacDonald, 1994). One-to-one technology is an integration technique where each student enrolled in a k-12 school is loaned a device such as an iPad, Chromebook, laptop, or another technological device to use as long as they are enrolled at that particular school (Chan et al, 2006). The researcher is an administrator in a school district which is in its second year of one-to-one technology integration in the classroom. The integration of technology in the classroom has ushered in new and innovative ways to teach and learn in and out of a traditional classroom setting (Hull & Duch, 2018). To understand the push for technology integration in education, one must look at technology in a historical, social, and theoretical context.

History of Technology Integration

Throughout the 1900s, various educators and inventors thought technology would be instrumental in helping young people have a better quality of life, particularly through vocational and technical training. Additionally, these leaders of education reasoned that through the use of

technology and inventions, learning would be more relevant and applicable to daily life (Wirth, 1983; Zargari & McDonald, 1994). Technology integration in the classroom has evolved from the use of the slide ruler, hornbook, and magic lantern in colonial times to students having portable devices they use frequently in the current times (Keith, 2015; Purdue Online, 2018).

In the 1970s, the handheld calculator was introduced and was one of the first forms of one-to-one technology in the classroom; variations of this device are still used today (OurITC.com). The first computer and software for classroom usage were developed in the late 1970s and early 1980s. The Apple Two and IBM computer was specifically designed for classroom and personal use. The computers used a floppy disk and CD ROMs that stored data and had educational games programmed on them that assisted students in learning math, geography, and spelling. These computers and software were revolutionary because the disk could store reference materials such as encyclopedias without the bulk and cost of a traditional set (Keith 2015; OurITC.com, 2018; Purdue Online, 2018).

Although the internet was invented during the 1980s, technology integration into schools did not begin to flourish until the early 2000s, when World Wide Web became easily accessible (Keith 2015). These developments made the world smaller and connected people around the globe. The Internet enabled people to have unlimited access to information. In the classroom, the interactive whiteboard replaced the traditional chalk and dry erase board, bringing teaching to life by enabling teachers to facilitate interactive lessons and engaging activities, play videos, and engage students in interactive lessons.

The 2000s introduced computers that were smaller, faster, affordable, and smarter. These characteristics made technology integration in schools more appealing and realistic. Approximately 1,000 K-12 schools began to experiment with one-to-one technology in the early

2000s. Shortly after the initial one-to-one implementation, the concept began to spread around the country. Maine was the first state to implement the concept of one-to-one technology statewide (Zucker, 2004; Holen, Woei, and Gourneau, 2017).

Numerous devices are used for one-to-one technology integration; Chrome Book and IPad are the most popular devices when schools are implementing one-to-one initiatives. The initiatives are assisting with the digital divide among school children by not only providing them with computers, but also Wi-Fi portable devices that can be used at home (Thinley, Reye, & Geva, 2014; Zakrzewski, 2016).

Technology integration in schools has an extensive history and influence on trends in education stretching, from colonial days with the magic lantern and other primitive devices, to contemporary educational practices that incorporate personal devices and access to unlimited information. Early educators could have never imagined the technological world in which we now live, and today we cannot fathom the world that future generations will live in. There are no limits to the role technology can play in education and making the world a better, more efficient place.

Social Context

Computers and other technological advances have changed the social context of not only the way pedagogy is delivered to students but also the way in which society functions. When technology is considered in a social context, society can be divided into two groups: Digital Natives and Digital Immigrants. Gibbons (2007) stated that digital natives are people who were born during the information age and do not know a life without personal devices and connectivity. Conversely, digital immigrants are people who were born before the technology age but have acclimated themselves to using available technology.

The use of technology in the classroom can be challenging because of the difference in experiences these two groups have had in and out of the classroom with technology. For digital natives, the use of technology is second nature; it is like walking. For some digital immigrants, technology use is not second nature and can be intimidating. Technology integration in the classroom can be more impactful if teachers are given the proper amount of training before the technology is introduced to students. Through training, teachers learn effective ways to use technology to enhance the traditional curriculum. Training also gives teachers confidence that they can properly use new technology and be able to problem solve when faced with an issue or questions from students (Helsper & Eyron, 2010; Wang, Myers, & Sundaram, 2013).

Today's students are accustomed to having answers to all of their questions at the click of a button or through digital virtual assistants like Apple's Siri or Amazon's Alexa. Instead of teachers focusing on how to get a final answer, the focus has shifted more towards critical thinking and processing skills. Computer integration in the classroom has assisted with this shift. Students can use technology to research solutions to real-world problems and get up-to-date research related to the problems (Hur and Oh, 2012).

Technology has also made education accessible to people no matter their location via online learning. Students in K-12 and college can have the same educational advantages as students who are in a traditional brick and mortar classroom. In addition to online learning, classes can partner with schools in different countries to learn about their culture and their way of life. If used correctly, technology and traditional teaching methods can offer students unlimited ways to learn and broaden their content knowledge (Hogan & Strasburger, 2018).

Social media has added many positive attributes to the way in which people communicate. However, the use of social media has created a deficit in communication skills in

specific populations. People are connected twenty-four hours and seven days a week via social media. As an administrator, the researcher has seen the negative consequences of such connectivity. Students sometimes use social media platforms as a substitute for face-to-face communication. Usually, when this occurs, students are more likely to engage in conversation or behaviors that they would not if the conversation was in person. People have harmed themselves and others because of posts on social media. Having technology in the classroom can help students with learning social media etiquette and facilitating discussion surrounding the improper use of technology (Jasso-Medrano, & López-Rosales, 2018; Luxton, June, & Fairall, 2012).

Technology and social media have become an intricate part of society and will only become more prevalent in the future. Because schools are a microcosm of society, it is necessary to make technology a part of students daily classroom lives. One way to accomplish this is by implementing one-to-one technology initiatives. When schools implement these programs, they provide a somewhat level playing field for all students regardless of race or socioeconomic status.

Theoretical Context

There are numerous theories related to the evolution of technology use in the classroom. To support the current study, the researcher is focusing on the following theories: Multiple Intelligences Theory (MI), Expectancy Theory, Maslow's Hierarchy of Needs, and IT's Value Hierarchy. These theories collectively explain why the integration of technology in the classroom may help to address students with different needs.

In his book *Frames of the Mind,* Gardner (2011) proposed the Multiple Intelligence Theory (MI). Gardner stated that students learn in different ways. Instead of studying traditional one-dimensional intelligence, intelligence needs to be evaluated differently. Gardner (2011)

identified eight intelligences that teachers need to recognize when teaching. These intelligences consider students talents, abilities, and values in the classroom. Integrating technology in the classroom, particularly one-to-one technology can address different types of learners and how to design instruction and activities that will address their uniqueness.

Victor Vroom developed the Expectancy Theory of Motivation. This model figures out people's motivation through a certain type of calculation (Parijat & Bagga, 2014). This theory states that based on students' behaviors, actions, and expectations, the teacher can design lessons that motivate students. All people are motivated by something, and, for Digital Natives, technology may serve as a form of motivation. Computer games and activities may be a motivator because students may get instant gratification by completing an activity or task.

In the researcher's it is opinion, Maslow's Hierarchy of Needs is a foundational theory to everything that is relevant in education. Phifer (1998) stated that basic needs in the hierarchy must be met before students can excel. It is virtually impossible to teach today's students without implementing some form of technology. The researcher observes teachers and students daily in a classroom setting. From these observations, it is perceived that technology is essentially becoming a basic need in the classroom. By providing each student with a device that basic technology need is met.

The IT Value Hierarchy was developed based upon Maslow's Hierarchy of Needs. Urwiler and Frolic (2008) discussed the different levels of the IT Values Hierarchy. At the basic level is Infrastructure and Connectivity Needs; the top of the pyramid is paradigm-shifting. Having the infrastructure to connect is a need this theory supports. Having this opportunity to connect digitally allows students to move up the pyramid to reach a point that is called paradigm-shifting, which is similar to self-actualization.

Multiple Intelligence and Expectancy theories, Maslow's Hierarchy of Needs, and the IT Values Hierarchy may explain why technology integration—particularly one-to-one technology—may be beneficial to student academic achievement. Individual school districts spend upwards of millions of dollars on one-to-one technology integration, but are schools receiving a return on their investments? Is technology integration in the curriculum having an impact on student academic achievement?

Problem Statement

This study is important because billions of dollars are spent annually for the implementation of one-to-one technology initiatives in school districts across the country, and the relationship to student academic achievement should be known. Johnson (2012) stated that 56 billion dollars are spent on educational technology, 36% of which is spent on K-12 education, which equates to about $400 per student just on technology. Few specific studies address one-to-one technology implementation, particularly how attitude level towards this technology in K-12 schools relates to student academic achievement. The studies that have been conducted have mixed results related to the effectiveness of one-to-one technology integration in a K-12 school setting.

Harris, Al-Bataineh, & Al-Bataineth (2016) conducted a study with fourth graders to find out if one-to-one technology affects student academic achievement. The results of this study were inconclusive, with little statistical differences. At one test site, one class that implemented one-to-one technology scored slightly higher on an achievement test; however, at another site, the traditional classroom scored slightly higher on the assessment than the one-to-one class.

Lowther, Ross, & Morrison (2003) conducted a study in which 21 classrooms were included in the study, nine controlled classroom and 12 classes with one-to-one laptops. To

measure achievement, the researchers used a writing prompt and problem-solving task. For both measures, the students in the laptop classes scored higher than the students in the controlled classrooms. Teachers in the laptop classes indicated that accessibility to laptops increased students' research skills and engagement.

Holen, Woei, and Gourneau (2017) found that one-to-one integration had a positive impact on high school learning activities. Their study concluded that one-to-one integration also had a positive impact on students' attitude and perception towards learning. These findings may contribute to student academic achievement. However, the study failed to correlate attitudes towards one-to-one implementation to student academic achievement.

With K-12 technology integration, specifically one-to-one implementation, studies are sparse and among those studies results are mixed. School districts are investing billions of dollars in technology integration in school. When investing this type of money for technology integration, districts want student academic achievement to be positively affected. The problem is that all these funds are spent on one-to-one technology integration in schools and little research has been conducted to examine the relationship between students' attitude towards technology and student academic achievement. This study will examine the correlation between students' attitude towards one-to-one technology integration and student academic achievement.

Purpose Statement

The purpose of this quantitative bivariate regression analysis was to determine if a predictive relationship exists between attitudinal level towards one-to-one technology and student academic achievement of ninth-grade students enrolled in Algebra 1 and Biology 1. The predictive variable is students' attitudinal level towards technology; the criterion variable is students' test scores on End of Course (EOC) test in Algebra 1 and Biology 1. The attitudinal

level will be measured by the PATT-SQ questionnaire. The attitudinal level is determined by whether the participant has a positive or negative response to questions on the questionnaire. The End of Course test is given to all students enrolled in foundational classes in English, math, science and social studies. Students can score anywhere between a zero to 100 on EOC tests. The higher the score, the higher the achievement level.

The Significance of the Study

This study adds to the sparse existing body of knowledge of K-12 public school technology integration policies, particularly schools that have implemented one-to-one technology programs. This study will build upon the Harris, Al-Bataineh, & Al-Bataineth (2016) study in which the researchers looked at the correlation between one-to-one technology integration and student academic achievement. These researchers conducted their research on an elementary school level; my research will look at two high schools that have implemented one-to-one technology. There are several factors such as age, the way courses are taught, and student accountability that may have a different influence on student academic achievement than at an elementary school. Also, this research will specifically examine if attitudes toward one-to-one technology relate to student academic achievement.

Hull and Duch (2018) researched the Mooresville Digital Conversion initiative. The researchers used the differences-in-differences strategies to examine the effect of the laptop program initiative on student academic achievement in Mooresville schools. The study looked at test scores before the initiative and after implementation. The researcher also studied if scores increased with the number of years the program was implemented. Part of this study will use some of the methods Hull and Duch (2018) used, but the difference is correlating attitudes towards technology and student academic achievement on the End of Course test.

Cristia et al. (2017) investigated the initiative of one-to-one laptop integration using data collected after 15 months of implementation in 318 primary schools in rural Peru. One of the areas the researchers examined was student academic achievement related to the laptop program. The researchers found that in the classes with laptops there was no statistically significant effect on student academic achievement. Multiple variables were suggested that may have led to these results, including pedagogy, home computer use, and students' comfort level with technology. This aspect of student academic achievement Cristia et al. (2017) studied will be expanded to look at two STEM areas – math and science and how attitudes toward technology can influence student academic achievement in these two subjects

Numerous studies have looked at the correlation between technology integration in K-12 schools and student academic achievement, but none have been found that correlate students attitudes towards technology with student academic achievement (Cristia et al., 2017, Harris, Al-Bataineh, & Al-Bataineth 2016, Hull & Duch, 2018). According to Vroom "persons consciously endeavor or select a specific undertaking that is envisaged to lead to outcomes that are regarded highly by them" (Lazaroiu, 2015, p. 67). If school administrators can measure students' attitudes before one-to-one technology integration, they may be able to be proactive and put programs in place that will improve students' attitudes toward technology. If students' attitudes towards technology are more positive, they will be more open and have higher expectations for themselves regarding the use of devices that may be allocated to them for educational purposes.

Research Questions

RQ 1: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1?

RQ 2: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1?

Definitions

1. Student academic achievement – The level at which students perform in an educational setting (Shahzad & Naureen, 2017).
2. Attitude – Psychological tendencies that are expressed by evaluating a particular entity with some degree of favor or disfavor (Ardies, De Maeyer, & Gijbels, 2014)
3. Differentiated Instruction - teaching students according to the way they best learn (Gregory & Chapman, 2007).
4. Digital Divide – Gaps in computer and internet access (Scheerder, Deursen & Dijk, 2017).
5. Digital Natives – This generation has never been without technology, and it is second nature for them to use technology (Gibbons, 2007).
6. Digital Immigrants – People who were born before 1980 and learned to use computers as adults (Wang, Myers, & Sundaram, 2013).
7. End of Course Examination Program (EOCEP) – The test that students must take if they are enrolled in or Algebra 1, Mathematics for the Technologies 2, English 1, Biology 1, Applied Biology 2, or U.S. History and the Constitution in the state of South Carolina. This test is commonly referred to as an EOC.
8. Multiple Intelligence - states that students learn in different ways and considers the students' values and strengths when teaching them. There are eight different intelligences identified (Gardner, 2011)

9. PATT-SQ Survey- An instrument that measures different aspects of attitudes towards technology in secondary schools (Ardies, De Maeyer, & Gijbels, 2014).
10. One-to-One Technology – In a K-12 school setting each student has their technological device, such as IPad, Laptop, Chrome book (Chan et al., 2006).
11. Student Engagement – refers to how engrossed or attentive students seem to be in their learning or how integrated they are with their classes (Caruth, 2018).
12. Teacher Self-Efficacy - a teacher's belief in their ability to influence certain outcomes (Tilton & Hartnett, 2016).
13. Technology Integration – incorporating the use of technology into the traditional classroom curriculum (Keith, 2015).

CHAPTER TWO: REVIEW OF THE LITERATURE

Overview

Rapid development and new information technologies drive today's educational arena. This growth has led to a need for people to receive more specialized training and skills. The use of technology in education plays an essential role in acquiring knowledge by the student and teacher (Giannoukos, Hioctour, Galiropouloss& Besas, 2007). Modern classrooms are filled with students who are considered Digital Natives. These students were born during the evolution of modern technology. Digital Natives are constantly on their devices connecting with peers that are near and thousands of miles away. Research has shown that the use of technology can be a major influence on teenagers' attitudes towards technology and its use in the classroom (Donate et al., 2017; Dredge, Gleeson, & Garcia, 2014). This review of literature will examine theoretical basis for integrating technology into the classroom, factors that affect the effectiveness of one-to-one technology, and gaps in literature I have found in regards to how students' attitude towards one-to-one technology affects student academic achievement.

Theoretical Framework

Numerous theories have influenced one-to-one technology integration in the classroom. For the sake of this paper, the author will focus on Gardner's Multiple Intelligences Theory (MI), Expectancy Theory, Constructivism, and Maslow's Hierarchy of Needs.

Multiple Intelligences (MI)

Most teachers have at least one student in their classroom who is disengaged and has an apathetic attitude towards school. Gregory and Chapman (2007) stated "Students differ from one another in size, shape, and social development. Teachers can no longer teach 'the lesson' and hope that everyone gets it" (p. 4). Most of the time these students are apathetic because the

teaching methods the teacher is using is not connecting with the students. How else would one explain that when observing a child in one class they are asleep, staring out the window, or fidgeting discreetly with their phones; however, in another class, the same child is up, active and fully participating? The difference could be the teaching delivery of the teacher. In his book, *Frames of the Mind*, Gardner (2011) proposed the Multiple Intelligences Theory (MI). This theory states that students learn in different ways and considers the students' values and strengths when teaching them. There are eight different intelligences identified by Gardner: Linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist. Armstrong (2009) stated, "To provide a strong theoretical foundation Gardner sets up certain basic tests that each intelligence had to meet to be considered a full-fledged intelligence and not simply a talent, skill, or aptitude" (p. 8). Gardner used eight factors to establish the criteria for intelligence.

This theory is important in technology integration in education because it addresses different learning and teaching methods. Integration of technology and particularly one-to-one implementation is theoretically based on MI because it seeks to address the different learning style and interest of all students and seeks to address what today's students understand, which is technology.

Expectancy Theory

All students are motivated by something, and educators have spent countless hours trying to figure out how to motivate seemingly unmotivated students. Victor Vroom developed the Expectancy Theory of Motivation. This model figures out people's motivation through a certain type of calculation (Parijat & Bagga, 2014). The Expectancy Theory is grounded on four assumptions: 1) a person's previous experiences dictate expectations, 2) a person's conduct is a

consequence of choices, 3) individual requirements are distinct to their expectations, 4) individuals will make choices based on personal goals (Lazaroiu, 2015; Parijat & Bagga, 2014). Therefore, the Expectancy Theory says that effort or motivation = E x I x V. The relationship between effort and performance is known as Expectancy (E). The relationship between performance and rewards/work outcomes is known as Instrumentality (I). Last, the relationship between rewards/work outcomes and personal goals is known as Valence (V).

> Vroom claims that persons consciously endeavor or select a specific undertaking that is envisaged to lead to outcomes that are regarded highly by them. Persons influence their sense on the likelihood that their undertaking will generate specific outcomes and the appeal of the outcomes. (Lazaroiu, 2015, p. 67).

Simply stated, this motivation theory suggests that people are motivated by what they see as beneficial and self-gratifying. There is no doubt that high school students enjoy being connected and value the familiarity of technology being used in classrooms as part of the curriculum. Because of their familiarity, students may be motivated to complete assigned tasks and be a participant in their learning.

Maslow's Hierarchy of Needs

Maslow's Hierarchy of Needs is a foundational theory for education. This theory is often referenced when discussing student motivation and need. Maslow's Hierarchy of Needs begins with the basics of food, clothing, and shelter; the top of the hierarchy is self-actualization. Between these two needs are safety, belonging, and esteem (Phiefer, 1998). As needs are met, students are equipped and motivated to aspire to higher needs. The IT Value Hierarchy has been developed based on Maslow's Hierarchy of Needs. Urwiler and Frolic (2008) discussed the different levels of the IT Values Hierarchy. At the basic level is Infrastructure and Connectivity

Needs, the top of the pyramid is paradigm-shifting. In between those two needs are stability and security needs, integrated information needs, competitive differentiation, and paradigm-shifting. School administrators who implement one-to-one technology are seeking to advance students on both hierarchies (Skelsky-Guest, 2014; Urwiler & Frolic, 2008). The figures below have many similarities, and both are crucial in meeting technology needs and students' needs in a school. Just as Maslow's highest need was for individuals to self-actualize, the IT Hierarchy highest

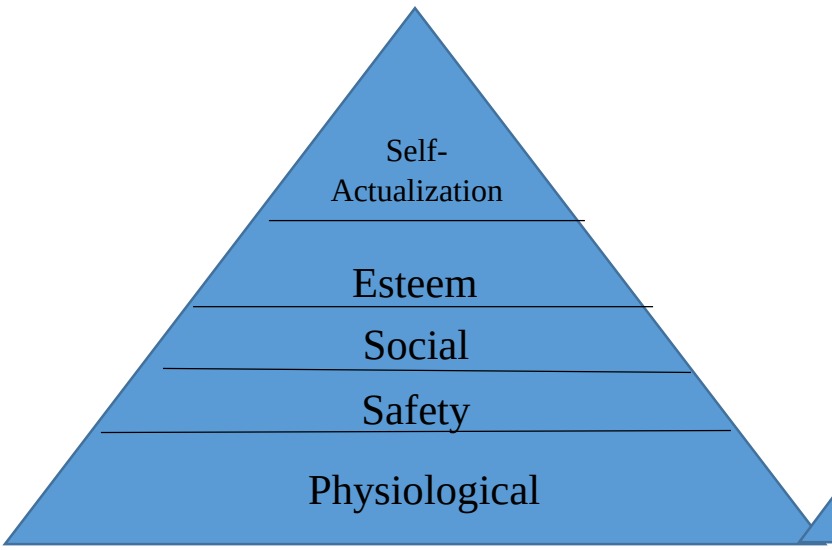

Figure 1 Maslow's Hierarchy of Needs

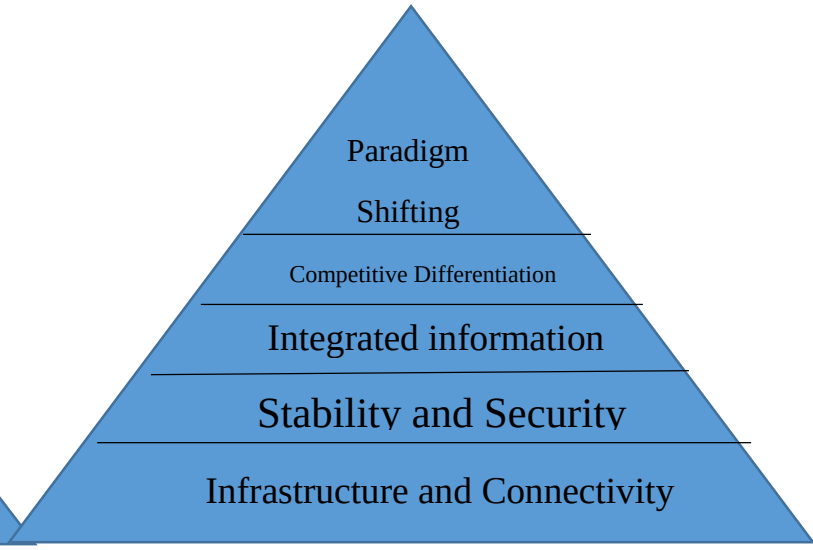

Figure 2 IT Values Hierarchy

need is shifting paradigms or the way people incorporate IT. In implementing one-to-one technology, school district administrators are trying to change the concept of accessibility of technology to provide devices for all students, not just those student who can afford them.

Constructivism

Bofill (2003) stated that Constructivism places a significant role in the student's environment in learning. Students use their previous experience and knowledge to make meaning of current information. Learning activities within the Constructivism framework are discovery learning, inquiry learning, exploration, and hands-on learning. Technology use, especially in

Problem Based Learning (PBL), is helpful in giving students the tools they need to help instruction make sense (Bofill, 2003; Manganello, 2010; Wilson, 2012).

Wilson (2012) stated the following about Constructivism: (a) learning is an active process of meaning-making based upon previous experiences and interactions; (b) learning activities are created out of conflict and challenges which results in problem solving; (c) learning is social, in that it involves collaboration, negotiation, and participation in organic human exchanges; and (4) learners should take responsibility for their learning. Using technology helps students to make sense of learning by hands-on approaches to discovery. One-to-one technology particularly provides differentiated instruction for students and allow them to use the device in a way that enhances teacher instruction (Bofill, 2003; Dimock & Boethel, 1999; Wilson, 2012)

The four theories mentioned in this section are essential for understanding technology integration in the classroom, particularly when it comes to one-to-one technology. Gardner's Multiple Intelligences (MI) theorize that students learn in different ways. By implementing technology, students with different learning styles can learn in a way to address their needs. Vroom's expectancy theory states that students are motivated by what they see as gains for their experiences. Students are Digital Natives and using one-to-one technology is familiar to them and may motivate them to be more engaged in their learning. In reference to technology, the IT Values Hierarchy was compared to Maslow's Hierarchy of Needs. These two theories suggested that in an organization human needs and technological needs are similar. Last, the Constructivist framework states that learners use computers to help make sense of their learning. This occurs through differentiated learning such as Project Based Learning.

Related Literature

The author's intent was to find articles related to one-to-one technology, specifically students attitude towards technology and the impact on student academic achievement. However, numerous factors lend themselves to students' attitude towards technology which will be examined in this review of the literature. Aspects of technology explored are the history of technology integration in schools; types of one-to-one technology; the difference between Digital Natives and Digital Immigrants; the impact of social media on students' attitudes towards technology; teacher efficacy and the use of technology; Problem Based Learning and technology; and the advantages of one-to-one technology.

History of Technology Integration

Technology integration in schools has been occurring since the invention of technology. For one to appreciate the advances in technology integration, one must understand the evolution of technology use in schools. Long before the invention of modern computers or devices, technology played a key part in educating students. Zargari and MacDonald (1994) stated that early education leaders thought that technology and education could solve most of society's ills by providing new information and using knowledge to design programs.

In colonial times, the slide ruler, hornbook, and magic lantern- (a type of projector) were used as instructional aids. The chalkboard and pencil were invented and used in the classroom around 1900 (Keith 2015; Purdue Online, 2018). During the early 1900s, vocational training utilized technology to improve skill sets of students. John Dewey was instrumental in making vocational training available to students. He and his colleagues, David Snedden, and Charles Prosser, saw themselves as part of an education reform movement. The movement challenged

the traditional way of educating students, to making education more relevant to changing students' socio-economic plight in life (Wirth, 1983; Zargari & McDonald, 1994).

Technology integration began to flourish during the 1900s. In 1920 the radio was made available to students who were within range to receive lessons. The overhead projector and ballpoint pen were introduced during the 1930s; twenty years later videotapes, the photocopier, and the skinner testing machine expanded teaching methods and delivery. The early 1970s brought about a shift in classroom tools by offering scantrons and the first form of one-to-one technology with the introduction of the handheld calculator (OurITC.com). The Apple Two was designed specifically for classroom use in 1977. The computer used floppy disks which were programmed with games to help students learn math and geography. IBM made the first personal computer in the 1980s, and the CD ROM was brought into education. These two inventions were revolutionary because a large amount of data such as an entire set of encyclopedias and video and audio files could be saved to a disk. The CD ROM was the precursor to the floppy disk and flash drives (Keith 2015; OurITC.com, 2018; Purdue Online, 2018).

During the 1990s technology grew exponentially. The Internet was made available to the general public in the mid-1990s. Before releasing to the public, the internet was only used for NASA, educational institutions, and the military. Initially, the internet was accessed through a slow dial-up connection to a LAN telephone line. Eventually, the internet became more user-friendly, and the broadband connection was available through the Ethernet in a building. Today the internet is available via Wi-Fi which enables users to be connected regardless of location. The interactive whiteboard became a classroom necessity during the 1990s and remains a classroom staple today. In modern times, computers have become faster, smaller, and more

affordable. I-Pads and similar devices were also made popular in the 2000s (Keith 2015; OurITC.com, 2018; Purdue Online, 2018).

To understand and appreciate one-to-one technology in the classroom, one must realize the major advances that have occurred since the beginning of formal education. To progress from the slide ruler, magic lantern, and hornbook in colonial times to laptops, YouTube, and I-Pad is truly ingenious. As current generations look at technology from the 1900s as archaic, future generations will look at technology from current times in a similar fashion. The evolution of technology has changed the way the world operates. At one time communities were as large as the people they communicated with face-to-face. However, now a community can be expanded to people in different countries, with different cultures, and different ideas.

Historical Role of Teaching and Modern Teaching

Early educators/philosopher such as Confucius, Plato, and Aristotle believed that existing educational institutions and teaching reflect the belief system and values of the dominant political, social, and economic group or class that benefits from maintaining the status quo (Gutek, 2011, p. 36). The author believes this statement supports traditional teaching methods and roles. The role of a teacher was very distinct during the foundational years of public education. Teachers were the sole authority figure and source of information in the classroom. Teachers were the ones with the knowledge that students needed to learn. Students respected teachers' authority and did not challenge their beliefs, ideas, or teachings. The traditional teacher could be more focused on teaching the child and did not have to concern themselves with the issues students bring to the modern classroom.

Maslow's hierarchy of needs is more prevalent in education today than perhaps it ever has been. Students enter the school building with needs that some could not conceive. In

addition to assisting students with basic needs, teachers are teaching a generation of digital natives. These digital natives have access to information at all times. This access is a blessing and a curse. A blessing because students can gain knowledge, have access to all types of educators, and use their research skills to find answers to questions they may have. A curse because teachers have to sometimes mediate the drama that is produced as a result of social media, messages, and other platforms.

Whereas in the past teachers were the sole source of information in a classroom, 21st Century teachers are more of facilitators in a classroom. Teachers still have distinct expertise and knowledge, but their role is to help students to become seekers of knowledge and use their problem-solving skills and prior knowledge to answer questions and solve problems. The integration of technology has assisted students in their seeking and formulating ideas in the classroom. Last teachers must be able to engage students and hold their attention. This generation of students is accustomed to stimulation and entertainment at their fingertips 24 hours a day. Teachers must develop differentiated teaching strategies that will appeal to this generation of digital natives (Helsper & Rynon, 2010).

King David in the bible stated that there is nothing new under the sun. The same goes for teaching. Digital natives still have the same basic needs as students before electricity was invented. The need to be nourished, supported, uplifted, and feel wanted. From the researcher's experience, these needs are what students long for. Yes, teachers are in the classrooms to help students become better, brighter, and perhaps more enlightened, but paramount to all of this is the relationship the teacher establish with students. Although technology has revolutionized education, it cannot replace relationships that are established between students and teachers.

One-to-One Technology Initiatives

The 2000s have brought about technology that is easy to use, affordable, and useful in enhancing the classroom teaching and learning environment. Technology has changed the way people communicate, learn, and how people spend their time. The classroom is no exception. The majority of classrooms in the United States are equipped with electronic devices, and most students have access to their devices at all times. Chan et al. (2006) stated there are six characteristics of one-to-one technology devices: portable, socially interactive, customized to individual needs, context-sensitive, and connective.

At the beginning of the 2000s, a few K-12 schools begin slowly implementing one-to-one initiatives; in the following years, the concept spread across the United States (Zucker, 2004). Holen, Woei, and Gourneau (2017) stated that in the year 2000 there were about 1000 schools that implemented one-to-one technology, and a few years later Maine was the first state in the United States to implement the initiative statewide. Presently, numerous states and particularly schools have implemented one-to-one programs all over the country (Holen, Woei & Gourneau, 2017; Zucker, 2004).

An array of devices have been part of the one-to-one initiatives including Chromebooks, IPads (Tablets), and some schools have implemented Bring Your Own Device (BYOD). Chromebooks have claimed nearly half of the K-12 market for one-to-one devices. Jesdanun (2017) reported that Chromebooks share of the United Stated educational market was 49%. Chromebook's popularity is limited to K-12 education and Macs, and Window laptops are still popular on college campuses and schools abroad. There are numerous reasons cited for Chromebook popularity in public K-12 schools. First, they are easier for classrooms to share;

second teachers can observe students' screens, and limit apps and sites students can access; last, Chromebooks are inexpensive compared to other devices, and they are durable (Jesdanun, 2017).

IPads are the second most popular device for one-to-one initiatives. In 2015 according to Habler, Major and Hennessy (2016)

> Ipads and other forms of tablets are used because they feature the integration of several components and sensors, e.g., Global Positioning System (GPS) and built-in camera] within a single device, typically with a touchscreen, no built-in keyboard or mouse, lightweight, (at least nominally) good battery life and at a comparatively low price compared with other traditional computing devices, (p 140).

However, Thinley, Reye, and Geva (2014) reported that in schools, mobile devices are being used to deliver information, but barely used to engage students actively in the learning process. The authors also report that some of the disadvantages to using a tablet as opposed to a laptop is that the screen size is smaller, the battery life is shorter, and the device is more prone to damage. IPads are primarily used on college campuses as opposed to K-12 schools (Thinley, Reye, & Geva, 2014; Zakrzewski, 2016).

A slowly moving trend in K-12 schools for one-to-one devices is Bring Your Own Device (BYOD) programs. Bruder (2014) stated that the premise behind BYOD in schools is that children who use technology in which they are familiar will be encouraged to participate and engage in the educational environment. Some of the concerns are that students will abuse the privilege of having access to a device during school hours by trying to maneuver ways around firewalls and other preventive services. Usually, if a school has a BYOD policy, devices are provided to students who do not have a personal device.

It is pertinent to know the type of devices that are used in a K-12 setting to gauge the effect on student academic achievement. Chromebooks have cornered the market on one-to-one devices in the K-12 arena. However, IPads also make up a significant portion of the devices. BYOD is a move that is gaining momentum in schools across the United States. One-to-one integration of technology in schools is a noble idea. However, schools cannot distribute technology without support, training, and a plan for effective use. As students become technically savvy, more technology integration will occur in K-12 schools and school leaders must be thoughtful and frugal in using taxpayers' money in implementing the technology.

Digital Divide

Deursen and Dijk, (2011) defined the digital divide as gaps in computer and internet access. Often the cause of this divide is the lack of financial resources for school-aged children (Eiseman, 2018). Warf (2018) identified five types of digital divides—global, urban-rural, gendered, ethnic, and age. Warf (2018) suggested that discussing the digital divide "Helps to make visible, that which is invisible, i.e., access to cyberspace, (p. 6). "Former President Bill Clinton coined the phrase digital divide in the mid nineteen nineties. Between 1991 and 1996 the ownership of personal computers increased from 300,000 to 10 million in the United States. This rapid growth in the use of computers and technology have led to those without access to lag behind those who do have access. Unfortunately, students who do not have access are often members of racial and ethnic groups, particularly African-Americans and Latino Americans (Eiseman, 2018; Huffman, 2018).

Serrano-Cinca, Munoz-Soro, and Brusca (2018) went further in expanding the concept of the digital divide to people who do not have cellular phones internet access. Serrano-Cinca, et al. (2018) also discussed concepts called "digital capability divide", and "digital outcome divide".

These concepts not only addressed the issue of the lack of access to technology, but also the lack of knowledge people have in using technology and how one can use technology to help them access services that are provided online such as e-commerce, e-Government, and online shopping services. The importance of computers and the internet cannot be underestimated in the world in which we live. Tasks as simple as completing a college or job application require the use of the internet. Students are particularly dependent upon technology to complete school assignments. Yes, students can use technology during school hours or visit the local library, but implementing initiatives such as one-to-one technology in schools level the digital playing field for impoverished students (Bach, Wolfson, & Crowell, 2018; Deursen & Dijk, 2011; Huffman, 2018).

The benefit of access to technology in education is substantial. Not only can technology be used as an educational tool, but a resource for information. In education, students can use technology to write papers, complete homework, conduct research, and complete online classes. Additionally, special student populations such as English as Second Language students and students with disabilities can benefit from assistive technology (Bach, Wolfson, & Crowell, 2018; Deursen & Dijk, 2011; Huffman, 2018; Starke, 2018).

In the school in which the researcher works, Rosetta Stone is used as a tool to teach students how to speak English. This program is downloaded to each students' Chromebook which allows them to practice speaking English in the evenings and on weekends when they are home. Allowing students to have this program on their school-issued devices, not only assist the student, but the ESL student can use the program to help their parents learn English.

Students with an Individual Education Plan (IEP) can use Assistive Technology (AT) and Information and Communication Technology (ICT) to help them read, write, and complete tasks

in a school similar to their regular education peers. Unfortunately, because this technology is expensive, some special education students do not have access, which creates a digital divide. However, there have been innovations in inexpensive or free AT and ICT that are available online. Students who have a school-issued computer can download many of these programs that will assist them in completing educational tasks (Mavrou, Meletiou-Mavrotheris, Kärki, Sallinen, & Hoogerwerf, 2017; Starke, 2018).

Even with the implementation of technology in education, students need to understand the significance of the digital divide in the United States and worldwide. Warf (2018) recommended six ways to teach children about digital divides and how it affects people's lives: (a) Map internet access worldwide. This visual will show students the disparity in internet access, (b) Interview a non-internet user. This gives a firsthand, personal account of the effect of the divide, (c) Explore with students the differences in access between rural residents and urban inhabitants, (d) Ask students to be an internet nonuser for a day. Then discuss their feelings, and limitations they may have experienced, (e) Develop strategies on the way students can address the digital divide in their communities, and last (f) Ask students to contemplate life before the internet era.

Any initiative that can assist with gaps in education by under-served groups adds to a positive school and American culture. However, in attempting to lessen the gap, educational leaders must be aware of some of the social and economic restrictions these students may have outside the school. Awareness of students' needs is one reason it is important to have feedback from all stakeholders including community members who know the culture of each community.

Digital Natives and Digital Immigrants in the Classroom

Gibbons (2007) stated numerous labels could be ascribed to students who attend high schools. These labels include Digital Natives, the Net Generation, the Google Generation, the iPhone Generation, Generation Z, and the list continues. This generation has been saturated with different types of technology and gadgets since infancy. Helsper and Eynon (2010) concluded that because this generation has never been without technology, they process information differently than Digital Immigrants. Furthermore, Digital Natives are accustomed to receiving information quickly and multitasking.

The technological age and the presence of Digital Natives in the classroom have changed the way educators think about teaching. Nearly all students have a cell phone and access to a personal computer. This access has created some unique opportunities in the classroom. Some of the opportunities include the ability to obtain an education in any location. Distance and online learning have become prevalent in the education field. Teachers and students can be separated by thousands of miles, but still, be in the same digital classroom. Another opportunity is that research can be completed from any computer with an internet connection. Gone are the days of spending long hours in the library and carrying around cumbersome books to get needed information for a class assignment. Another advantage of being a Digital Natives is the ability to communicate with anyone on earth, regardless of their location (Helsper & Eynon, 2010). Digital Natives live in a time of unlimited access to people and information. If used correctly, technology can improve lives and increase productivity.

Conversely, Digital Immigrants are people who remember having a corded telephone in their homes and thought call waiting was revolutionary. Digital Immigrants were born before 1980 and learned to use computers as adults. The author is a digital immigrant, who can

remember pay phones, collect phone calls, getting a busy signal when trying to make a call, and Mac computers with green screen. Today's technology makes technology just five years ago look antiquated and outdated (Wang, Myers, & Sundaram, 2013).

Unlike Digital Natives, technology and computers are not second nature to Digital Immigrants. Digital Immigrants do not necessarily need a device in their presence at all times to feel connected to others. Most Digital Immigrants enjoy face-to-face conversations and an occasional handwritten note or letter, whereas, some Digital Natives do not know how to write in cursive or address an envelope. These are two skills Digital Natives never had to learn because of email, text messages, and instant messaging (Helsper & Eyron, 2010; Wang, Myers, & Sundaram, 2013).

Wang et al. (2013) stated that the best term to distinguish Digital Natives from Digital Immigrants is digital fluency. Digital fluency can be defined as the ability to reformulate knowledge to express oneself creatively and appropriately and to produce and generate information rather than comprehend it, (p. 410). Miller and Bartlett (2002) identified three components of digital fluency- net savviness, critical evaluative techniques, and diversity. Net savviness is understanding the way the internet works and how to use it as a resource to find information. Critical evaluative techniques involve being able to determine if any internet source is reliable and trustworthy. Diversity is the extent to which online consumption is broad and varied. Digital fluency can be an influential determinant in how a person uses the internet.

The question remains- Do the differences between Digital Immigrants and Natives affect the ability to use one-to-one technology in the classroom effectively? There is not a definitive answer to this question. Christensen, Horn, and Johnson (2011) stated that when companies invent new technology, they are not inventing it with teachers in mind. However, students bring

new technology into the classroom and teachers should have some understanding and familiarity with that technology, even if vague.

Technology and Child Development

Ihmeiden and Alkhawaldeh (2017) stated **"**Children's attachment to technology tools has become a distinctive characteristic of children's groups in modern societies as they are deeply embedded in technology tools and digital media Studies involving the effect of technology on child development have been mixed", (p. 140). Some studies suggested that the frequent use of technology by preschool children can have harmful effects such as attention deficit, hyperactivity, cyberbullying, or physical aggression. Also, preschoolers who heavily used technology showed signs of social anxiety and isolation. The same results have been discovered in older children as well. Adolescents and teens who heavily rely upon technology show deficits in face-to-face communication and expression, in addition to being able to ineffectively socially interact with peers and adults (Adams & Thompson, 2016; Papadakis, Kalogiannakis, & Zaranis, 2018; Ralph & Petrina 2018). Worsley, et al. (2018) stated that problematic internet use could lead to attachment anxiety and avoidance, and depression.

Contrary to the negative effects of technology on school-aged children, there have been some positive findings in regards to technology and child development. Researchers have found that physical, language, cognitive, social, and emotional development have been positively affected by integrating information and communication technology in the early years. Additionally, studies suggest that social media can assist with stressors in school-aged children's lives because they find commonality and comfort with others who are experiencing similar issues (Ihmeiden & Alkhawaldeh, 2017; Kerawal, & Crook, 2013).

Educational games and software can contribute to cognitive and tactile development in children. The American Academy of Pediatric once recommended banning technology for children under four, but now states that if chosen appropriately, educational software could contribute positively to children's development (Cristia, Ibarraran, Cueto, Santiago, & Severin, 2017; Guinta, 2018). Ihmeiden & Alkhawaldeh (2017) study indicated that both parents and preschool teachers expressed a high degree of agreement that technology positively influences child development. The research of technology on child development is still ongoing. There are several extraneous variables such as parental guidance and involvement that can influence whether or not technology has a positive or negative effect on child development. In a school setting, there should be ample monitoring and guiding in the early years when students are learning to incorporate technology in education. In the middle and secondary years, teachers should use technology that will complement the traditional classroom (Hardy, & Castonguay, 2018; Papadakis, Kalogiannakis, & Zaranis, 2018).

Impact of Social Media on Students' Attitudes

As a high school administrator, social media presents one of the greatest opportunities and challenges for students. Social media has evolved into a multi-billion users industry. If one has a phone and they are Digital Natives, chances are they use at least one social media site daily. Facebook alone has 1.65 billion monthly users (Baer, 2018). The year 1997 was the birth of social media. A site called Six Degrees of Separation was formed to connect people to the internet. My Space, the first surge in social media platforms was introduced in 2003. In 2005 Facebook and Twitter were introduced, soon after, social media sites soared. Today there are thousands of social media sites, all are slightly different but connected by the common thread of globally connecting people (Baer, 2018 & Keith, 2015).

Social media affects education every day. The researcher is an administrator at a high school, and every week there is some issue to investigate because of a social media posting. It is relevant to review the impact of social media on students because this impact could also affect the attitude of students towards technology. A recent study of $7^{th} – 12^{th}$ graders found that 80% of those surveyed use social media daily and nearly 50% are on social media two or more hours daily (Alam, Ryu, & Lee, 2017; Hogan, & Strasburger 2018).

Social media has changed the way youth communicate. Instead of face-to-face interactions, teens are settling for screen interactions on sites such as Face Time or Skype. Social media has affected classroom communication. Some students are not able to express themselves effectively verbally because of electronic communication. Social media has contributed to cyberbullying, isolation, pornography, depression, jealousy, and sexting (Hogan & Strasburger, 2018). The excessive use of social media has led to a displacement effect. Because teens and tweens are constantly engaged with a device, they miss out on participating in extra-curricular activities, reading, and in person interaction with friends and families. Czeisler and Shanahan, (2016) indicated that the use of mobile devices during bedtime promotes physiological and social stimulation at a time when the brain needs to shut down for the day. The result is sleep deprived students that may not be as astute and engaged during the school day. O'Neil (2017) found that 40 million American show signs of compulsive technology use. These compulsive behaviors such as texting, chatting, updating social media profile, and surfing the web may be as destructive as other types of addictions such as alcohol or substance abuse.

Unfortunately, there have been some major news headlines of young people harming themselves or taking their own lives because of social media post. Researchers have concluded that suicidal idealization is increased when youth spend a significant amount of time on social

media platforms. Furthermore, depression can manifest as a result of addictions to social media. Social media platforms have been host to cyberbullying and harassment among school-aged children. When conducting a web search on suicide, researchers revealed that half of the topics that were yielded were pro-suicide. This finding shows that there are individuals on the internet that encourage people to consider suicide as an option to their depression, hopelessness, and problems. Impressionable minds may ponder the option of suicide and determine that this is the right solution to their problems (Jasso-Medrano, & López-Rosales, 2018; Luxton, June, & Fairall, 2012; Robinson, Cox, Bailey, & et al. 2016).

Paradoxically, social media can also have positive effects on students. Some of the positive aspects that have been observed are collaboration and tolerance, access to social support networks, health communication and promotion, self-esteem and well-being, and feeling a sense of connectedness and belonging. Robinson, Cox, Baily, et al. (2016) conducted a systematic review of social media and suicide prevention. The researchers discovered that some social media sites are developed specifically for the purpose of suicide prevention. Other sites are designed so that they can reach and identify those who are contemplating suicide, and that youth and adolescents use some of the sites to seek peer support. The study also found that there are few people who went online to find a suicide partner or seek suicidal methods.

Teachers and school leaders must take the time to discuss appropriate and inappropriate social media use. Conversations must take place that will explore the long-term effects a social media post may have on one's life and the lives of others. If used productively, social media can bring about positive results in youth and adolescents. It can also compliment classroom lessons (Czeisler and Shanahan, 2016; Hogan & Strasburger, 2018).

Teacher Efficacy and the Use of Technology

Tilton and Hartnett (2016) stated that teachers play a crucial role in the successful implementation of new technologies in classrooms. Teachers' beliefs and attitudes towards technology have been linked to subsequent adoption and integration. Teacher efficacy means a teacher's belief in their ability to influence certain outcomes. Teacher efficacy judgment in technology is influenced by four main sources of information–mastery, coaching, modeling, and interactions with students. Teachers mastering certain types of technology will increase their confidence when students are using new or familiar technology.

Danielsson, Burg, and Lidel (2018) suggested that the power that teachers hold in the classroom and mastering technology concepts, leads to the most effective use of technology in the classroom. When teacher master concepts they are not afraid to be creative with implementing technology in their lessons, which yields a better result for their students. When teachers master concepts, this leads to teachers feeling confident in coaching students on technology. Teachers who coach their students are not afraid of appearing incompetent in technology use. They are able to step in when students have questions and are able to guide students who are not using technology effectively. Mastery and coaching lead to teachers modeling how to use technology effectively. One-to-one devices are not left sitting idle in the classroom. Teachers use them to introduce concepts and use to enhance the lesson. Teachers displaying these characteristics are more likely to influence their students in a positive way towards technology (Caprara, Pastorelli, Regalia, Scabini, & Bandura, 2005; Smerdon et al., 2000).

Some teachers have embraced new technology and incorporated it into their lessons. Teachers who have a high sense of technological self-efficacy are more likely to examine their

practice, and not place the responsibility on students to learn about the technology being used (Kopcha, 2012). These teachers recognize that they have to meet students where they are to make lessons more interesting and that some technology integration is needed. Savvy teachers know that technology can be a hook for despondent students. Particularly, when teachers use some games such as Quizzlet, Classroom Jeopardy, or other computer-based games, otherwise disengaged students will participate. Hur and Oh (2012) referenced several studies that stated that computer-based learning was just as effective as or more effective than traditional learning methods.

However, some teachers have not fully incorporated technology into their classroom. Heath (2017) stated that "Teachers are the linchpins of educational initiatives including one-to-one initiatives and teachers who are more self-actualized and have a greater sense of efficacy ... take action and persist in the effort required to bring about successful implementation" (p 88). Some teachers do not eagerly integrate technology into their lessons because of limited knowledge of the technology and not wanting to appear inept in front of their students. Christensen, Horn, and Johnson (2011) discussed the evolution of technology and how that influenced society. The authors stated that when companies invent new technology, they are not inventing it with teachers in mind. Because technology is geared towards younger people, some teachers have a difficult time learning how to use and integrate it into their classrooms. Therefore schools must take the responsibility to train teachers in the use of technology. When teachers are properly trained in technology before integrating it into the curriculum, teacher efficacy is increased.

Teacher efficacy regarding technology can serve as an impediment or a catalyst to integrate technology. 75% of the teachers in K-12 schools are Digital Immigrants, while their

students are Digital Natives. There is a perception that Digital Immigrants are resistant to new technology and will underutilize technology if made available to them in the classroom. Because technology can be used improperly, educators must encourage proper use by integrating it in the classroom and school-related assignments. Teachers must also appeal to students' techie side by having meaningful assignments that incorporate technology. Research indicates that the crucial component of increasing teachers' confidence in integrating technology is training. School districts must invest funds and time to teach teachers how to use the costly equipment that is to be made available to students (Giannoukos, Hioctour, Galiropouloss & Besas, 2007; Moritz, 2014). If teachers do not feel confident and competent in the use of technology in the classroom, devices are not used in the way in which they were intended.

Online Instruction

Online instruction has become a viable mode of instruction for many students. Online or distance education first began as correspondence courses in the 19th century, then in the early 20th Century, transformed to educational television, then evolved to web learning in the mid-1990s. As online learning has transformed, so has the type of students who take these classes. Students enrolled in these courses are mostly nontraditional-age students, but also traditional high school and middle school age students take advantage of these online opportunities (Perry & Pilati, 2011; Lervik, Vold, & Holen, 2018).

Student technological self-efficacy has played a large role in the success of students engaged in online learning. Student technological self-efficacy is the belief that the student can perform a certain task using the technology that is available to them (Tekinarslan, 2011). Yang (2012) suggested that students' self-efficacy influences work performance, learning and achievement, and adaptability to new technology.

Online learning requires a special set of skills or capability in order to be successful such as: maintaining a stable internet connection, knowing how to navigate an online program, searching for relevant information to give understanding to the lesson, uploading and downloading relevant information, and chatting with professors and classmates. Success in an online program depends upon students' technology self-efficacy. If students are comfortable with the technology that is associated with the program, they are more likely to be successful in those classes (Krause, 2004; Perry & Steck, 2015; Yang, 2012). Perry and Pilati, (2011) suggested that besides users' comfort, other factors that affect the online learning experiences are similar to a traditional classroom: community, timely feedback, clear expectations, and reasonable chances for success. Community is probably one of the most difficult factors to establish considering students and teachers may never have face-to-face interactions.

Online learning can be used as a stand-alone education method or can be used to complement traditional classroom learning, which is referred to as a "hybrid", or "blended" method. In stand-alone delivery, students and teachers may never meet in an actual classroom, but virtually. In a virtual classroom, students and teacher interact by chatting or video conferencing. Students complete and submit assignments online and are responsible for pacing themselves with assignments. Teachers in a secondary setting have used online learning to enhance differentiated instructional methods such as flipped classrooms, project and problem-based learning, and cooperative learning. The use of technology in these differentiated methods are essential for students' success (Krause, 2004; Yang, 2012, & Perry and Pilati, 2011).

Online learning or E-learning has changed the availability of educational virtually for everyone. In the early form of distance learning, namely correspondence courses, little reverence were given. However, in today's educational arena distance learning is hosted by some of the

most prestigious secondary, and collegiate institutions in this country. Distance learning will continue to attract students because of availability, convenience, and the diversity of programs that are offered.

Differentiated Instruction and One-to-One Technology

Students long for challenging experiences that require engagement, an opportunity to use personal skills (DeLay and Swan, 2014). If these characteristics are absent in classroom instruction students may become apathetic towards school and become disengaged and unmotivated. The integration of technology in the classroom can provide teachers with multiple ways to differentiate instruction during their research. Milman, Carlson-Bancroft, and Vanden Boogart (2014) discovered multiple ways technology was used in differentiated instruction. Following traditional lessons that included paper and pencils, or manipulatives, teachers would use computer apps to complement the formal lesson that was taught. When teachers used computer app based lessons, they would set the lesson at individual levels for students based on their mastery level. Teachers also selected computer apps or websites that featured differentiated content. Students also were able to read e-books on their device based on their literacy level (Ackley, 2017; Milman, Carlson-Bancroft, & Vanden- Boogart, 2014).

Project-Based Learning (PBL) heavily relies on technology use. Galvan and Coronado (2014) stated that Project-Based Learning is when a group of students work collectively on a project over time to create a product that is either in the form of a presentation or performance. Technology is heavily used in STEM (Science Technology Engineering Math) assignments. With well-designed projects, students better comprehend theories coupled with practice. When students engage in projects based on classroom lessons, they tend to remember concepts and can

use them in other classes. Additionally, Project Based Learning prepares students for the real world where one often works in teams to accomplish tasks, (Ozdamli &Turan, 2017).

The flipped classrooms is another differentiation method that heavily utilizes technology and has proven to be effective in engaging students. Wormeli (2006) stated that when thinking about differentiated assessments, teachers need to begin with the end in mind. This is also true when teachers are planning a flipped classroom lesson. The flipped classroom concept, as stated by Bull et al. (2012) places more emphasis on hands-on learning and lectures are replaced with preparation work outside the classroom such as screencast, podcast, video chats and videos. During class time, students are placed in small groups to work cooperatively. Schaffer (2016) conducted a study involving 36 students in eleventh grade US Literature and taught a unit on the Great Gatsby using the flipped classroom model. From this study, Schaffer (2016) concluded that the technological component helped with engagement and motivation; working in smalls groups "drew out" otherwise disengaged students; and all students had a voice, whether inside the classroom or online regarding the lesson.

Yuan and Yu-Ting (2016) designed a study where 181 students in a college engineering program, 77.3 % male and 22.7% female, participated in a flipped classroom model. The results of the study revealed students who were in the experimental group had greater learning achievement, gained more insight and clarification during group discussion, and took more ownership of their learning. In general, the research on flipped classrooms substantiates the findings in these two articles. The flipped classroom instructional method has substantial research to support its effectiveness in student motivation and achievement. Technology provides unlimited ways to differentiate instruction for students.

Technology can be used to complement traditional classrooms lessons, assess students' ability level, allow students who are working on a project together to share and access information from different locations, and develop and design projects that apply theories that have been learned. Technology in the classroom is just as essential as textbooks, paper, and pencils. Technology can open up numerous educational opportunities for students, and teachers should seek ways to use it to meet the varying needs of today's learners.

Advantages and Challenges of One-to-One Tech Integration

Varier et al. (2017) noted approaches to meeting the needs of twenty-first-century learners— enhanced collaboration, communication, digital literacy, and self-directed learning, is to implement one-to-one technology initiatives. Researchers have cited several advantages and room for improvement in implementing one-to-one technology initiatives.

There are several advantages reported in implementing one-to-one technology initiatives. One-to-one technology use creates exploratory and hands-on learning for students. Technology use allows students unlimited access to research and resources that can complement the classroom experience. Students can research topics without having to leave the classroom and go to the media center. Technology also allows for collaboration within the classroom where group projects can be more efficient and productive.

One-to-one technology allows classrooms to be more student-centered than teacher-centered. It is student-centered because instruction can be differentiated based upon students' needs and ability levels. One-to-one technology initiatives also help to lessen the digital divide among students because everyone has equal access to technology; some school districts even provide portable Wi-Fi devices for students' home usage. (Harris, Al-Bataineh, & Al-Bataineh, 2016). Increased efficiency and self-direction is another advantage of one to one technology.

During downtime, students can use devices to complete homework or projects. Instructional time is used more efficiently because teachers do not waste time transporting students to a computer lab for assignments that require technology. One to one technology also enables students to learn technology skills that can be used in life after high schools (Ackley, 2017; Milman, Carlson-Bancroft, & Vanden Boogart, 2014; Varier et al., 2017)

With all educational efforts, some positive aspects and areas warrant improvement. The lack of technical support in schools is cited as a major issue in one-to-one initiatives. Some school districts implement these initiatives without realizing the technical needs for such mass projects. When several hundred students are using technology at the same time all day, bandwidth must allow for such usage. However, bandwidth often does not support mass usage, and the network works improperly or does not work at all (Ackley 2017; Bruder, 2014; Cristia et al., 2017).

Another challenge for one-to-one implementation is the proper use of technology. Often devices are used as glorified pencil and paper. Teachers do not properly use technology because often they have not been properly trained. Kuzo (2015) stated that Media Specialist could be key in a smooth transition to one-to-one implementation. Media Specialists are on-site and have a vast knowledge of technology and software. Media Specialist can serve as trainers for teachers on the proper use of technology (Schrader, 2016; Wang et al., 2013).

One-to-one technology integration can be a valuable complement to traditional instructional methods. However, for schools to receive the maximum impact from technology, teachers must be properly trained and taught techniques on how to use the technology supplied to teachers. Schools districts are spending hundreds of thousands of dollars on technology; it is

necessary for districts to implement practices that will help them get the maximum impact for money that is spent.

Gaps in Literature

Technology can be an effective tool for extending instruction. Students who are known as Digital Natives have a preference and comfort with using technology in the classroom. There are mixed reviews on how one-to-one technology affects student academic achievement. This review of the literature did not discover articles relating to how students' attitude towards technology correlates to student academic achievement. Numerous researchers explained how teachers' attitudes influence the use of technology, and how that attitude is manifested in the classroom. Students' attitudes will be a major determinant in whether technology is used effectively. If students have a positive attitude towards technology, it is more likely they will be open to trying educational concepts that incorporate technology. Schools can be instrumental in shaping attitudes toward technology, by exposing students to positive experiences in integrating technology in the school's culture. Researching attitudinal levels towards one-to-one technology as a prediction of student academic achievement will help to fill a gap in the research literature.

Summary

Technology is a part of daily life for almost everyone. To help students stay competitive and engaged, education must have a technological component. Numerous theories support the implementation of technology in the classroom. Using technology helps to address multiple intelligences in which students learn and interpret instruction. Also, the use of technology can serve as a motivation to help students learn. When technology is incorporated with traditional instruction, it helps students make more meaning out of their learning based on previous experiences.

Furthermore, technology can work as a catalyst to help students take ownership of learning. In the past, pencil and paper were basics in education; today technology connectivity is becoming a basic need. The use of technology should always be based on learning theories and ways it can help students to achieve their educational goals.

This literature review focused on topics that may impact the way in which K-12 students view technology. The first intention of the review was to examine the history of technology integration and look at the historic role of teaching. To appreciate how far technology has advanced, it is necessary to look at the simplicity of technology including the magic lantern, hornbook, and the sliding rulers. When these instructional aides were invented, they were revolutionary for their times. In the same manner, the technology currently used in schools will appear simplistic in the 22nd Century.

One-to-one technology initiatives were transformational in education because the intent was to close the digital divide among students and provide devices for all students regardless of income. There are mixed reviews on whether or not these initiatives increased student academic achievement. However, having these devices has allowed for differentiated learning in the classrooms, and a means for students to do research, exploration, and access educational resources that complement classroom teaching. Teacher efficacy may also play a factor in influencing students' attitudes toward technology. In the classroom, there are Digital Natives-students and Digital Immigrants-teachers. If a teacher has been trained in the effective use of technology, is technologically savvy, and can use technology in a meaningful way, students may have a favorable attitude towards technology. However, if devices are used as a glorified notebook, and teachers are not seeking ways to use technology effectively, students' attitude may be neutral or negative towards technology use.

Social media may also affect the way students view technology. If interactions are positive, and students have numerous connections on social media, students are more likely to enjoy the benefits of devices. Juxtaposed, if students' social media interactions are negative, or they have been a victim of cyberbullying, they may have a negative attitude towards social media. This literature review did not reveal any research that referenced how attitudes of students towards technology correlated with student academic achievement. Numerous articles addressed teachers' attitude towards technology and how it influenced instruction.

CHAPTER THREE: METHODS

Overview

The purpose of this quantitative correlational study was to determine if a predictive relationship exists between the attitudinal level towards technology and student academic achievement of ninth-grade students. This study is important because hundreds of thousands of dollars are spent annually for the implementation of one-to-one technology initiatives in school districts across the country, and the relationship to student academic achievement should be known. The participants in this study was drawn from a convenience sample of high school students enrolled at a high school in northern South Carolina during the spring 2018-2019 school year. The sample size consists of 111 ninth and tenth-grade students who are enrolled in Algebra 1, and 84 ninth and tenth-grade students enrolled in Biology 1.

Design

A quantitative correlational design will be used in this study since the purpose of this study is to look at the predictive relationship between the criterion variables (Algebra 1 and Biology 1 achievement), and the predictive variable (attitudinal test scores). Because a correlational study uses statistical analysis to explore the relationship between variables, it is appropriate for this study.

Research Questions

RQ 1: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1?

RQ 2: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1?

Null Hypotheses

$H_0$1: There is no significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1.

$H_0$2: There is no significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1.

Criterion Variable (CV): Algebra 1 and Biology 1 End of Course (EOC) test scores

Predictor Variables (PV): Attitudinal Level on the PATT-SQ

Participants and Setting

The participants for this study were drawn from a convenience sample of one high school located in rural northwest South Carolina who were enrolled in either Algebra 1 or Biology 1, during the spring of the 2018-2019 school year. This population is a convenience sample because the author works in the same school district from which the sample was chosen and was granted access to needed data. A bivariate regression analysis will show if there is a significant predictive relationship between the population's attitude towards technology and test scores on the End of Course Exams for these classes (Borg, Borg & Gallman, 2007; Yezbick & Tutty, 2017). Students enrolled in Algebra 1 and Biology 1 are predominantly ninth-grade students, but tenth-grade students were enrolled as well.

The sample included 111 students enrolled in Algebra 1, and 84 students enrolled in Biology 1. The sample for Algebra 1 was comprised of 61 males, 50 females, 73 Caucasian students, 29 African Americans students, two Latino American students, and two that are designated as multiple races. The sample for Biology 1 was comprised of 41 males, 43 females, 59 Caucasian students, 20 African Americans students, two Latino American students, and three that are designated as multiple ethnicities, and one Asian student. For this study, the total sample

size was 195. This sample size follows the advice of quantitative research scholars (Warner, 2013). This sample size also exceeds the minimum number of participants required for bivariate regression analysis (Gall, Gall, & Borg, 2007). This sample size also exceeds the required 66 students to meet the minimum for a medium effect size with the statistical power of 0.7 at the alpha level $\alpha = 0.05$ (Gall et al. 2007).

The school in this study is located in a rural setting in the school district. The graduation rate is around 84%, 70% of graduates attend a two or four-year college, the poverty rate is around 50%, and over 90% of students are Caucasian Americans, the total student population for the school is around 700. The school operated on a four by four block schedule which meets 90 minutes a day, five days a week for a total of 90 days of classroom instruction per class. Before the 2017-2018 school year, End of Course tests was administered in a computer lab, but with the implementation of one-to-one technology during the 2017-2018 school year the test was administered in the teacher's classroom with each student using their school-issued Chromebook. The End of Course test was not timed.

Instrumentation

Two instruments were used in this study- The PATT-SQ to measure attitudes towards one-to-one technology and South Carolina End of Course (EOC) test to measure student academic achievement. In 1984, research was done in the Netherlands to determine the attitude and concepts of technology held by students' ages 12-15, the instrument that was developed to measure this was the Pupil's Attitude Towards Technology (Incantalupo, Treagust, & Koul, 2014). However, since its inception, the instrument has been revised. The original instrument was extensive with over 150 questions. In 2012 the instrument was revised and named the revalidated PATT-SQ survey. The revised instrument consists of 25 five-point Likert scale

questions which measure six factors of attitudes towards technology: interest in technology, boredom with technology, perceived difficulty of technology, technical career aspirations, perceived consequences of technology, and belief about gender differences (Ardies, Demaeyer, & Gijbels, 2013).

For the purpose of this study, the researcher identified five items on the survey that was used to determine students' attitudes towards technology. These five items directly relate to attitudes of students towards technology. The five items are:

1. There should be more education about technology.
2. Technology lessons on my *one-to-one device are important.
3. If there was a school club about technology, I would definitely join it.
4. One-to-one technology makes everything work better.
5. Technology is very important in life.

*Please note that in some survey items, the word technology may have been replaced with one-to-one technology. The average of the point for these five items will be listed as the students' attitude scores. An attitude score of 5-10 indicates a negative attitude towards one-to-one technology; a score of 11-16 indicates a neutral attitude towards technology, and a score of 17-25, represents a positive attitude towards technology.

All high school students enrolled in Algebra 1 and Biology 1, at the research site completed the PATT-SQ anonymously online. The PATT-SQ has been used in several studies that tested schoolchildren's attitude towards technology (Ardis et al., 2015; Svenningsson et al., 2018; Incantalupo et al., 2014). The Cronbach's alpha was used in measuring internal reliability for each category. The Cronbach's coefficient aim was *a*-value >0.70 as recommended by

(Lovelace & Brickman, 2013). The overall reliability of the instrument is .80 which indicates that the instrument is valid and reliable (Ardis et al., 2015).

This study sought to determine if students' attitudinal scores on the PATT-SQ could predict their achievement scores in Algebra 1 and Biology 1 End of Course test grades. The sample consisted of ninth-grade students at a rural high school that is enrolled in Algebra 1 and Biology 1 classes, n=111 for Algebra 1 and n= 84 students for Biology 1. The PATT-SQ took about 10 minutes to administer. Students' results were be scored and stored in an online database. End of course test grades were obtained from the school's Testing Coordinator. The researcher requested that all identifying information be removed from test scores before receiving. Once obtained the data was entered into SPSS for analysis.

The South Carolina Education Accountability Act of 1998 requires the administration of end of course examinations in gateway courses for which English Language Arts, mathematics, science, and social studies credit is awarded (South Carolina Department of Education, 2015). All students enrolled in classes that have an end of course examination are required to take the test. The grade on the end of the course grade counts for a fifth of the student's final grade in the class. The score is a scaled score and not a percentage of correct answers.

Administration of end of course exams is done online and paper-pencil format. Algebra 1 first implementation was 2003-2004, with baseline data from 2002-2003. The first years of administration for Biology 1 was 2009-2010 with baseline data from the previous year.

Multiple types of reliability indexes were presented by the South Carolina Department of Education (2015). Two measures of the reliability of raw scores and the classical standard error of measurement (SEM) are given. Also, the passing cut scores, the conditional standard error of measurement (CSEM) for raw scores, for scale scores, and measures of decision consistency

were determined. Table 1 reports the reliability coefficients and SEMs. The reliabilities of the total raw scores were computed using the Kuder-Richardson formulas KR- 20 and KR-21. The KR-21 reliability coefficient was used in computing the CSEM for the raw scores in Table 2

Table 3.1. Reliability Coefficients

Reliability Coefficients of Raw Scores					
Administration	Number Of Item	Number Of Test Takers	KR-20	KR-21	Classical SEM
Algebra 1/Mathematics for the Technologies 2					
FALL 2014	50	8,003	0.859	0.847	3.948
SPRING 2015	50	51,360	0.894	0.883	3.810
SUMMER 2015	50	153	0.850	0.840	4.026
Biology					
Fall 2014	60	13,111	0.912	0.909	4.402
Spring 2015	60	41,528	0.915	0.909	4.334
Summer 2015	60	90	0.890	0.883	4.918

Note. Adapted from the South Carolina Department of Education EOCEP, 2015, *Table 7.1: Reliability coefficients of raw data*. Retrieved from Office of Assessment, Division of Innovation and Effectiveness. (2015). South Carolina end of course manual: Operational test technical report. Columbia, SC: South Carolina Department of Education.

The scale score CSEM at the passing cut score was computed by the conditional standard error of the Rasch ability cut score. The scale score CSEM is defined as the reciprocal of the square root of the test information function at the point on the ability continuum that corresponds to the scale score cut (South Carolina Department of Education, EOCEP, 2015). Table 2 presents both the raw score and scale scores CSEMs.

Table 3.2. Conditional Standard Errors of Measurement

2014-2015 EOCEP Conditional Standard Errors of Measurement

Administration	Raw Scores	Scale Scores
Algebra/Mathematics for the Technologies 2		
Fall 2014	3.289	4.418
Spring 2015	3.301	4.385
Summer 2015	3.314	4.452
Biology		
Fall 2014	3.825	4.520
Spring 2015	3.748	4.442
Summer 2015	3.767	4.464

Note. Adapted from South Carolina Department of Education EOCEP, 2015, *Table 7.2: 2014-15 EOCEP conditional standard errors of measurement*. Retrieved from Office of Assessment, Division of Innovation and Effectiveness. (2015). South Carolina end of course manual: Operational test technical report. Columbia, SC: South Carolina Department of Education.

When student performance is reported in a pass or fail category, a reliability index is computed regarding the probabilities of consistent classification of students, as specified in standard 2.15 in *Standards for Educational and Psychological Testing* (AERA, APA, and NCME 1999). Table three presents a summary of agreements between the operational test classifications—that is, the percentages of students who would be consistently classified in the same category (pass or fail) on two equivalent administrations of the test. The consistency index for the passing score is computed for each administration (South Carolina Department of Education, EOCEP, 2015).

Table 3.3. EOCEP Consistency Index for Passing Scores

2014-2015 EOCEP Consistency Index for Passing Scores

Administration	**Consistency Index**
Algebra/Mathematics for the Technologies 2	
Fall 2014	0.914
Spring 2015	0.913
Summer 2015	0.853
Biology	
Fall 2014	0.904
Spring 2015	0.904
Summer 2015	0.848

Note. Adapted from the South Carolina Department of Education EOCEP, 2015, *Table 7.3: 2014-15 EOCEP consistency index for passing scores.* Retrieved from Office of Assessment, Division of Innovation and Effectiveness. (2015). South Carolina end of course manual: Operational test technical report. Columbia, SC: South Carolina Department of Education.

> Three types of validity evidence are reported for the algebra test forms: test content, item fairness, and internal structure. Evidence of content validity is presented in the item content distribution across domains and the alignment of the current year's EOCEP test items with the state content standards. Evidence of item fairness is examined with the information on differential item functioning (DIF). Evidence of internal structure is provided in correlations among content domains (South Carolina Department of Education EOCEP, p. 32, 2015).

The South Carolina academic standards were used to develop all EOCEP items. All items were reviewed for bias and differential item function (DIF). DIF statistics provide information regarding relative group performance at the item level for gender and ethnic comparisons while controlling for ability. Once an item is flagged for a significant DIF, judgment is used to determine whether the difference in difficulty shown by the DIF index is unfairly related to group membership. The DIF index statistic does not necessarily indicate bias but shows the strength and weakness in the test groups. The Mantel-Haenszel (MH) chi-square for dichotomous items was selected for detecting DIF (South Carolina Department of Education EOCEP, 2015).

Based upon the DIF Statistic, items were separated into one of three A-C categories- negligible, intermediate, or large DIF. When the assessment was constructed, all items analyzed with DIF including the flagged ones were reviewed and approved by the South Carolina Department of Education. Flagged items were only approved after closed examination by a team

at the SCDE. Please see Table 4 below for a summary of Differential Item Functioning (DIF) (South Carolina Department of Education EOCEP, 2015).

Table 3.4. Differential Item Functioning

Summary of Differential Item Functioning for Operational Items

Administration	Cat	Whites/African-Americans			Males/Females		
		Alg	Bio	Eng	Alg	Bio	Eng
Fall 2014	A+	24	21	26	31	26	31
	A-	23	36	29	18	30	22
	B+	0	0	0	0	3	3
	B-	3	2	1	1	1	1
	C+	0	0	0	0	0	0
	C-	0	1	1	0	0	0
Spring 2015	A+	21	22	30	32	30	28
	A-	26	32	23	17	27	26
	B+	0	0	3	0	2	0
	B-	3	5	0	0	1	1
	C+	0	0	0	0	0	0
	C-	0	1	0	1	0	1

Note. Adapted from South Carolina Department of Education EOCEP, 2015, *Table 8.5: Summary of differential item functioning for operational items*. Retrieved from Office of Assessment, Division of Innovation and Effectiveness. (2015). South Carolina end of course manual: Operational test technical report. Columbia, SC: South Carolina Department of Education.

Procedures

Upon receiving approval of the dissertation proposal by the dissertation committee, and the Institutional Review Board (IRB), data collection began. Permission has been procured from the high school principal to conduct this study at his high school. The researcher has also procured permission from the principal to have access to spring 2019 EOC test scores in Algebra 1 and Biology 1 and the results of the PATT-SQ, both are considered archival data because the school already administer both instruments.

Survey distribution began during the Spring 2019 semester by the Tech Coach at the high school. Once approval was received from all entities, the researcher was granted access to the data. A Google form that has the questions from the PATT-SQ instrument was created. The Tech coach advised each teacher when the survey would be administered to their classes. The administration period for the PATT-SQ will be the same as the End of Course test for each class (approximately a week). Participants were from three sections of Algebra 1, and three sections of Biology 1 that were offered at the school. During the weeks of administration, students completed the PATT-SQ once they finished taking their EOC exam. Directions were given to students by their teacher. All students were directed to the teacher's Google Classroom page where they could access the survey. Students completed the surveys on their Chromebooks. Total administration of the survey did not exceed 10 minutes. Once the surveys were anonymously completed they were stored in a Google document, and the tech coach submitted results to the researcher. Surveys were anonymous to secure truthfulness and students' privacy.

The principal designated the school's testing coordinator to electronically submit EOC test scores to the researcher. The testing coordinator removed names from individual test scores to secure privacy for each student. EOC scores were submitted to the researcher the following fall, once proper approval was secured. Data was entered and analyzed in SPSS. Each participant was assigned a numerical code to ensure anonymity.

Data Analysis

A bivariate regression model was used for data analysis to examine the relationship between the predictive variable (attitudinal scores) and the criterion variables (EOC scores). Bivariate regression analysis involves analyzing two variables to establish a predictive relationship between two continuous variables. More specifically, it will let the researcher (a)

determine whether the bivariate regression analysis between these two variables is statistically significant, (b) determine how much of the variation in the criterion variable is explained by the predictive variable, (c) understand the direction and magnitude of any relationship, and (d) predict values of the criterion variables based on different values of the predictive variable, (Laerd, 2015, p. 1).

A bivariate regression analysis has seven assumptions that must be considered. The first and second assumptions are that there is a continuous predictive variable and a continuous criterion variable. If these two assumptions are not met, bivariate regression analysis is not the appropriate model to use. The third assumption is that there needs to be a linear relationship between the independent and criterion variable. A straight line indicates a linear relationship. A curvy or no line indicates that there is not a linear relationship. The fourth assumption is that there should be independence of observations that can be checked using the Durbin-Watson statistic. Errors and residuals need to be independent in Bivariate regression analysis. If they are not independent, they often are referred to as correlated. In essence, this means that one residual cannot provide any information about another residual. There should be no significant outliers is the fifth assumption of a bivariate regression analysis. A visual scan of a scatter plot will be used to determine if there are outliers. Outliers can have a detrimental effect on the regression equation and statistical inferences; and a large effect on the variability of residual which affects normality and homoscedasticity, which contributes to less accurate predictions, and significant effect on the line of best fit (Warner, 2013).

The next assumption is that the data need to show homoscedasticity. Homoscedasticity is important because it indicates that the variance of errors (residuals) is constant across all the values of the predictive variable. The seventh and final assumption is to check that the residuals

(errors) of the regression line are approximately normally distributed. Normal distribution can be accessed by a histogram (with a superimposed normal curve) of the standard residuals, and the Kolmogorov-Smirnov can be used to test normality because the sample size is greater than 50 (Laerd, 2015).

CHAPTER FOUR: FINDINGS

Overview

The purpose of this quantitative correlational study was to determine if a predictive relationship existed between attitudinal level towards technology and student academic achievement of ninth-grade students enrolled in ninth grade STEM classes of Algebra 1 and Biology 1. The PATT-SQ was used to measure attitudes towards technology, and End of Course test scores was used to measure student academic achievement. Chapter four begins with the researcher discussing the descriptive statistics of the data set. The researcher concluded the chapter by reporting the results of the data collected. This included listing each hypothesis and results of the hypotheses.

Research Questions

RQ 1: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1?

RQ 2: Is there a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1?

Null Hypotheses

$H_0$1: There is no significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1?

$H_0$2: There is no significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1?

Criterion Variable (CV): Algebra 1 and Biology 1 End of Course (EOC) test scores

Predictor Variables (PV): Attitudinal Level on the PATT-SQ

Descriptive Statistics

Descriptive statistics for the criterion variable End of Course test grades for Algebra 1 and scores on the PATT-SQ can be found in Table 4.1. N=111 students enrolled in three sections of the Algebra 1 class.

Table 4.1. Descriptive Statistics

	Mean	Std. Deviation	N
Algebra 1 EOC	68.26	12.221	111
PATT-SQ Score	14.45	4.229	111

Results

Data screening

Data screenings were conducted on the predictor variable attitudinal level, and criterion variable Algebra 1, regarding data inconsistencies and outliers. The researcher sorted the data in each variable and scanned for inconsistencies and data errors. No inconsistencies were identified. Scatter plots were used for the criterion variable to detect if there were any outliers. Three outliers were identified and removed. See figure 3 for Scatter Plots.

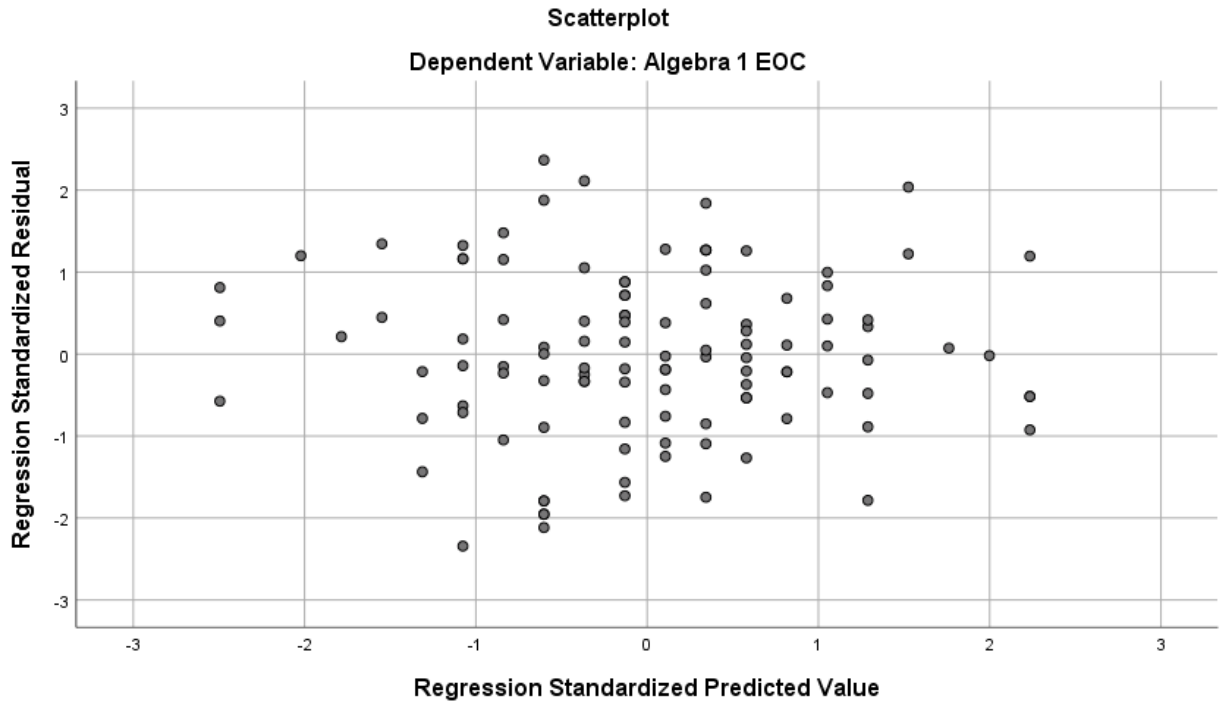

Figure 3. Scatter Plot for Algebra 1 End of Course Test

Assumptions

Assumption Tests 1 and 2- Continuous independent and criterion variables

The predictive variable of attitudinal scores are measures on a likert scale of 0-5, and the criterion variable of student academic achievement is measured on a scale of 0-100. The data for both the independent and criterion variable meets the criteria of being continuous, so assumption tests were continued.

Assumption Test Three – Linear relationship between dependent an predictive variables

A scatterplot of attitudinal scores and Algebra 1 student academic achievement was plotted. Visual inspection of this scatterplot indicated a non- linear relationship between the variables. The assumption of linearity is violated but the test is robust enough to continue with the analysis. Additionally, an examination of the box and whisker plot found that some outliers

were present, they were removed and the researcher continued with the assumption tests. See figures 4 and 5.

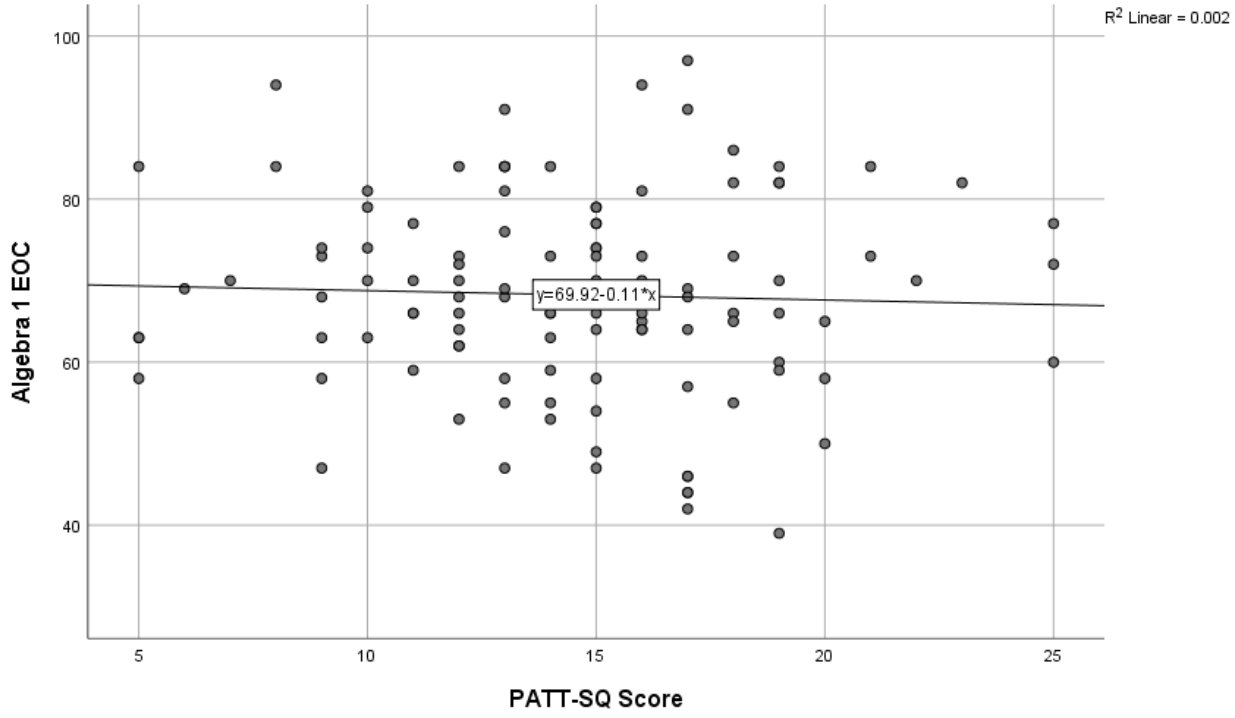

Figure 4. Scatter Plot

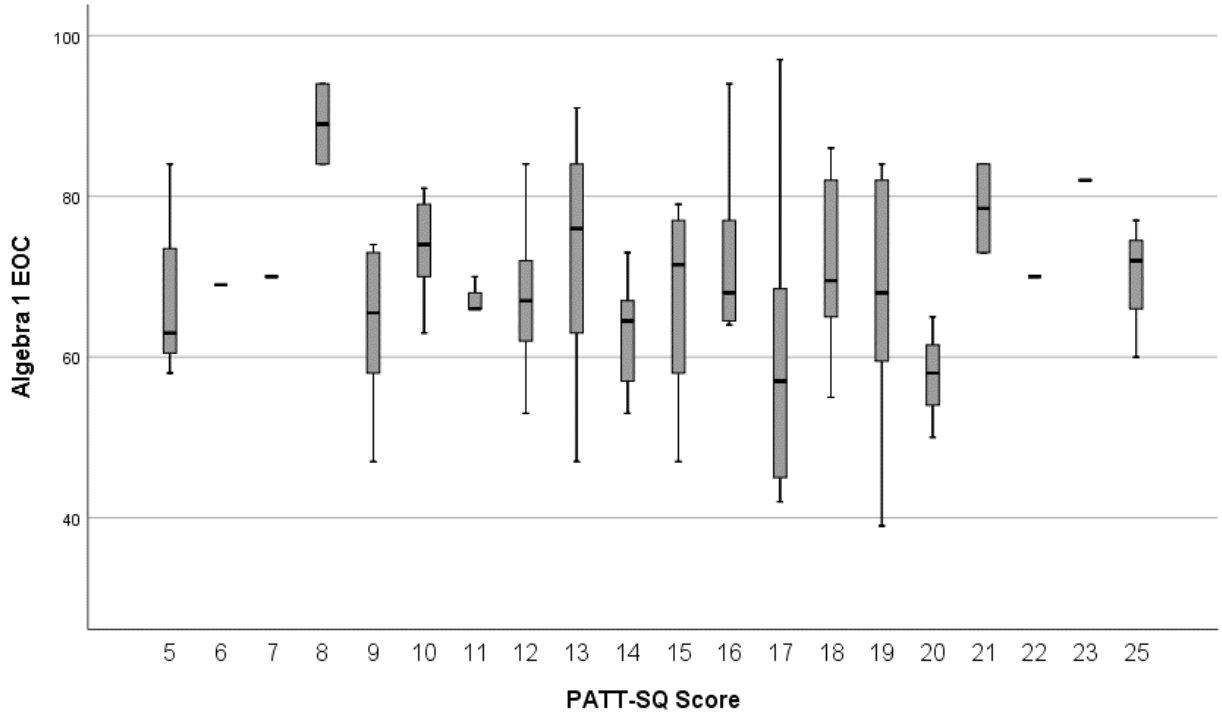

Figure 5. Box and Whiskers

Assumption Test Four- Independence of Residuals

There was independence of residuals as assessed by a Durbin-Watson statistic of 1.707 in Algebra 1. This indicates that one residual cannot provide information about another residual. The Dubin Watson statistic can range from 0-4. This statistic of approxiamately two indicates that there is no correlation between residuals (Warner, 2013).

Table 4.2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	.040[a]	.002	-.008	12.267	1.707

a. Predictors: (Constant), PATT-SQ Score

b. Criterion variable: Algebra 1 EOC

Assumption Test Five Assumption of Bivariate Outliers

An inspection of the box and whiskers plot found three outliers. The outliers were removed and the assumption testing continued.

Assumption Test Six Homoscedasticity

The assumption of homoscedasticity indicates that residuals are constant across all the values of attitudinal scores. There was homoscedasticity, as assessed by visual inspection of a plot of standardized residual versus standardized predicted values. If the residuals were not evenly spread there would be heteroscedasticity which would be indicated by an increasing or decreasing funnel shape. When one scan scatter plot in figures 6-7, one can ascertain that residuals are constant (Laerd, 2015).

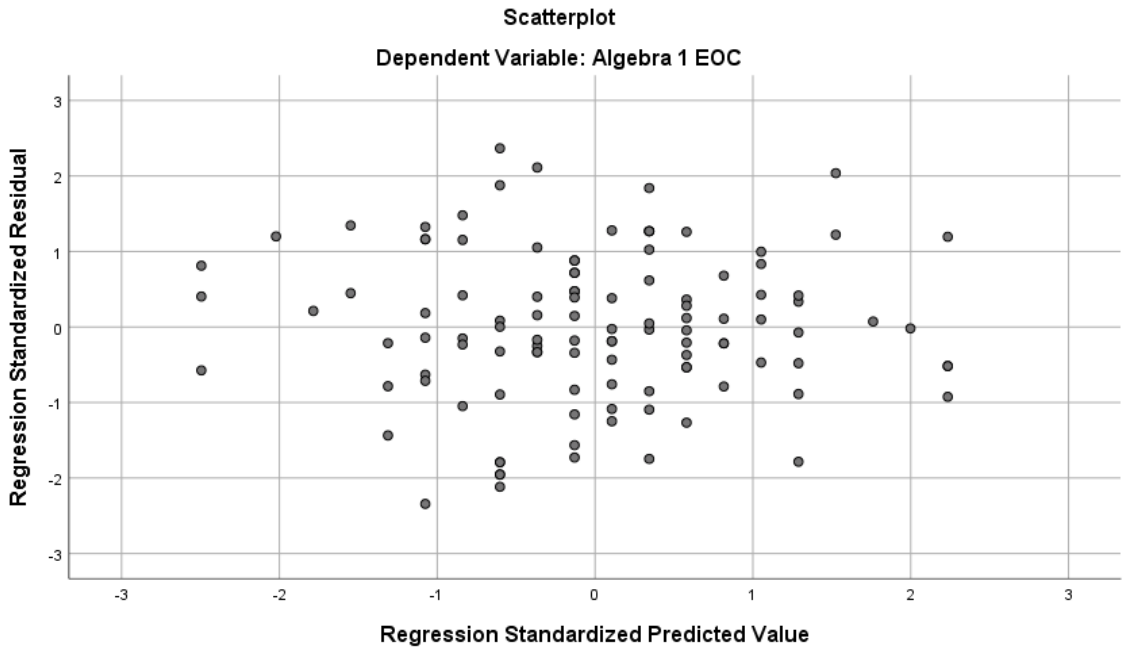

Figure 6. Regression Standardized Residual versus Predicted Value for Algebra 1

Assumption Test Seven Normality of Residuals

Residuals were normally distributed for the criterion variable (Algebra 1, as assessed by the visual inspection of a normality probability plot. See figure 7.

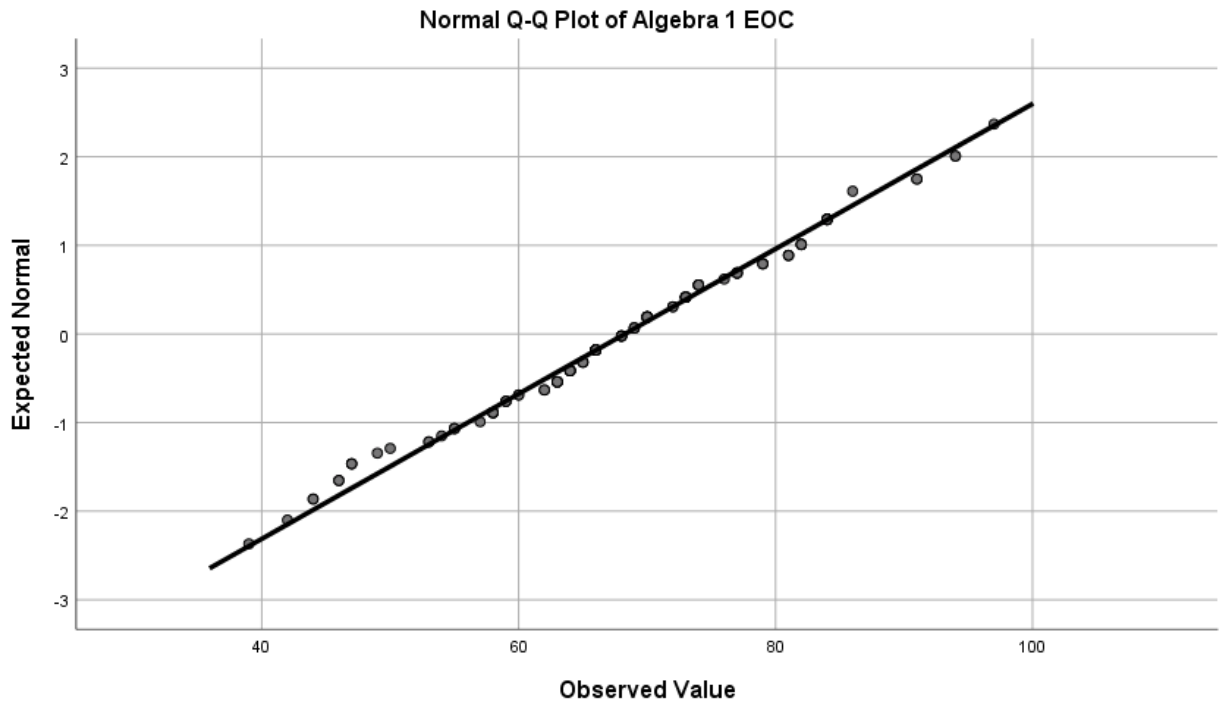

Figure 7. Normality Probability Plots for Algebra 1

The Kolmogorov-Smirnov was used to test normality because the sample size was greater than 50. Test distribution is normal, p >.05.

Table 4.3. Test of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Algebra 1 EOC	.063	111	.200*

The researcher also used a histogram to test normality. Algebra 1 EOC scores had a normal distribution. See figure 8.

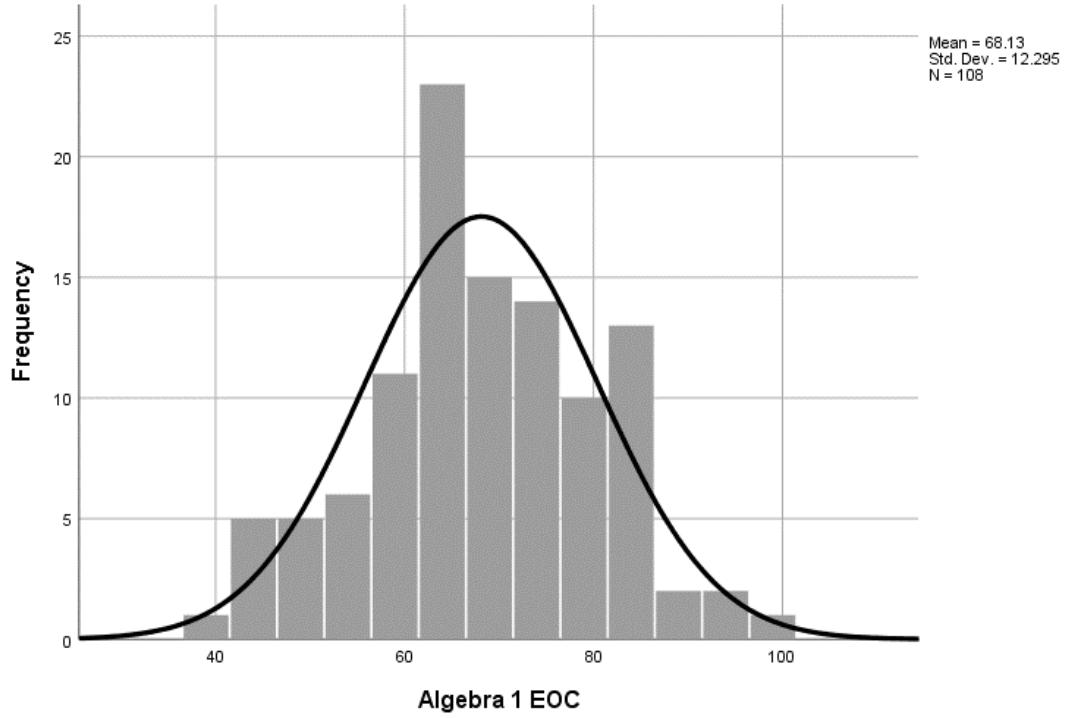

Figure 8. Histogram for Algebra 1.

Results for Null Hypothesis One

Bivariate linear regression was used to test the null that there is not a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1. The researcher failed to reject null hypothesis one at a 95% confidence level were F (1, 109) = .173, p =.679. The variable of attitude towards technology explains 4% of the variability of the criterion variable student academic achievement in Algebra 1. A bivariate regression analysis established that attitudes towards technology did not statistically significantly predict student academic achievement as measured by Algebra 1 EOC scores. The effect size was small .040, (Warner, 2013, p. 208) See table 4.4.

Table 4.4. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.975	1	25.975	.173	.679[b]
	Residual	16403.449	109	150.490		
	Total	16429.423	110			

a. Criterion variable: Algebra 1 EOC

b. Predictors: (Constant), PATT-SQ Score

Hypothesis Two

Descriptive Statistics

Descriptive statistics for the criterion variable End of Course test grades for Biology 1 and scores on the PATT-SQ can be found in Table 4.5. N=84 students enrolled in three sections of the Biology 1 class.

Table 4.5. Descriptive Statistics

	Mean	Std. Deviation	N
BIOLOGY EOC	71.05	14.684	84
PATT-SQ Scores	13.39	3.896	84

Results

Data Screening

Data screenings were conducted on the predictor variable attitudinal level, and criterion variable Biology 1, regarding data inconsistencies and outliers. The researcher sorted the data in each variable and scanned for inconsistencies and data errors. No inconsistencies were identified. Scatter plots were used for the criterion variable to detect if there were any outliers and no outliers were identified. See figure 9 for Scatter Plots.

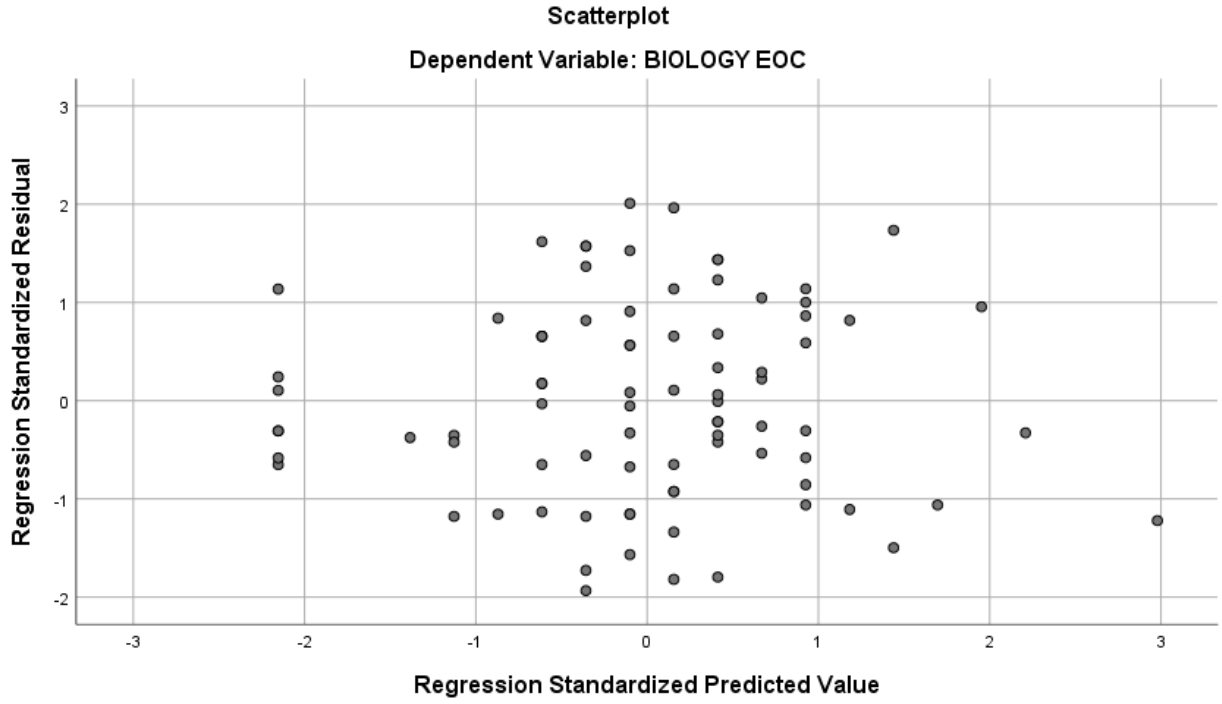

Figure 9. Scatter Plot for Biology 1 End of Course Test

Assumptions

Assumption Tests 1 and 2- Continuous independent and criterion variables

The predictive variable of attitudinal scores are measures on a likert scale of 0-5, and the criterion variable of student academic achievement is measured on a scale of 0-100. The data for

both the independent and criterion variable meets the criteria of being continuous, so assumption tests were continued.

Assumption Test Three – Linear relationship between dependent an predictive variables

A scatterplot of attitudinal scores and Biology 1 student academic achievement was plotted. Visual inspection of this scatterplot indicated a linear relationship between the variables. Because the relationship between attitudinal scores and academic achievement was linear, the assumption of linearity has not been violated. Additionally, an examination of the box and whisker plot found that no outliers were present, so the researcher continued with the assumption tests.

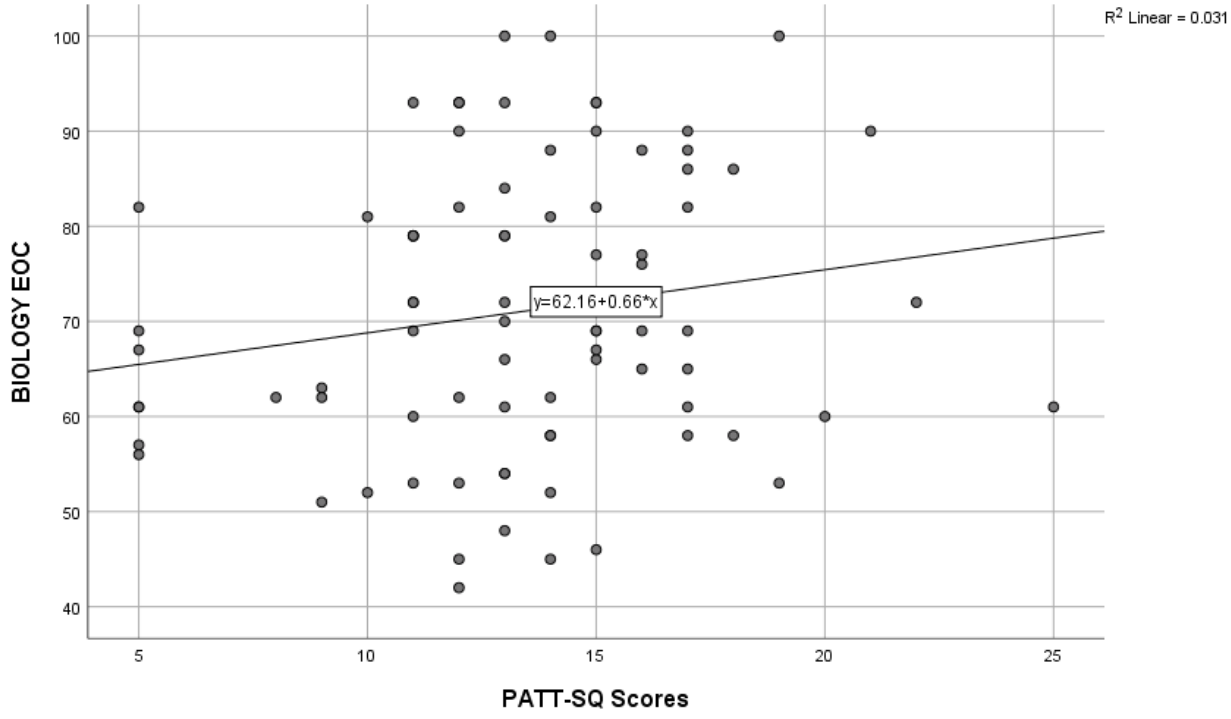

Figure 10. Scatter Plot

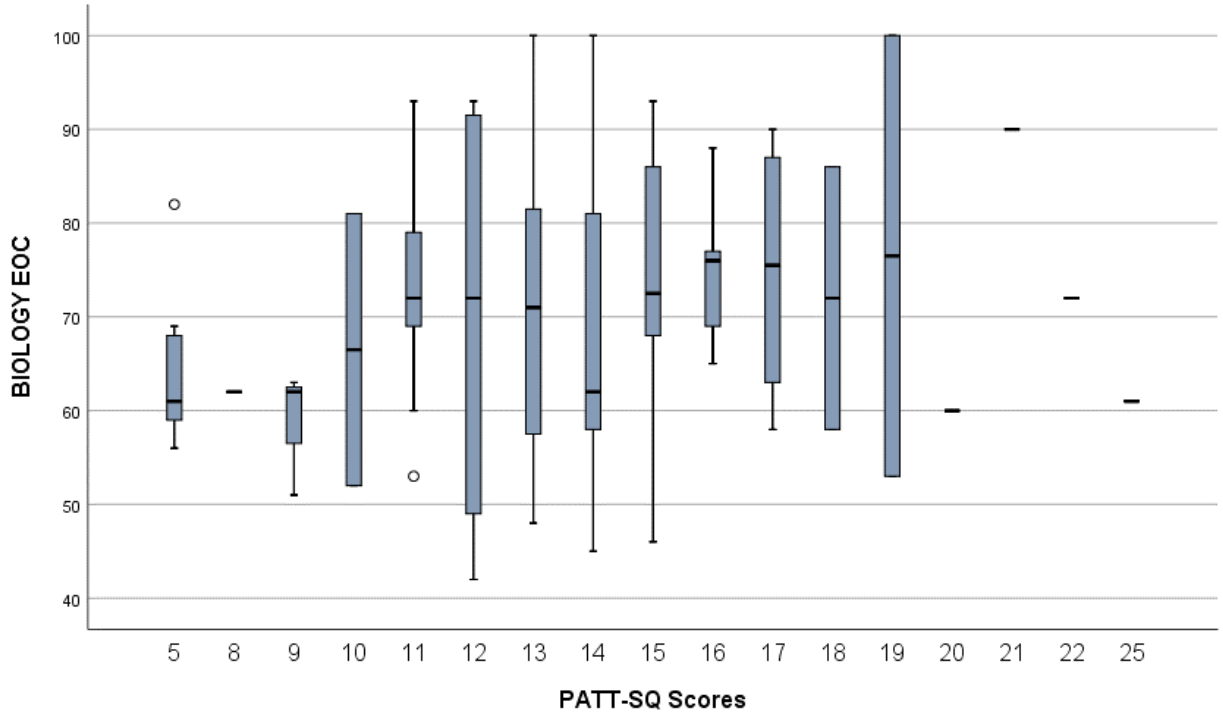

Figure 11. Box and Whisker identifying outliers among Biology 1 EOC and PATT-SQ Scores

Assumption Test Four- Independence of Residuals

There was independence of residuals as assessed by a Durbin-Watson statistic of 1.837 in Biology 1. This indicates that one residual cannot provide information about another residual. The Dubin Watson statistic can range from 0-4. This statistic of approxiamately two indicates that there is no correlation between residuals.

Table 4.6. Model Summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	.176[a]	.031	.019	14.542	1.837

a. Predictors: (Constant), PATT-SQ Scores

b. Criterion Variable: BIOLOGY EOC

Assumption Test Five Assumption of Bivariate Outliers

An inspection of the box and whiskers plot in figure 11 found no outliers, the assumption testing continued.

Assumption Test Six Homoscedasticity

The assumption of homoscedasticity indicates that residuals are constant across all the values of attitudinal scores. There was homoscedasticity, as assessed by visual inspection of a plot of standardized residual versus standardized predicted values. If the residuals were not evenly spread there would be heteroscedasticity which would be indicated by an increasing or decreasing funnel shape. When one scans scatter plot in figures 12-13, one can ascertain that residuals are constant (Laerd, 2015).

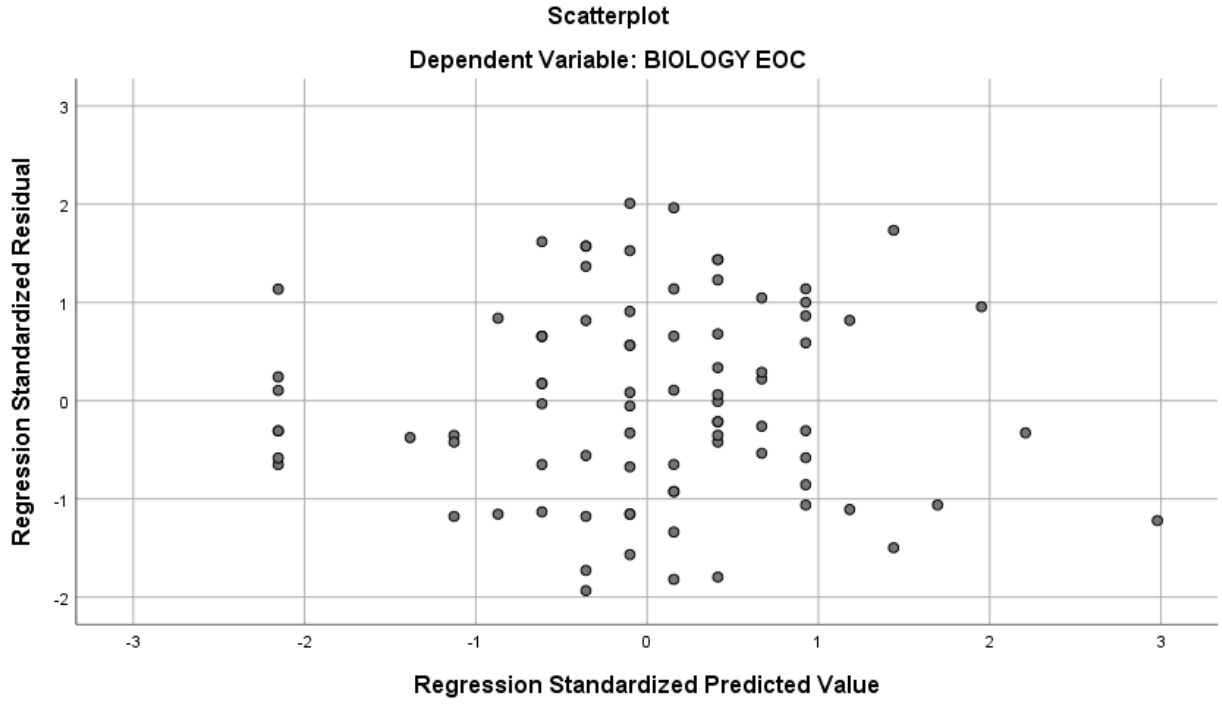

Figure 12. Regression Standardized Residual versus Predicted Value for Biology 1

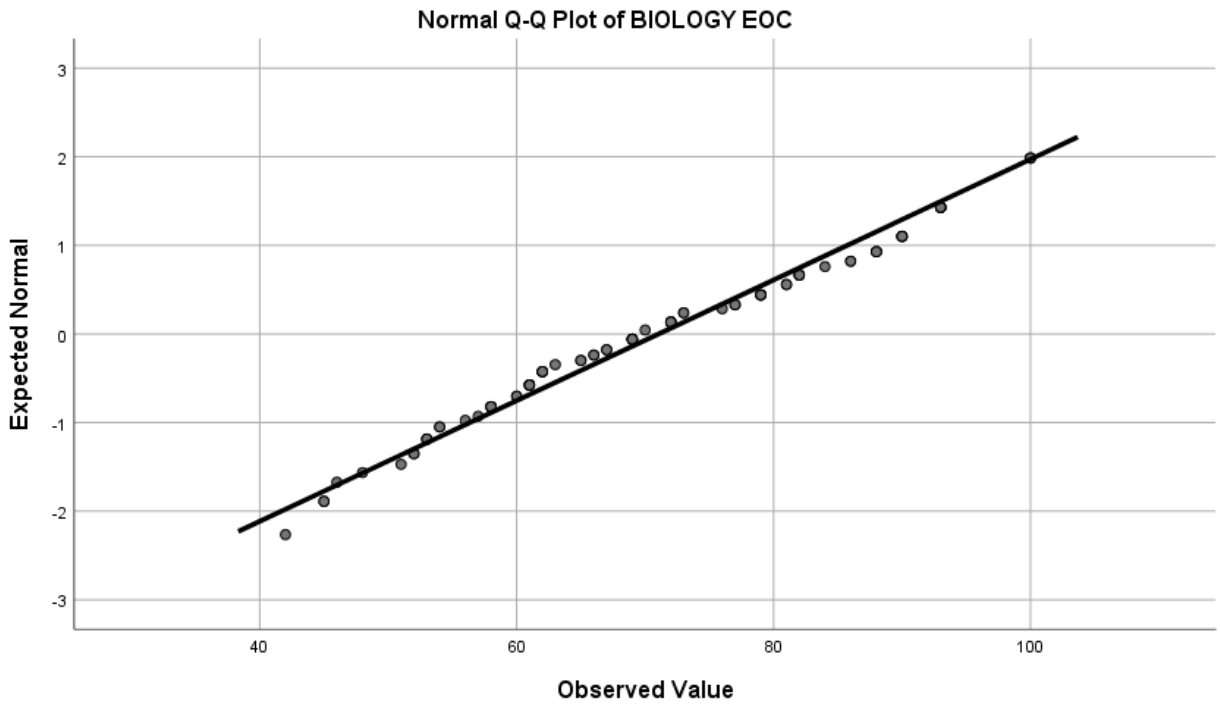

Figure 13. Normality Probability Plots for Biology 1

The Kolmogorov-Smirnov was used to test normality because the sample size was greater than 50. Test distribution is normal, p >05. See table 4.7.

Table 4.7. Test of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
BIOLOGY EOC	.088	84	.153

The researcher also used a histogram to test normality. Biology 1 EOC scores had a normal distribution. See figure 14.

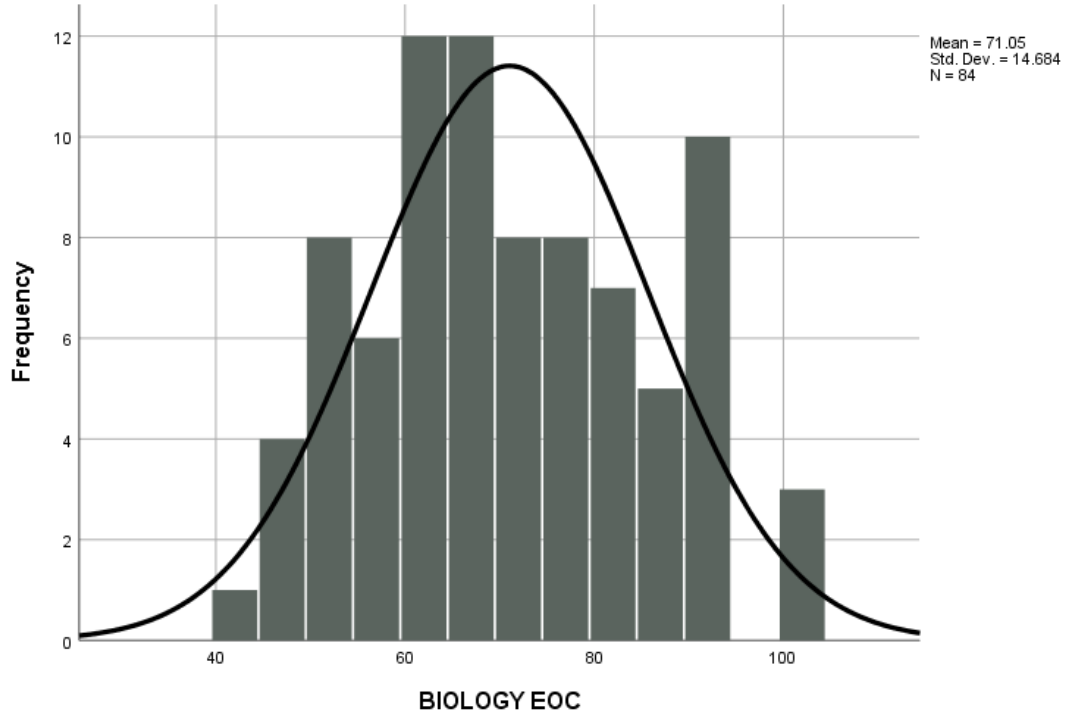

Figure 14. Histogram

Results for Null Hypothesis Two

A linear regression analysis was conducted to test the null hypothesis that there is no significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1. The researcher failed to reject null hypothesis two at a 95% confidence level where F (1, 82) = 2.626, p=.109, the variable of attitude towards technology explains 3.1% of the variability of the criterion variable student academic achievement in Algebra 1. A bivariate regression analysis established that attitude towards technology did not statistically significantly predict student academic achievement as measured by Biology 1 EOC scores. The effect size of .176 was small (Warner, 2013, p. 208). See Table 4.8.

Table 4.8. ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	555.232	1	555.232	2.626	.109[b]
	Residual	17340.577	82	211.470		
	Total	17895.810	83			

a. Criterion Variable: BIOLOGY EOC

b. Predictors: (Constant), PATT-SQ Scores

Conclusion

A bivariate regression analysis was conducted on one predictive variable attitudinal technology scores and two criterion variables, Algebra 1 and Biology 1 End of Course test grades. To access linearity, a scatterplot of attitudinal scores against EOC scores (Algebra 1 and Biology 1) with superimposed regression line was plotted. Visual inspection of these plots indicated a linear relationship between the variables. There were homoscedasticity and normality of residuals (Laerd, 2015). The attitudinal level towards one-to-one technology did not statistically significantly predict student academic achievement in ninth grade classes of Algebra 1 and Biology 1. Based on a bivariate regression analysis, the researcher failed to reject the null hypotheses at the 95% confidence interval between 65.96 and 70.56 for Algebra 1, Algebra 1- $R^2 = .002$, F (1, 109) = .173, p=.679; and a 95% confidence interval between 67.86 and 74.23 for Biology 1, Biology 1 - $R^2 = .031$, F (1, 82), =2.626, p=.109. The result of the regressions indicated the predictor of attitudinal scores showed a 4% variance for Algebra 1 student academic achievement and 3.1 % for Biology 1 student academic achievement.

For attitudinal level in the algebra 1 student academic achievement group, M=14.45, SD=4.229, and N=111. Attitudinal levels of 11-16 indicates that participants had a neutral attitude towards technology. This indicates that the participants in the Algebra 1 student academic achievement group was neutral in their attitudes towards one-to-one technology. The standard deviation of 4.229 is relatively large because it indicates that attitudinal levels among respondents are 4.229 points from the mean of 14.45.

For attitudinal level in the Biology1 student academic achievement group, M=13.39, SD=3.896, and N=84. Attitudinal levels of 11-16 indicates that participants had a neutral attitude towards technology. This indicates that the participants in the Biology 1 student academic achievement group was neutral in their attitudes towards one-to-one technology. The standard deviation of 3.896 is relatively large because it indicates that attitudinal levels among respondents are 3.896 points from the mean of 13.39.

CHAPTER FIVE: CONCLUSIONS

Overview

Computers and other technological advances have changed the social context of not only the way pedagogy is delivered to students but also the way in which society functions. The purpose of this quantitative correlational study was to determine if a predictive relationship exists between the attitudinal level towards one-to-one technology and student academic achievement of ninth-grade students. The criterion variable, attitudinal scores were measured by the PATT-SQ and end of course test scores from Algebra 1 and Biology 1 were used to measure student academic achievement. The results of the bivariate regression analysis will be discussed in this chapter including implications and limitations. Finally, recommendations for future research will be provided.

Discussion

The purpose of this non-experimental quantitative correlational study was to determine if a predictive relationship exists between the attitudinal level towards one-to-one technology and student academic achievement of ninth-grade students. The participants in this study were drawn from a convenience sample of students who were enrolled in ninth grade STEM classes of Algebra 1 and Biology during the spring of 2019, at a high school in northern South Carolina. Students completed a PATT-SQ survey and EOC test for both classes.

The researcher decided upon this study because there were no studies found that examined the impact of students' attitudes towards one-to-one technology and student academic achievement. Johnson (2012) stated that billions of dollars are spent annually for the implementation of one-to-one technology initiatives in school districts across the country, and the relationship to student academic achievement should be known. The school district in which

the researcher works is entering the second year of one-to-one technology implementation without any data to report on the impact on student academic achievement.

The researcher's intent was to examine ninth grade classes that every ninth-grader was required to enroll: Algebra 1 and Biology 1. A quantitative bivariate regression analysis was used to measure the two null hypotheses. The researcher used a linear regression model because it assessed the linear relation between attitudinal scores and student academic achievement in Algebra 1 as measured by EOC scores and the relationship between attitudinal scores and student academic achievement in Biology 1 as measured by EOC scores. This analysis allowed the researcher to determine: If there was a statistically significant predictive relationship between the dependent and predictive variable; how much variation and understand the direction and magnitude of any relationship (Laird Statistics, 2019).

Harris, Al-Bataineh, & Al-Bataineh (2016), stated that in their research they found that one-to-one technology implementation facilitated: student-centered classrooms through differentiated instruction; instruction time was more efficient because students could remain in one place to use technology as opposed to going to a computer lab, and once students completed classroom assignments, they could use their device to complete homework or work on enrichment assignments.

Although the research site in this study was in the second year of one-to-one implementation, based upon the findings, students' attitudes towards technology did not affect student academic achievement. Students rated that technology was very important to them and that one-to-one technology makes everything better, but this positive attitude did not translate into student academic achievement. In the researcher's opinion, one-to-one technology integration should lead to students feeling more positive about technology, which should develop

familiarity and ease of use for students. If students feel comfortable with technology for educational purposes the student-centered and efficient classrooms Harris, et al. (2016) mentioned would be more of a reality than a concept.

Teachers may have a strong influence on students' attitudes towards technology. Heath (2017) stated that technology integration is seen as more favorable if teachers have a positive belief about technology and belief in themselves as technologically capable agents. This current study revealed that nearly 30% of respondents stated that they would rather not have technology lessons on their devices at school. The researcher thinks this attitude may be due to the teacher's position towards technology in the classroom. When teachers are actively using technology in a way that engages students, and the teacher is confident in their ability to integrate technology, students may have a more favorable attitude towards technology use in the classroom.

Fifty-four percent of the respondents in this study suggested that technology was very important in their lives. However, Heath (2017) asserted that although students are digital natives and use technology almost every moment, they have very limited knowledge in using devices for educational purposes. Heath (2017) further stated that teachers provided students with various educational apps to use in the classroom and assumed students could use them with ease, however, in most cases the opposite was true. Heath (2017) mentioned that students are not productive digital natives. They can navigate social media platforms, games, and texting, and are more of social media natives than digital natives. This concept gives credence to the findings of the survey that students think positively towards technology, but it does not translate into academic achievement. When students think about technology, they are thinking more along social lines, than educational.

The research site for this study was concluding the second year of one-to-one technology integration. The first year of integration was trial and error. There were bandwidth issues, technological errors, teachers were not properly trained on how to integrate the technology in their lessons, and the list of issues seemed endless. However, during the second year some of these crucial issues were resolved, albeit not fully. These issues during the formative years could have contributed to the lack of a predictive relationship between attitudes towards technology and academic achievement.

Vaughn (2010) stated that during a six years period, their middle school became a Texas Technology Immersion Pilot (TIP) school. Part of the total immersion plan was to ensure the network infrastructure could support the integration, that software was appropriate and user-friendly, that teachers were trained in not only the software but how to integrate it into their classrooms, they looked at the sustainability and funding for the integration, and last they conducted regular evaluations and assessments. This researcher surmises that perhaps the attitudes towards one-to-one technology and the lack of student academic achievement may have been partly due to the way the technology program was implemented. The TIP program took nearly six years to implement, at the current research site implementation was completed within a few months.

Null Hypothesis One

A bivariate regression analysis was performed to test the null that there is not a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Algebra 1. The researcher found that there was no significant relationship between attitudinal scores and student academic achievement in Algebra 1. The result of the regression analysis indicated that attitudinal scores showed a 4% variance for Algebra 1 student academic

achievement. This low number indicates that attitudes towards one-to-one technology have no effect on student academic achievement.

The researcher expected the variance to be higher, but the study failed to reject the null hypothesis. Students' attitudes toward technology cannot predict student academic achievement based upon Algebra 1 EOC test scores.

Null Hypothesis Two

A bivariate regression analysis was performed to test the null that there is not a significant predictive relationship between attitudinal scores on the PATT-SQ and EOC scores in Biology 1. The researcher found that there was no significant relationship between attitudinal scores and student academic achievement in Biology 1. The result of the regression analysis indicated that attitudinal scores showed a 3.1% variance for Biology 1 student academic achievement. This low number indicates that attitudes towards one-to-one technology have no effect on student academic achievement.

Implications

During the first week in September, an article appeared on the researcher's news feed that suggests parents of school-age children would like to see if the amount of money being spent in technology is really making a difference with student academic achievement. As school districts across the world are investing an increasing amount of taxpayers' money into technology integration, there are questions about the impact this integration is having on student academic achievement.

The researcher decided to research technology integration in school, particularly one-to-one technology because the district in which the researcher works was just beginning to implement one-to-one technology in the form of Chromebooks for all students. This is the

second year of implementation at the school in which the researcher works and with each year the cost is increasing. Although students are responsible for any damage to their Chromebooks, there are still costs associated with maintenance of the Chromebook, increasing bandwidth with Wi-Fi, and buying new protective cases yearly when the devices are redistributed after the summer break.

The researcher was certain the research would prove a significant relationship between attitudes towards one-to-one technology and student academic achievement. However, the results of the researcher's analysis was not in favor of the hypothesis. For both hypotheses, the predictive variable of students attitudes towards one-to one had very little to do with student academic achievement. For five items in the survey, the researcher focused, there were two that resonated. Item four stated, "Technology is very important to me." Students ranked this question highest. The researcher's conclusion is that these Digital Natives were born with a silver iPhone in their hands, instead of a silver spoon. They view technology as an essential part of their lives. But the question is whether students value technology more on a social level or academic level? Do these students have an affinity towards technology, but for more practical reasons?

The second item "One-to-one technology makes everything works better" was a low scoring item. While students regard technology as being important to them, they do not highly regard one-to-one technology usefulness. The explanation for this attitude is that when students think about technology in general, perhaps, social media, personal devices, and communicating with friends come to mind. Conversely, when one-to-one technology is considered, the thought of schoolwork and academics come to mind, which is less appealing to some. Whatever the

reason, students do not hold one-to-one technology implementation in high regards as compared to technology as a whole.

From the researcher's interactions with fellow educators, they have a similar perception of technology integration in schools. Without any real empirical evidence, the belief is that access to technology can be the great equalizer in education and that this access will afford lower socioeconomic students the same advantages (technologically speaking) as students who have means to purchase their own devices. This limited research data suggest that the impact of one-to-one technology integration on student academic achievement is not significant. Perhaps this limited study can be the catalyst for a larger study to examine the impact of technology integration because this present study did not justify the funds that are being spent on this initiative in schools around the world.

Limitations

The first limitation of this study is using high school freshmen as participants. When the researcher analyzed the data and individual questionnaire, some students ranked every question equally, although some of the rankings contradicted each other. This suggests that some students did not take the survey seriously, they rushed through the questionnaire without reading the questions. I chose high school freshmen because they are the only groups of students that are required to take two STEM courses- Algebra 1, and Biology 1, and have a state-mandated end of course test attached to them. But, the researcher thinks due freshmen maturation, they did not see the importance of answering the questions with fidelity. Perhaps high school juniors or seniors may have been better participants.

The courses chosen for this study (algebra and biology) limited the study to a specific population. Expanding the study to students in other courses as well as all levels such as college preparatory, honors, and Advanced Placement level.

The data used in this study was archival. The researcher believes the EOC test data was reliable and appropriate, but the way students responded to the attitude questionnaires may not have been as reliable because of the maturation of the respondents. EOC test scores have a direct impact on students' grade point averages which affects options after high school. The attitude questionnaire has no impact on students, so the motivation to take the questionnaire seriously may not have been present for some participants. For Biology 1 the population size was initially supposed to be almost double. But some of the surveys these students completed did not upload to the Google document, so those students were omitted from the study. Other limitations may could have been the courses chosen for this study (algebra and biology) that limited the study to a specific population; the school level-high school as opposed to middle or elementary schools; and the location of the school which was rural mostly Caucasian may have limited the study. The smaller population size may have limited the outcome of this study. Expanding the study to more students may change outcomes.

Recommendations for Future Research

Based upon the researcher's findings, below are suggestions for future research:

1. Future studies should consider using older students as participants, and not solely high school freshmen.
2. Additional studies should consider administering the PATT-SQ as a pre-test at the beginning of the semester, and a post-test at the end of the semester and use that data to measure academic achievement.

3. The variable of attitude is very subjective to the external environment of the participant, in future studies another variable related to technology should be identified (such as how students' use technology daily) that could better explain student academic achievement.
4. Future studies should ensure the sample size is diverse enough (e.g. honors, college preparatory, and remedial students).
5. Make certain that communication is maintained with the research site.
6. An independent-sample t-test study of comparing student academic achievement of pre and post-one-to-one integration may be useful in seeing if there was growth in student academic after technology integration.
7. A qualtitative study to help address areas that required more study.

References

Ackley, S. (2017). A case study of best practices of implementing a one-to-one Technology program. ProQuest LLC. ProQuest LLC. Retrieved from http://ezproxy.liberty.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED580612&site=ehost-live&scope=site

Adams, C. & Thompson, T. L. (2016). Researching a post human world: Interviews with digital objects. London, UK: Palgrave Macmillan. doi:10.1057/978-1-137-57162

Alam, M.H., Ryu, WJ. & Lee, S. (2017). Hashtag-based topic evolution in social media. *World Wide Web. 20(*6), 1527-1549.

Ardies, J., De Maeyer, S., Gijbels, D., & van Keulen, H. (2014). Students' attitudes towards technology. *International Journal of Technology and Design Education, 25*(1) 43-65.

Armstrong, T. (2009). Multiple intelligences in the classroom [kindle version]. Retrieved from https://www.amazon.com/Multiple-Intelligences-Classroom-Thomas-Armstrong/dp/1416607897#reader_1416607897

Bach, A. J., Wolfson, T., & Jessica K. Crowell. (2018). Poverty, literacy, and social transformation: An interdisciplinary exploration of the digital divide. *Journal of Media Literacy Education*, *10*(1), 22–41.

Baer, W. (2018). Countering the artificial intelligence threat. *Cosmos & History*, *14*(1), 17–26.

Bame, E., Dugger, W., De Vries, M., & McBee, J. (1993). Pupils' Attitudes Toward Technology—PATT-USA. *The Journal of Technology Studies*, *19*(1), 40-48. Retrieved from http://www.jstor.org/stable/43603608

Bofill, L. (2013). Constructivism and collaboration using Web 2.0 technology. *Journal Of Applied Learning Technology*, *3*(2), 31-37.

Bruder, P. (2014). Gadget go to schools: The benefits and risks of BYOD (bring your own device). *Education Digest, 80*(3), 15-18.

Buchanan, T., Joban, S., & Porter, A. (2014). Internet self-efficacy does not predict student use of internet-mediated educational technology. *Research in Learning Technology*, *22*(14), 100-115.

Caprara, G. V., Pastorelli, C., Regalia, C., Scabini, E., & Bandura, A. (2005). Impact of adolescents' filial self-efficacy on quality of family functioning and satisfaction. *Journal Of Research On Adolescence*, *15*(1), 71-97.

Caruth, G. D. (2018). Student engagement, retention, and motivation: Assessing academic success in today's college students. Participatory Educational Research (PER), *5*(1), 17-30.

Chan, T., Roschelle, J., Hsi, S., Kinshuk, K., Sharples, M., Brown, T. J., et al. (2006). One-to-one technology-enhanced learning: an opportunity for global research collaboration. *Research and Practice in Technology Enhanced Learning, 1*(1), 3–29.

Christensen, C.M., Horn, M.B., & Johnson, C.W. (2011). Disrupting class: How disruptive innovation will change the way the world learns (2nd ed.). New York, NY: McGraw Hill.

Cristia, J., Ibarrarán, P., Cueto, S., Santiago, A., & Severín, E. (2017). Technology and child development: Evidence from the one laptop per child program, *9*(3), 295–320.

Czeisler, C.A., Shanahan, T.L. (2016). Problems associated with use of mobile devices in the sleep environment: streaming instead of dreaming. *JAMA Pediatric 170*(12), 1146-1147.

Danielsson, A. T., Berge, M., & Lidar, M. (2018). Knowledge and power in the technology classroom: A framework for studying teachers and students in action. *Cultural Studies of Science Education, 13*(1), 163-184. doi:http://dx.doi.org.ezproxy.liberty.edu/10.1007/s11422-016-9782-0

De Lay, A. M., & Swan, B. G. (2014). Student apathy as defined by secondary agricultural education students. *Journal of Agricultural Education*, *55*(1), 106.

Deursen, A. J. A. M., & Dijk, J. A. G. M. (2011). Internet skills performance tests: Are people ready for eHealth? *Journal of Medical Internet Research*, *13*(2), e35.

Dimock, K. V., Boethel, M., & Southwest Educational Development Lab., A. T. (1999). Constructing knowledge with technology. Retrieved from https://eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED431398

Donate, A. G., Marques, L. M., Lapenta, O. M., Asthana, M. K., Amodio, D., & Boggio, P. S. (2017). Ostracism via virtual chat room-Effects on basic needs, anger and pain. *Plos One*, *12*(9), e0184215. doi:10.1371/journal.pone.0184215

Dredge, R., Gleeson, J. M., & de la Piedad Garcia, X. (2014). Risk factors associated with impact severity of cyberbullying victimization: A qualitative study of adolescent online social networking. *Cyberpsychology, Behavior And Social Networking, 17*(5), 287-291. doi:10.1089/cyber.2013.0541

Eisenman, R. (2018). Reducing the digital divide. *Journal of Information Ethics, 27*(1), 12-13.

Gall, M. D., Gall, J. P., & Borg, W. R. (2006). *Educational research: An introduction* (8th ed.). New York, NY: Allyn & Bacon.

Galvan, M., & Coronado, J. (2014). School instructional climate and student academic achievement: An examination of group norms for differentiated instruction. *National Teacher Education Journal, 7*(4), 39-42.

Gardner, H, (2011). Frames of mind: The theory of multiple intelligences. New York, NY: Basic Books.

Gibbons, S. (2007) Redefining the roles of information professionals in higher education to engage the net generation. Paper presented at EDUCAUSE, Australasia. Retrieved from http://www.caudit.edu.au/educauseaustralasia07/authors_ papers /Gibbons2.pdf

Giannoukos, G., Hioctour, V., Galiropoulos, C., & Besas, G. (2017). New technology in education. *Journal Of Educational And Social Research, 7*(1), 9.

Gregory, G. & Chapman, C. (2007). *Differentiated instructional strategies: One size doesn't fit all*. Thousand Oaks, CA: Corwin Press.

Guinta, M. R. (2018). Social media and adolescent health. *Pediatric Nursing*, *44*(4), 196-201.

Gutek, G. (2011). Historical and philosophical foundations of education (5th ed). Boston, MA: Pearson.

Haßler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal Of Computer Assisted Learning*, *32*(2), 139-156. doi:10.1111/jcal.12123

Hardy, B. W., & Castonguay, J. (2018). The moderating role of age in the relationship between social media use and mental well-being: An analysis of the 2016 general social survey. *Computers in Human Behavior, 85*, 282-290. doi:10.1016/j.chb.2018.04.005

Harris, J. L., Al-Bataineh, M. T., & Al-Bataineh, A. (2016). One to one technology and its effect on student academic achievement and motivation. *Contemporary Educational Technology*, *7*(4), 368-381.

Heath, M. K. (2017). Teacher-initiated one-to-one technology initiatives: How teacher self-efficacy and beliefs help overcome barrier thresholds to implementation. *Computers In The Schools, 34*(1), 88-106.

Helsper, E., & Eynon, R. (2010). Digital Natives: Where is the evidence? *British Educational Research Journal, 36*(3), 503-520. Retrieved from http://www.jstor.org/stable/27823621

Hogan, M., & Strasburger, V. C. (2018). Social media and new technology: A primer. *Clinical Pediatrics, 57*(10), 1204-1215. doi:10.1177/0009922818769424

Holen, J.B., Woei, H. & Gourneau, B. (2017) Does one-to-one technology really work: An evaluation through the Lens of Activity Theory. *Computers in the Schools, 34*(1-2), 24-44, doi: 10.1080/07380569.2017.1281698

Huffman, S. (2018). The digital divide revisited: What is next? *Education*, *138*(3), 239–246.

Hull, M., & Duch, K. (2018). One-to-one Technology and Student Outcomes: Evidence From Mooresville's Digital Conversion Initiative. *Educational Evaluation and Policy Analysis*. doi:10.3102/0162373718799969

Hur, J. W., & Oh, J. (2012). Learning, engagement, and technology: Middle school students' three-year experience in pervasive technology environments in South Korea. *Journal Of Educational Computing Research, 46*(3), 295-312. doi:10.2190/EC.46.3.e

Hutinger, P. L., & Johanson, J. (2000). Implementing and maintaining an effective early childhood comprehensive technology system. *Topics in Early Childhood Special Education*, *20*(3), 159–173. https://doi.org/10.1177/027112140002000305

Ihmeideh, F., & Alkhawaldeh, M. (2017). Teachers' and parents' perceptions of the role of technology and digital media in developing child culture in the early years. *Children and Youth Services Review, 77*, 139-146. doi:10.1016/j.childyouth.2017.04.013

Incantalupo, L., Treagust, D., & Koul, R. (2014). Measuring student attitude and knowledge in technology-rich biology classrooms. *Journal of Science Education and Technology, 23*(1), 98-107. Retrieved from http://www.jstor.org/stable/24019830

Jasso-Medrano, J. L., & López-Rosales, F. (2018). Measuring the relationship between social media use and addictive behavior and depression and suicide ideation among university students. *Computers in Human Behavior*, *87*, 183-191. doi:10.1016/j.chb.2018.05.003

Jesdanun, A. (2017, February 10). How Google's Chromebook conquered schools. Associated Press News. Retrieved from https://www.apnews.com/41817339703440a49d8916c0f67d28a6

Johnson, D. (2012). Stretching Your Technology Dollar. *Educational Leadership*, *69*(4), 30–33.

Keith (2015). The History of social media: The evolution of social media. Retrieved from http://historycooperative.org/the-history-of-social-media/

Kerawall, L. & Crook, C. (2013). Children's computer use at home and school: Context and continuity. British Educational Research Journa, 28(6), 751-771.

Kopcha, T. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education, 59*(4), 1109–1121. doi:10.1016/j.compedu.2012.05.014

Krause, J. M. (2017). Physical education student teachers' technology integration self-efficacy. *Physical Educator, 74*(3), 476–496.

Kuzo, J. (2015). School librarians: Key to technology integration. *Knowledge Quest, 44*(1), 74-76.

Laerd Statistics (2015). Simple Bivariate regression analysis using SPSS Statistics. *Statistical tutorials and software guides*. Retrieved from https://statistics.laerd.com/

Lazaroiu, G. (2015). Work motivation and organizational behavior. *Contemporary Readings in Law and Social Justice, 7*(2), 66-75.

Lervik, M. J., Vold, T., & Holen, S. (2018). Conditions for cooperating and dialogue through the utilization of technology in online education. *Universal Journal of Educational Research, 6*(10), 2352–2363.

Lovelace, M., & Brickman, P. (2013). Best practices for measuring students' attitudes toward learning science. *CBE Life Sciences Education, 12*(4), 606–617.

Lowther, D. L., Ross, S. M., & Morrison, G. M. (2003). When Each One Has One: The Influences on Teaching Strategies and Student academic achievement of Using Laptops in the Classroom. *Educational Technology Research & Development, 51*(3), 23–44.

Luxton, D. D., June, J. D., & Fairall, J. M. (2012). Social media and suicide: A public health perspective. *American Journal of Public Health, 102 Suppl 2*(S2), S195-S200. doi:10.2105/AJPH.2011.300608

Manganello, F. (2010). Constructivist instruction: Success or failure? *Journal of Educational Technology & Society, 13*(3), 281-284. Retrieved from http://www.jstor.org/stable/jeductechsoci.13.3.281

Mavrou, K., Meletiou-Mavrotheris, M., Kärki, A., Sallinen, M., & Hoogerwerf, E.-J. (2017). Opportunities and challenges related to ICT and ICT-AT use by people with disabilities: An explorative study into factors that impact on the digital divide. *Technology & Disability*, *29*(1/2), 63–75. doi:10.3233/TAD-170174

Miller, C. & Bartlett, J. (2012). "Digital fluency": Towards young people's critical use of the internet. *Journal of Information Literacy*, *6*(2), 35–55.

Milman, N. B., Carlson-Bancroft, A., & Vanden Boogart, A. (2014). Examining differentiation and utilization of iPads across content areas in an independent, prek-4th grade elementary school. *Computers In The Schools*, *31*(3), 119-133.

Moritz, G. (2014). A digital immigrant. *Arkansas Business, 31*(8), 22.

How Google Chromebooks conquered schools (2017). Anick Jesdanun, Feb. 10, 2017 Retrieved from https://www.apnews.com/41817339703440a49d8916c0f67d28a6

Olson, J. D., & Appunn, F. D. (2017). The technology adoption process model and self-efficacy of distance education students. *Quarterly Review of Distance Education*, *18*(2), 57–75.

O'Neil, T. D. (2017). Cyber wellness: A liberal studies course in higher education. Proceedings of the EDSIG conference ISSN: Vol. 2473, (pp. 3857–).

OurICT Website, The evolution of classroom technology: From the 1600s to the 21st Century. (n.d.). Retrieved January 22, 2019, from http://www.ourict.co.uk/technology-education-history/ technology/resources/evolution-technology-classroom

Ozdamli, F., & Turan, B. (2017). Effects of a technology supported Project Based Learning (TS-PBL) approach on the success of a mobile application development course and the students' opinions. *TEM Journal, 6*(2), 258-264. doi:10.18421/TEM62-10

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2018). Educational apps from the android google play for Greek preschoolers: A systematic review. *Computers & Education, 116*, 139-160. doi:10.1016/j.compedu.2017.09.007

Parijat, P. & Bagga, S. (2014). Victor Vroom's Expectancy Theory of Motivation: An evaluation. *International Research Journal of Business and Management, 7*(14), 1-9.

Perry, E. H., & Pilati, M. L. (2011). Online learning. *New Directions for Teaching and Learning, 2011*(128), 95-104. doi:10.1002/tl.472

Perry, D. R., & Steck, A. K. (2015). Increasing student engagement, self-efficacy, and meta-cognitive self-regulation in the high school geometry classroom: Do iPads help? *Computers in the Schools*, *32*(2), 122–143.

Phiefer, A. (1998, August). Abraham Maslow's Hierarchy of Needs - A Christian perspective. Paper presented at the The 22' Integration Faith and Learning Seminar, Schloss Bogenhofen, Austria.

Purdue University Online, The evolution of technology in the classroom (n.d.). Retrieved January 22, 2019, from https://online.purdue.edu/ldt/learning-design-technology/resources/evolution-technology-classroom

Ralph, R., & Petrina, S. (2018). Social learning with mobile devices in preschool classrooms. *European Journal of STEM Education*, *3*(3).

Robinson, J., Cox, G., Bailey, E., Hetrick, S., Rodrigues, M., Fisher, S., & Herrman, H. (2016). Social media and suicide prevention: A systematic review. *Early Intervention in Psychiatry, 10*(2), 103-121. doi:10.1111/eip.12229

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics & Informatics*, *34*(8), 1607–1624.

Scrader, A. (2016, November). Pros and cons to 1 to 1 computing. [Web log post]. Retrieved from http://www.edudemic.com/one-to-one-computing/

Shaffer, S. (2016). One high school English teacher on his way to a flipped classroom. *Journal of Adolescent & Adult Literacy*, *59*(5), 563-573.

Serrano-Cinca, C., Muñoz-Soro, J. F., & Brusca, I. (2018). A multivariate study of internet use and the digital divide. *Social Science Quarterly*, *99*(4), 1409-1425. doi:10.1111/ssqu.12504

Shahzad, K., & Naureen, S. (2017). Impact of teacher self-efficacy on secondary school students' student academic achievement. *Journal of Education and Educational Development*, *4*(1), 48–72.

Skelsey Guest, H. (2014). Maslow's Hierarchy of Needs - the sixth level. *Psychologist*, *27*(12), 982-983.

Smerdon, B., Cronen, S., Lanahan, L., Anderson, J., Iannotti, N., Angeles, J., & National Center for Education Statistics, W. D. C. (2000). Teachers' tools for the 21st century: A report on teachers' use of technology. *Statistical Analysis Report*.

South Carolina Department of Education, Office of Assessment, Division of Innovation and Effectiveness. (2015). South Carolina end of course manual: Operational test technical report. Columbia, SC: South Carolina Department of Education.

Starke, R. H. (2018). Internet or incarnation?: Bridging the digital divide. *Christianity Today*, *62*(4), 75-82.

Svenningsson, J., Hulten, M., Hallstrom, J. (2018). Understanding attitude measurement: exploring meaning and use of the PATT short questionnaire. *International Journal of Technology and Design Education, 28*(1), 67-83. doi:10.1007/s10798-016-9392-x

Tekinarslan, E. (2011). Faculty of education etudents' self-efficacy perceptions toward online technologies. *Electronic Journal of Social Sciences, 10*(37), 120–134.

Thinley, P., Reye, J., & Geva, S. (2014). Tablets (iPad) for m-learning in the context of Social Constructivism to institute an effective learning environment. *International Journal Of Interactive Mobile Technologies, 8*(1), 16-20. doi:10.3991/ijim.v8i1.3452

Tilton, J., & Hartnett, M. (2016). What are the influences on teacher mobile technology self-efficacy in secondary school classrooms? *Journal Of Open, Flexible & Distance Learning*, *20*(2), 79-93.

Urwiler, R., & Frolick, M. N. (2008). The IT Value Hierarchy: Using Maslow's Hierarchy of Needs as a metaphor for gauging the maturity level of information technology use within competitive organizations. *Information Systems Management, 25*(1), 83-88. doi:10.1080/10580530701777206

Varier, D., Dumke, E., Abrams, L., Conklin, S., Barnes, J., & Hoover, N. (2017). Potential of one-to-one technologies in the classroom: teachers and students weigh in. *Educational Technology Research & Development*, *65*(4), 967-992. doi:10.1007/s11423-017-9509-2

Vaughn, S. (2010, September-October). Total technology immersion: how one rural school district has taken one-to-one to new heights. *Learning & Leading with Technology*, *38*(2), 10-11.

Warf, B. (2018). Teaching digital divides. *Journal of Geography, 10*(18),1-11. doi:10.1080/00221341.2018.1518990

Wang, Q., Myers, M. D., & Sundaram, D. (2013). Digital Natives and Digital Immigrants. *Business & Information Systems Engineering, 5*(6), 409-419.

Warner, R. M. (2013). *Applied statistics: From bivariate through multivariate techniques* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Wilson, B. G. (2012). Constructivism in practical and historical context. *Trends and Issues in Instructional Design and Technology,3, 45-52.* Retrieved from *https://s3.amazonaws.com/academia.edu.documents/30885943/Constructivism.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1536596785&Signature=uV%2BaCcWGMj%2FEe2fRoQbCAd1wwKQ%3D&response-content-disposition=inline%3B%20filename%3DConstructivism_in_practical_and_historic.pdf*

Wirth, A. G. (1983). Productive work in industry and schools. Landan, MD: University Press of America.

Wormeli, R. (2006). *Fair isn't always equal: Assessing & grading in the differentiated classroom.* Portland, ME: Stenhouse Publishers.

Worsley, J. D., McIntyre, J. C., Bentall, R. P., & Corcoran, R. (2018). Childhood maltreatment and problematic social media use: The role of attachment and depression. *Psychiatry Research, 267,* 88-93. doi:10.1016/j.psychres.2018.05.023

Yang, S. (2012). Exploring college students' attitudes and self-efficacy of mobile learning. *Turkish Online Journal of Educational Technology - TOJET, 11*(4), 148–154

Yezbick, E., & Tutty, J. I. (2017). Rapport, perceptions of effectiveness, and course grade expectations: A correlational analysis. *I-Manager's Journal on Educational Psychology, 11*(1), 14-25.

Yuan, S., & Yu-Ting, W. (2016). Analysis of learning achievement and teacher-student interactions in flipped and conventional classrooms. *International Review of Research in Open and Distributed Learning,* 17(1),79-99. Retrieved from https://eric.ed.gov/?q=author%3ayuan+&ff1=dtySince_2016&pg=2&id=EJ1090880

Zakrzewski, J. L. (2016). Using iPads to your advantage. *Mathematics Teaching In The Middle School*, *21*(8), 480-483.

Zargari, A., & MacDonald, K. (1994). A history and philosophy of technology education. *Technology Teacher*, *53*(8), 7-11.

Zimmerman, W. A., & Kulikowich, J. M. (2016). Online Learning Self-Efficacy in Students with and without Online Learning Experience. *American Journal of Distance Education*, *30*(3), 180–191.

Zucker, A. (2004). Developing a research agenda for ubiquitous computing in schools. *Journal of Educational Computing Research*, *30*(4), 371–386.

APPENDIX A

IRB EXEMPTION

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

August 28, 2019

Brenda Patterson Ishmael
IRB Application 3963: Attitudinal Level Towards One-to-One Technology Among Student Academic Achievement in Ninth Grade Stem Classes

Dear Brenda Patterson Ishmael,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Your study does not classify as human subjects research because it will not involve the collection of identifiable, private information.

Please note that this decision only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued non-human subjects research status. You may report these changes by submitting a new application to the IRB and referencing the above IRB Application number.

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

Sincerely,

[redacted]

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office

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