THE IMPACT OF 1:1 LAPTOP ENVIRONMENTS ON THE ENGLISH LANGUAGE ARTS ACHIEVEMENT OF FIFTH GRADE STUDENTS FROM DIVERSE SOCIO-ECONOMIC BACKGROUNDS

by

Nicole Gilner Miller

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

This quantitative study extends previous research on the impact of one to one (1:1) laptop environments on student outcomes in English Language Arts (ELA) by focusing on students from various socio-economic backgrounds, while using a new technology-enhanced, state-administered assessment to measure performance. This study is significant because policy makers focus on state test scores when planning educational investments. Therefore, results from this study can assist policy makers in determining best practices related to technology integration to ensure equitable opportunities for all students. A non-experimental ex post facto causal comparative research design was used to explore the impact of 1:1 laptops on the ELA achievement of fifth grade students from various socio-economic backgrounds using a state-administered technology enhanced assessment. The target population included fifth grade students attending public schools within five different school systems located in a northeastern state that took the Partnership for Assessment of Readiness for College and Careers (PARCC) assessment during the 2015-2016 school year. The sample size was 400 students. To measure ELA achievement, data from the 2015-2016 PARCC assessments was collected along with demographic information on socio-economic status. A two-way ANOVA revealed a significant difference in the dependent variable (ELA PARCC scores) based on social economic status (FARMS vs. Non-FARMS). However, no significant difference was found in the dependent variable based on learning environment (1:1 laptop vs. not 1:1 laptop), and no significant interaction was found between learning environment and socio-economic status on PARCC ELA scores. Recommendations for future research are provided.

Keywords: one-to-one laptops, achievement gap, technology enhanced standardized assessments, socio-economic status

Dedication

This project is dedicated to my Lord and Savior, Jesus Christ who provided me the strength, ability, opportunity, and support needed to persevere and complete this work. My desire is for this work to honor and glorify Him. I would also like to thank God for my wonderful and supportive husband, Kirk. Your unwavering love, support, guidance, encouragement, and your persistent belief in me inspires me to be the best that I can be. I love you very much!

To my school family, I am so grateful for the support you have shown me throughout this experience. I am blessed to work with such an amazing group of individuals who put children first. I would also like to thank my dissertation chair, Dr. Robin Dabney for her encouragement and guidance throughout this project. Your gentle spirit is an encouragement to me! To Dr. Michelle Barthlow, thank you for believing in me from the very beginning of this project. I will forever remember starting this journey with you during EDUC 919. Thank you to Dr. Janet Wilson for helping me develop my leadership abilities. Also, to Dr. Deanna Keith, my first professor at Liberty University, thank you for setting the stage for a very rewarding experience!

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List of Abbreviations

Analysis of variance (ANOVA)

California Standards Test (CST)

Common Core State Standards (CCSS)

English Language Arts (ELA)

Every Student Succeeds Act (ESSA)

Free and Reduced Meals (FARMS)

Information and Communication Technology (ICT)

Institutional Review Board (IRB)

Local Educational Agencies (LEAs)

Massachusetts Comprehensive Assessment System (MCAS)

National Assessment of Educational Progress (NAEP)

No Child Left Behind (NCLB)

One to One (1:1)

Partnership for Assessment of Readiness for College and Careers (PARCC)

Statistical Package for the Social Sciences (SPSS)

Texas Assessment of Knowledge and Skills (TAKS)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this chapter is to provide a strong background related to technology integration in public schools while developing the context for the current study on 1:1 laptop environments and student achievement. The purpose and significance of this study are also explored and the research questions are presented.

Background

The ubiquitous nature of technology in the 21st century has dramatically impacted the way society interacts with the world. Students are no longer relying solely on flipping through printed pages of text to locate information; instead they are relying more heavily on online resources (Kingsley & Tancock, 2014). Students can locate answers to questions in an instant by using online search engines while learning new skills through YouTube and online networks (Downes & Bishop, 2012). Information is literally at the fingertips of today's students. In their study of 21st century learners, Prettyman, Ward, Jaunk, and Awad (2012) found that "students are shifting from being consumers of knowledge to creators of knowledge whose curiosity about the world contributes to their capacity to develop as 21st century learners" (p. 13). Subsequently, traditional patterns of learning have been revolutionized by the ever-present access to technology (Downes & Bishop, 2012). This increased use of technology in nearly all aspects of daily life has influenced the personalities and learning styles of digitally native learners (Keengwe & Georgina, 2013). Prensky (2012) stated, "today's students think and process information fundamentally differently from their predecessors" (p. 68) due to the ubiquitous nature of technology and the volume in which students interact with it.

Prettyman et al. (2012) found that 21st century learners described themselves as being "critical thinkers, problem-solvers, and good communicators" (p. 13). As such, students in the 21st century desire to construct knowledge through authentic learning activities that are collaborative, context-based, technology-oriented, and connected to the real world (Keengwe & Georgina, 2013). Consequently, the significance of technology within learning environments has become an important issue for educators. However, many classrooms have not realized the full benefits that technology can provide within a student-centered learning environment (Christensen, Horn, & Johnson, 2011; Wang, Hsu, Campbell, Coster, & Longhurst, 2014). In fact, Yan and Ranieri (2013) suggested that the implementation of technology within schools has fallen short in comparison to home use on a global level.

The insufficient use of technology within the learning process is problematic in today's world where technology is permeating all other aspects of daily life. Today's students are preparing for a world where communication often occurs electronically, information is shared via blogs and web cameras, buying and selling items occurs on the Internet, meetings are held in 3D chat rooms, coordination of projects and work groups occur electronically, the creation of websites is second nature, and searching for information on the Internet is commonplace (Prensky, 2012). To be productive in the 21st century workforce, students must be efficient at evaluating, creating, and utilizing information, media resources, and technology (Partnership for 21st Century Learning, 2016). In order to achieve this, students must be empowered through high quality experiences using technology that promotes critical thinking, creativity, and the digital literacy necessary to be successful in today's global, information based world (Rosen & Manny-Ikan, 2011). Unfortunately, high quality technology-based activities are not always realized in many classrooms today.

Compounding the issue related to the lack of technology integration within schools, previous research has found that children from low socio-economic homes are less likely to be technologically competent when compared to higher socio-economic families (Dolan, 2016; Ritzhaupt, Liu, Dawson, & Barron, 2013). In addition, reliable technology access has not been realized by many youth, particularly children from low socio-economic backgrounds or those at risk for dropping out of school (Warschauer & Matuchniak, 2010). Thus, it is crucial for system leaders and teachers to evaluate technology integration and equity issues in order to provide all students with the rich, context-based, and authentic learning opportunities necessary for future success in a technology-driven world. By understanding the most effective ways to integrate technology, leaders can reduce social inequities and provide high quality technology programs for all students thereby narrowing the social achievement gap (Rosen & Manny-Ikan, 2011; Warschauer & Matuchniak, 2010).

Over the past 40 years, educators have made attempts to use technology to improve student learning. This has led to significant deliberation over the effectiveness of technology in the teaching and learning process. In fact, a now famous debate related to the impact of technology on student learning outcomes began in the 1980's between Clark (1983) and Kozma (1994). During this time, technology was beginning to make its way into the classroom. Clark (1983) argued that technology was simply a tool or piece of hardware that could be used to deliver instruction. He compared technology within the classroom to a truck used to deliver groceries and believed that instructional design and pedagogy were more vital key factors in achieving student learning outcomes. Kozma (1994), on the other hand, argued that technology had unique attributes specific to how information was presented and how the user engaged with the technology that could lead to improved student learning. Although this debate lasted for at least a decade, there seems to be a consensus among researchers today that technology is important to the learning process in the 21st century (Keengwe & Georgina, 2013; Ritzhaupt et al., 2013; Rosen & Manny-Ikan, 2011; Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). Accordingly, Downes and Bishop (2015) stated that effective technology rich learning environments "can facilitate engaging learning opportunities that are relevant to students' lives and reflect technology-rich cultures beyond the classroom walls" (p. 17).

In an effort to support increased technology use within classrooms, the No Child Left Behind Act (NCLB) of 2001 required school systems to establish or expand current technology initiatives with the goal of improving academic achievement (No Child Left Behind Act of 2001, 2002). Moreover, schools were required to assist students in overcoming the digital divide by providing learning experiences that would ensure all students were technologically literate by the end of eighth grade (No Child Left Behind Act of 2001, 2002). More recently, the Every Student Succeeds Act (ESSA) of 2015 was adopted through federal legislation further expecting schools to personalize learning opportunities to increase student achievement as well as emphasize digital literacy (Every Student Succeeds Act of 2015, 2015). This new piece of legislation also required the effective use of technology to administer computer-based assessments as well as blended learning opportunities (Every Student Succeeds Act of 2015, 2015). In response to the increased emphasis on technology over the years, some schools have implemented 1:1 laptop programs with the goal of increasing student achievement as well as ensuring all students have equal access to technology.

Although there were several 1:1 laptop initiatives that occurred in the 1990's, the state of Maine launched the first large scale 1:1 laptop initiative in 2001 resulting in 241 middle schools receiving laptops for their teachers and students (Gulek & Demirtas, 2005). In 2003, Henrico

County Schools in Virginia implemented the second largest 1:1 laptop program by providing laptops to approximately 23,000 students (Gulek & Demirtas, 2005). A year later, the state of Texas piloted a 1:1 laptop immersion program in 21 middle schools (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010). Since then, several other states and individual counties have implemented 1:1 laptop programs with varying degrees of success related to student achievement outcomes (Fleischer, 2012).

In his literature review on 1:1 computing environments, Fleischer (2012) contended that there was weak evidence to suggest 1:1 laptop initiatives improve student-learning outcomes. However, the vast majority of empirical research on this topic measured student achievement using a paper-pencil, multiple choice, criterion-based assessment format, which may not be the most reliable or valid way to assess the effect of a technology-rich environment (Bebell & Kay, 2010; Clariana, 2009; Russell, 2002; Silverman, 2005; Suhr, Hernandez, Grimes, & Warschauer, 2010). Consequently, numerous researchers have called for the development of performance-based assessments that accurately measure the complex 21st century skills resulting from technology-rich environments using a digital platform (Jing & Yong, 2008; Schnellert & Keengwe, 2012; Warschauer & Matuchniack, 2010). In the northeastern state where this research study was conducted, this type of next generation assessment has become a reality due to the transition to the Common Core State Standards (CCSS).

In response to the adoption of the CCSS in English Language Arts and mathematics in 2010, the Board of Education of the identified northeastern state joined the Partnership for Assessment of Readiness for College and Careers (PARCC) consortium to develop a next generation, performance-based assessment aligned to the new standards (Partnership for Assessment of Readiness for College and Careers [PARCC], 2016a). As a result, students in grades three through eight and high school who were enrolled in a public school participated in the first full implementation of the newly developed technology enhanced PARCC assessment for ELA and math during the 2014-2015 school year in order to evaluate student progress towards college and career readiness.

The newly implemented PARCC assessment is standardized, technology-enhanced, and performance-based, thereby providing a more relevant and stronger measure to assess 21st century skills within context using authentic learning tasks. Moreover, the PARCC assessment requires students to problem solve, synthesis complex information, utilize multi-media, and think critically while answering questions on a technology based platform. According to Kingsley and Tancock (2014), "performance tasks expected within the PARCC assessment simulate the fundamental competencies needed for comprehension of Internet text" (p. 390), which will require providing pedagogical practices aligned to these types of innovative tasks. In an effort to more effectively prepare students for the rigorous, technology-based nature of the PARCC assessment, some schools are electing to implement 1:1 laptop programs. In addition, there is an increased emphasis on technology integration that provides students with experiences that support the development of complex 21st century skills while also mirroring the PARCC assessment. However, there are many students from low socio-economic families who attend schools that lack the technological resources or infrastructure necessary to effectively implement technology-rich environments, such as 1:1 laptop programs. It is unknown if these students will be at a disadvantage when competing on such technology-savvy assessments.

There is empirical research that suggests that 1:1 laptop programs may have positive effects on the learning outcomes of students from low socio-economic backgrounds. For example, using a social-constructivist learning method with 1:1 laptops, Rosen and Manny-Ikan

(2011) found that students from low socio-economic backgrounds performed significantly higher in mathematics, Hebrew, and English as a foreign language when compared to students who received instruction in the traditional setting. Judge, Puckett, and Bell (2006) found that students' technological competency and access to computers within the classroom were positively correlated with increased student achievement. Researchers have further argued that effective use of technology within schools can mitigate unequal access and opportunities outside of school thus bridging social justice gaps and narrowing the achievement gap among different socio-economic groups (Cleary, Pierce, & Trauth, 2006; Rosen & Manny-Ikan, 2011; Warschauer & Matuchniak, 2010). Dolan (2016) suggested that schools could narrow the social justice gap related to technology access by equipping all students regardless of socio-economic background with opportunities to be producers of knowledge, rather than passive consumers by effectively implementing 1:1 laptop programs. By providing authentic, real world, context-based learning that aligns with the mode of assessment, effective 1:1 programs can provide students with the equal opportunities they deserve to become digitally literate.

Therefore, Lave's (1988) situated learning theory provided an appropriate theoretical framework for the current research study. According to Collins (1988), "Situated learning is the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life" (p. 2). In other words, learning is situated within the context of the lived-in world (Lave & Wenger, 1991). Moreover, Brown, Collins, and Duguid (1998) contended that learning and knowledge are situated within the context and culture for which the knowledge is used. Thus, situated learning theory suggests that students may be more successful in achieving technology-enhanced performance standards as measured by the PARCC assessment when provided with the opportunity to learn and practice using technology within their daily learning environment. When student knowledge is measured in a similar manner to how it is learned within the classroom, students may be able to transfer knowledge more easily to new scenarios or problems. Thus, the technology-based PARCC assessment may provide students who participate in a 1:1 laptop program with an authentic assessment experience, which aligns with the concept of situated learning.

In summary, in order to become skilled members of the 21st century workforce, students must develop digital literacy as well as become competent users of technology. To achieve this, students must be provided 21st century tools that reflect real-world environments as new skills are learned and assessed (Mouza, 2008). Although there have been numerous studies on 1:1 laptop environments, student performance results are mixed at best. In addition, few studies explored the impact of 1:1 laptop environments on students from different socio-economic backgrounds. In an effort to inform future educational investments, it is important to examine the benefits of 1:1 laptops programs through a new lens using a technology-based assessment geared towards measuring 21st century skills to measure student performance.

Problem Statement

Although there has been an increase in the number of 1:1 laptop programs implemented within schools, there is limited research on the potential benefits of such programs as it relates to student achievement on computerized, statewide assessments at the elementary level. Interestingly, only one research study was found that utilized a digital platform to evaluate a complex performance task completed by students who participated in a 1:1 laptop environment in Israel (Spektor-Levy & Granot-Gilat, 2012), and three research studies were found that used paper-based and computer-based assessments to measure student performance (Bebell & Kay, 2010; Clariana 2009; Harris, Al-Bataineh, & Al-Bataineh, 2016). Three of these studies identified middle school students as their target population (Bebell & Kay, 2010; Clariana, 2009; Spektor-Levy & Granot-Gilat, 2012), and only one targeted elementary students (Harris et al., 2016). Specktor-Levy and Granot-Gilat (2012) found that students in a 1:1 laptop program scored significantly higher than the comparison group on the complex computerized task while Clariana (2009) found that students in the 1:1 laptop program scored significantly higher on the computerized assessment, but this increase did not exist on the paper pencil state assessment. Similarly, Bebell & Kay (2010) found that 1:1 laptop students scored higher on a computerized writing test, but found mixed results on the paper pencil state assessments. The research conducted by Harris et al. (2016) did not support the argument that 1:1 technology would increase achievement.

While all four of these studies used computerized assessments to measure student performance, none utilized statewide, computer-based standardized exams. Moreover, these studies did not account for the important impact that socio-economic status and the digital divide may have on student achievement when using technology-enhanced assessments to measure performance. There are a few recent studies that have found that 1:1 laptop programs have been successful in narrowing the achievement gap for students from low socio-economic backgrounds (Rosen & Manny-Ikan, 2011; Zheng, Warchauer, & Farkas, 2013; Zheng, Warschauer, Hwang, & Collins, 2014). Zheng et al. (2014) examined science performance and Rosen & Manny-Ikan (2011) focused on math, Hebrew, and English as a foreign language in 1:1 environments. Zheng et al. (2013) found that low socio-economic learners and Hispanic students in California and Colorado made significant gains in writing achievement when learning in a full and partial laptop program. Yet, none of these studies used a computerized testing mode to measure performance.

As states transition to online standardized testing platforms, educators must reassess the most effective ways to integrate technology in order to prepare diverse groups of students for 21st century assessments. The present study builds on previous research by investigating the potential impacts of 1:1 laptop environments on the ELA achievement of elementary students from various socio-economic backgrounds while utilizing a computerized statewide assessment. Additionally, this study answers calls for further research specifically related to 1:1 laptop environments and student achievement (Bebell, Clarkson, & Burraston, 2014; Fleischer, 2012; Suhr et al., 2010). The problem is that earlier research on 1:1 environments relied primarily on an assessment format that did not effectively evaluate the impact of 1:1 environments and did not account for how technology rich environments could impact students from diverse backgrounds in different ways on a technology-enhanced state assessment, creating a need for further research.

Purpose Statement

The purpose of this quantitative causal comparative study was to explore the impact of 1:1 laptop environments on the ELA achievement of fifth grade students from different socio-economic backgrounds using a state-administered, technology-enhanced assessment. The target population included fifth grade students attending public schools within five different school systems located in a northeastern state that took the PARCC assessment during the 2015-2016 school year. The sample size included 400 students. Of the 400 students, 200 qualified for free and reduced meals and 200 did not. The independent variable, instructional environment, was defined as students that were provided a 1:1 laptop environment and those who were not. In general, 1:1 laptop environments included individual access to a laptop, wireless Internet, and student use of laptops to complete academic tasks (Penuel, 2006). The second independent variable included socio-economic status, which was determined based on each student's eligibility for free and reduced meals (FARMS). The dependent variable was the ELA achievement of fifth grade students as measured by the PARCC assessment.

The primary theory being explored in this study was Lave's (1988) situated learning theory, which informed the selection of the first independent variable, instructional environment (1:1 laptops vs. not 1:1 laptops). This theory suggests that students may be more successful on a technology-based assessment such as the PARCC assessment when provided with consistent opportunities to practice and learn new material using technology within the regular learning environment. Therefore, situated learning theory provided the framework that suggests that the independent variable, 1:1 laptop environments, may impact the achievement levels of fifth grade students on the technology enhanced ELA PARCC assessment. The digital divide and socio-economic ELA achievement gap provided the framework that informed the selection of socio-economic status as the second independent variable in this study.

For the purpose of this study, the dependent variable, English Language Arts achievement was based on the Common Core State Standards and defined as the ability to read and comprehend complex text and effectively communicate through writing while analyzing sources (Educational Testing Service, Pearson, & Measured Progress, 2016). These 21st century literacy competencies include a students' ability to "access, synthesize, and contribute to information" (National Council of Teachers of English, 2007, p. 5) as well as the ability to locate, evaluate, and "communicate effectively to others with digital technologies" (Leu et al., 2013, p. 211). Consequently, Leu et al. (2013) argued that an increased focus on online comprehension and research is needed for students to acquire the ELA skills necessary to be successful. In this study, fifth grade ELA achievement was measured by the English Language

Arts PARCC assessment, which is specifically designed to measure student performance related to the ELA CCSS with the goal of measuring progress towards college and career readiness (Educational Testing Service et al., 2016).

Significance of the Study

Numerous studies have explored 1:1 laptop programs and student learning (Bebell et al., 2014; Bebell & Kay, 2010; Clariana, 2009; Harris et al., 2016; Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Shapley et al., 2010; Suhr et al., 2010; Zheng et al., 2013). The results of earlier inquiries on 1:1 laptop initiatives are mixed and the large majority of research on this topic relied on paper pencil assessments to measure student learning. In order to acquire a more holistic understanding of the possible impact of 1:1 laptop programs on student learning, an appropriate tool must be utilized to measure student outcomes that are aligned with the 21st century skills fostered through a technology rich learning environment (Jing & Yong, 2008; Russell, 2002; Schnellert & Keengwe, 2012; Warschauer & Matuchniak, 2010). Until recently, technology-enhanced standardized assessments were not readily accessible within schools. However, with the development and use of the PARCC assessment, researchers have a new opportunity to assess the potential learning benefits of 1:1 laptop programs by using an instrument designed to measure 21st century skills.

Even with the increased emphasis on technology within schools, Dolan (2016) argued that a digital divide amongst students from diverse socio-economic backgrounds continues to exist. In fact, the digital divide is growing beyond access issues and now includes students who can and cannot use technology effectively (Dolan, 2016). By providing 1:1 laptop environments, school systems can promote equitable technological resources as well as opportunities for students to become digitally-literate members of society. However, some school systems do not have the infrastructure necessary to implement technology-rich learning environments for all students. As such, equity related to technology access and use is central to this study as it may impact student achievement on technology-based assessments, especially as it relates to the socio-economic achievement gap.

Currently, many state-administered, high-stakes tests are transitioning to technology based formats requiring students to demonstrate 21st century technological skills as well as the academic skills to be successful. This shift requires educators to examine the importance of technology within the learning environment as it relates to performance on high stakes tests. Accordingly, this study provides educators with important insights related to how 1:1 laptop programs may impact student ELA achievement on technology enhanced assessments. By developing a stronger understanding of how technology-based initiatives impact student achievement, school systems can make the program adjustments necessary to support student learning in this new era of school accountability. Finally, since policy makers focus on state test scores when planning educational investments, the results from this study can be used to inform policy and practice related to equality issues, achievement gap concerns, and technology integration within school systems.

Research Questions

The following research questions were explored within this study.

RQ1: Is there a significant difference in the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not?

RQ2: Is there a significant difference in the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not?

RQ3: Is there a significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS).

Definitions

The terms in this section are defined by the researcher unless otherwise specified:

1. *Digital Native*- Students who have lived in a technological world since birth (people born after 1980) are considered digital natives. These individuals are considered "native speakers" of digital technology (Prensky, 2012).
2. *Digital Divide*- The digital divide refers to people who have access to technology and those who do not and has grown to include individuals who can and cannot efficiently use technology (Dolan, 2016).
3. *1:1 Laptop Environment*- For the purposes of this study, a 1:1 laptop environment included three core features: (a) all students will have individual access to a laptop with word processing and spreadsheet capacity, (b) all laptops will have access to the school's wireless Internet, and (c) students will use their laptop to complete academic tasks within the classroom (Penuel, 2006). Examples of hardware included: MacBook Airs, Chrome books, etc. Cloud based software may be utilized on some laptops.
4. *National Assessment of Educational Progress* (NAEP)- NAEP is a national project led by the Commissioner of Education Statistics with the goal of assessing the knowledge of students on a national level in various subjects including reading and math (Institute of Education Sciences & National Center for Education Statistics, 2016). The NAEP assessment is a nationally-standardized assessment administered to students across the

United States in grades four, eight, and 12 in numerous subject areas (Institute of Education Sciences & National Center for Education Statistics, 2016).

5. *Socio-economic status*- Socio-economic status is based on criteria established by the National School Lunch Program. Students are identified based on these criteria as needing a free lunch, reduced price lunch, or full price lunch.

CHAPTER TWO: LITERATURE REVIEW

Overview

The purpose of this chapter is to provide a theoretical framework for the current study, while synthesizing relevant literature related to 1:1 laptop programs and student achievement. First, a theoretical framework grounded in situated learning is provided, followed by research findings related to the digital divide, computerized assessments, and the socio-economic achievement gap. Then, research related to the impact of 1:1 laptop environments on student outcomes, student engagement, and student uses of technology is presented, as well as implementation factors related to 1:1 laptop environments.

Theoretical Framework

The purpose of the current study was to explore the impact of 1:1 laptop environments on the ELA achievement of fifth grade students from different socio-economic backgrounds using a state-administered, technology-enhanced assessment. The theory of situated learning provided an appropriate framework for this study as it suggests that students who experience learning in an authentic context (Batson, 2011; Brown et al., 1989; Lave & Wenger, 1991; Thoonen, Sleegers, Oort, Peetsma, & Geijsel, 2011) while also utilizing the technology and tools within a relevant culture of practice (Lave & Wenger, 1991) may be able to more effectively apply knowledge to new situations (Brown et al., 1989; Catalano, 2015; Lave, 1988). Accordingly, students may be more successful in achieving performance standards measured through a technology-enhanced assessment when they are provided with the opportunity to learn using technology in the context of authentic and regular learning experiences within the classroom.

Situated learning theory refers to learning that is situated within an authentic context and culture in which the knowledge will be most useful (Brown et al., 1989; Collins, 1988; Catalano, 2015; Thoonen et al., 2011). Brown et al. (1989) further argued that the content learned should not be separated from "how it is learned and used" (p. 32). When knowledge is learned abstractly and outside of the real context, students often struggle to transfer the new knowledge to other situations (Brown et al., 1989; Bib-Yaw, Tsung-Hao, Sun-Ming, & Chen-Yuan, 2013). Herrington and Oliver (2000) contended that when learning occurs out of context, the learner perceives knowledge as the product instead of a tool to solve new problems. Advocates of situated learning contend that cognition and learning are fundamentally situated (Brown et al., 1989) and applying new knowledge is conditional on authentic experiences within context (Lave, 1998).

The ability to transfer acquired knowledge to new scenarios and problems is central to the learning process (Catalano, 2015; McLellan, 1996; Bib-Yaw et al., 2013) as well as situated learning theory. McLellan (1996) stated, "successful learning means the ability to transfer information and thinking strategies effectively, to understand when and how information and strategies can be applied in new contexts" (p. 14). By providing authentic learning experiences to students within context, educators can foster the development of "useable, robust knowledge" (Brown et al., 1989, p. 32) that may be applied to new situations. Lave and Wenger (1991) suggested that in order to become full practitioners, students must also participate and experience the technology and tools used in day-to-day practice within the learning community. Students who actively use tools relevant to the culture of practice "build an increasingly rich implicit understanding of the world in which they use the tools and of the tools themselves" (Brown et al., 1989, p.33). Therefore, students who practice and are taught new material using technology within the classroom on a frequent basis may be more likely to apply that knowledge when assessed using a technology-based platform.

Situated learning proposes students learn best by engaging with and exploring authentic learning activities. Consequently, Batson (2011) contended that situated learning places the experiences of students at the heart of the learning process. By implementing a situated learning approach, students discover knowledge through active learning experiences designed within an authentic context with the goal of constructing knowledge, rather than passively receiving knowledge from other people (Batson, 2011; Bib-Yaw et al., 2013). Bib-Yaw et al. (2013) suggested that students who learn through realistic, authentic, and context-based activities are able to acquire more meaningful knowledge that can be transferred to other real situations.

Carroll (2013) stated that authentic activities include everyday practices within our culture that are relevant to students and coupled with purposeful outcomes as well as real-world connections. Technology can provide the framework necessary where today's tools are accessible and utilized by students to engage in authentic and real learning opportunities in a social context (Carroll, 2013). According to McLellan (1996), technology is central to situated learning as it "expands the power and flexibility of the resources that can be deployed" (p. 12) within the learning environment. Warschauer (2007) argued that when instruction is detached from the resources and context of the broader world, learning feels disconnected from the real world and students disengage from school. Digital technology can be used as a powerful tool to expand learning beyond the walls of the classroom and contextualize learning within the broader world (Warschauer, 2007). Through technology, students can access authentic reading material on practically any topic, while exploring different perspectives and cultures from around the globe and develop products to share new knowledge with genuine audiences (Warschauer, 2007).

One-to-one laptop initiatives provide access to the technology necessary to situate learning within the broader world using technology-driven, authentic learning opportunities. According to researchers, examples of authentic learning activities may include tasks like collaborating with peers to develop a website, completing a lab experience, participating in active learning experiences using digital technologies (Batson, 2011), and synthesizing information from multiple texts online while engaging in research (Kingsley & Tancock, 2014). In a study on 1:1 learning environments in 18 North Carolina high schools, researchers found that teachers in 1:1 laptop environments integrated more authentic learning tools as well as assessments (Corn, Tagsold, & Patel, 2011). Teachers also reported that the ubiquitous access to online resources and software provided students with a more authentic learning experience (Corn et al., 2011). Through this initiative, students were exposed to a variety of writing modalities through authentic activities such as class blogs, newsletters, storyboarding, podcasts, and digital magazines while also writing for global audiences (Corn et al., 2011). In a two-year, multi-site case study, Warschauer (2007) also maintained that students in a 1:1 laptop environment have an advantage in developing 21st century skills by having more frequent opportunities for in-depth learning through empirical investigations and personalized learning. In other words, by using technology on a regular basis to complete academic tasks, students may be provided with more authentic experiences that are related to real world situations. Additionally, by providing authentic learning opportunities where students can practice skills connected to situations in real life, teachers "encourage a better person-environment fit and enhance students' motivation and performance in a positive way" (Thoonen et al., 2011, p. 502).

In 2000, Herrington and Oliver defined a framework related to the critical elements of situated learning. Several key components resonated as important to this study including the importance of providing authentic experiences and contexts for producing knowledge, supporting collaboration within the learning process, and ensuring authentic assessments related to specific tasks (Herrington & Oliver, 2000). Just as cognition and learning are situated and dependent on context (Brown et al., 1989), authentic assessments need to be aligned to the context in which the knowledge is learned (McLellan, 1996). McLellan (1996) stated that assessments must be "inextricably coupled with learning" (p. 101) because of the situated nature of knowledge. By providing authentic assessments aligned to the way the material is taught, students may transfer knowledge more easily to new situations.

The theory of situated learning was an appropriate framework for the current study as it suggests that students may be more successful on a technology-based assessment such as the PARCC assessment when provided with consistent opportunities to practice and learn new material using technology within the regular learning environment. When the assessment is situated within the context of how knowledge is learned, students may be able to apply knowledge to new situations more easily. Therefore, the performance-based, technology-enhanced PARCC assessment may provide students participating in 1:1 laptop programs with an authentic assessment experience aligned to how material was learned, which directly aligns with the theory of situated learning.

Related Literature

The Digital Divide

In Dolan's (2016) literature review on digital equality, it was found that the digital divide is expanding beyond access issues and now includes how technology is used differently between diverse populations. More specifically, the digital divide has evolved into a complex phenomenon that involves numerous factors including access, types of use, as well as the digital skill level of the individual (Dolan, 2016; Ritzhaupt et al., 2013). As a result, Dolan (2016) argued that the socio-economic status of students and schools strongly influenced technology use, while Ritzhaupt et al. (2013) contended that low-income students were less likely to be competent users of technology. Hohlfeld, Ritzhaupt, Barron, and Kemker (2008) developed a theoretical model to describe the digital divide as a multi-tiered construct. The first tier encompasses the equitable access to "hardware, software, the Internet, and technology support within schools" (Hohlfeld et al., 2008, p. 1650), and it is foundational to tiers two and three. The second tier addresses how and when students and teachers utilize technology within the learning environment, and tier three expands the digital divide by exploring individual student's technological skills and their ability to select the appropriate technology to accomplish personal goals (Hohlfeld et al., 2008).

Although many schools have made significant gains in providing access to computers and the Internet, there continues to be a divide linked to socio-economic status. Today, the differences in technology access are subtle and often involve the availability and frequency of technology use, quality of hardware, Internet speed, availability of high quality software, and the reliability of technology. In a recent statewide study that explored third grade computer use in Ohio, Wood and Howley (2012) found significant differences in computer lab access, the availability of laptops for classroom use, Internet speeds and reliability, as well as the availability of adequate software between schools. The researchers found that the availability and adequacy of technological resources generally favored affluent schools with higher socio-economic status. In addition, there were significant differences in professional development opportunities for teachers as well as computer resources for teacher use between schools. The results further revealed that technology use by third grade students was more sophisticated among students from high socio-economic schools when compared to other locations, and these disparities were linked to discrepancies in technological resources. Consequently, the findings within this study contradicted the claim that some have implied about equitable technology opportunities between schools in the United States (Wood & Howley, 2012). Valadez and Duran (2007) also examined how technology access and use differed between six schools in southern California. They found that the affluent school had a higher number of computers within classrooms, more Internet connections, and greater access to local networks when compared to the low resource schools, lending further evidence related to the unequal access of technology for students from diverse backgrounds.

In 2013, the Pew Research Center surveyed 2,462 Advanced Placement and National Writing Project teachers on technology use in middle and high school classrooms (Purcell, Heaps, Buchanan, & Friedrich, 2013). The results showed that 84% of teachers agreed that digital technologies available today lead to increased disparities between economically disadvantaged and affluent school systems. Purcell et al. (2013) stated that only 54% of teachers indicated that students had access to the necessary digital tools at school in order to be academically successful, and just 18% indicated that their students had the appropriate access at home. In addition, 39% of teachers who taught economically disadvantaged students claimed that their school was behind in effectively integrating technology into the learning process, and 56% believed that students lacked access to digital technology and resources, which impacted how technology could be integrated into the learning process. These differences in technology access and use based on socio-economic factors have resulted in unequal opportunities for students thereby expanding the digital divide (Dolan, 2016).

Additionally, in a study that explored the Information and Communication Technology (ICT) beliefs of elementary students from various socio-economic backgrounds, Vekiri (2010) discovered that students from low-income families reported lower confidence levels related to their ICT skills as well as fewer opportunities to develop ICT expertise. The variety of ICT activities experienced by low-income families was also found to be significantly lower when compared to higher income families (Vekiri, 2010). Studies have also found that low-income families are less likely to have access to computers as well as Internet access (Attewell, 2001; Vekiri, 2010). Vekiri (2010) further reported significant differences between different socio-economic groups related to student's access to and use of the Internet and computers outside of school in addition to how technology was used "showing that students from low-SES backgrounds were at a disadvantage compared to students from the other SES groups" (p. 946).

Nasah, Dacosta, Kinsell, and Seok (2010) found that access to information using technology increased as family income improved. In their research study exploring digital literacy and student use of technology, Nasah et al. (2010) found that together socio-economic status, gender, and age made a significant contribution towards an individual's use of technology in day-to-day life. The researchers further argued that students from low-income backgrounds are especially in need of ICT use in school so that they can compete with higher income students later in life (Nasah et al., 2010). Similarly, Vekiri (2010) argued that schools might be the only place where students from lower socio-economic backgrounds can develop expertise in technology.

Even when students have access to technology, studies have found that different groups utilize technology differently, resulting in unequal outcomes between diverse groups of students (Attewell, 2001; Dolan, 2016; Schnellert & Keengwe, 2012). Schnellert and Keengwe (2012) suggested that schools serving high populations of students from low socio-economic backgrounds often use technology for remedial memory-based tasks, whereas wealthier schools are more likely to integrate technology to enhance student expression and communication. Attewell (2001) argued that technology use for at-risk children might include larger amounts of drill and practice activities, while students from higher-income families experience richer educational opportunities using technology.

For example, using a qualitative approach to explore interactive whiteboard use in three elementary schools from various socio-economic backgrounds, Rafalow (2014) found that teachers from higher socio-economic schools demonstrated greater levels of freedom when using the whiteboard while incorporating advanced features and encouraging student interaction with the technology. Further data analysis showed that the interactive white board was used as a traditional blackboard in the lower socio-economic classroom 100% of the time whereas the white board was utilized in a dynamic manner 90% and 85.5% of the time in the middle and high socio-economic classrooms (Rafalow, 2014). Rafalow (2014) argued that cultural beliefs impact how technology is adopted into classroom practice, which may impact children from lower socio-economic schools that may not be exposed to instruction that incorporates technology competencies valued by the dominant culture.

Using a multi-site case study design exploring 1:1 laptop programs and information literacy practices of 10 schools in California and Maine, Warschauer (2007) found that teachers from high socio-economic schools were more likely to support critical inquiry than those from lower income schools even when every student had access to technology through a 1:1 laptop program. Similarly, when Reinhart, Thomas, and Toriskie (2011) explored the second level of the digital divide by exploring socio-economic factors between schools in the midwestern U.S.

and technology use that promotes higher-level thinking, they found that students from affluent schools were more likely to be provided instruction that developed critical thinking skills while also utilizing technology beyond the basic level. Based on their findings, the researchers concluded that technology access does not imply that technology will be used within instruction in a manner that promotes higher level thinking skills. However, this research should be reviewed with caution, as the reliability coefficients were relatively low for the instrumentation used with a .70 for the pedagogy portion and .73 for the technology portion. In addition, out of the eight subscales used, seven had a reliability coefficient below .70, which warrants a cautious approach in using these results.

Ritzhaupt et al. (2013) provided evidence supporting the third tier of the digital divide in their study exploring 5,990 middle school student's technological literacy in 13 schools in Florida. They found strong evidence to support a digital divide related to student's ICT literacy based on socio-economic status. More specifically, students from affluent backgrounds who were white and female outperformed other student groups within the study, which supported the researcher's assertion that low-income students are less likely to be competent users of technology.

In summary, based on the research presented above, there is strong evidence to support the existence of a multi-dimensional digital divide grounded in the socio-economic status of students and schools. Accordingly, Dolan (2016) and Ritzhaupt et al. (2013) asserted that the digital divide involves a variety of factors including access to technology, types of use, and individual ICT skill level. Based on these findings, school staff, policy makers, and researchers must work towards understanding the inequity occurring within schools and society related to technology in order to establish programs to ensure all students have an opportunity to develop the 21st century technological skills necessary for the future.

Computerized Assessments

The use of computer-based assessments in the educational process has dramatically increased as a result of new technology over the past decade. Several states have started offering computer-based assessments within their standardized assessment program (Horkay, Bennett, Allen, Kaplan, & Yan, 2006). According to the Every Student Succeeds Act passed in 2015, schools are expected to use technology to effectively administer computer-based assessments (Every Student Succeeds Act of 2015, 2015). The trend towards computer-based assessment makes it possible to assess students using performance tasks that are flexible, rich, timely, and "more seamlessly interwoven with multiple aspects of curriculum and instruction" (Pellegrino & Quellmalz, 2010, p. 130).

By ensuring that students are assessed within the context of the learning environment and with the same tools used throughout the learning process, educators may increase students' ability to transfer new knowledge when solving new problems. For example, Spektor-Levy and Granot-Gilat (2012) examined the impact of a 1:1 laptop environment on seventh and ninth grade students' performance as measured by a complex computerized learning task. In this study, one group of students received instruction in a 1:1 laptop environment, while the comparison group received instruction in a traditional setting with limited technology access (Spektor & Granot-Gilat, 2012). Both groups were given the same complex, computer-based assessment to measure the impact of the instructional environment (Spektor & Granot-Gilat, 2012). Findings suggested a significant difference between students in the 1:1 laptop group (M=65.95, SD=7.64) and comparison group (M=58.65, SD=7.94) with the 1:1 laptop group scoring higher (Spektor &

Granot-Gilat, 2012). Bebell and Kay (2010) also explored the student performance of seventh grade students enrolled in a 1:1 laptop program by randomly assigning them to complete a computerized or handwritten extended writing assessment. They found that students who completed their writing assignment on the computer wrote longer and higher quality essays compared to students who wrote their essays by hand. The findings implied that students who learn in a technology-rich environment might be at a disadvantage when required to take standardized assessments using a paper and pencil format (Bebell & Kay, 2010).

An experimental study conducted by Barrett et al. (2014) explored students' performance on computerized assessments versus paper pencil assessments based on their note taking method which included computerized or handwritten notes. Students in this study were asked to take notes using Microsoft Word or by hand using a paper and pencil (Barrett et al., 2014). Students were then given a quiz that required them to either type or write their responses (Barrett et al., 2014). Barrett et al. (2014) found that when there was congruence between students' assessment and note taking formats, students scored higher on the assessment compared to students whose formats were not congruent. More specifically, there was a strong positive relationship for students whose assessment and note-taking formats were congruent, irrespective of student attitudes towards the assigned format (Barrett et al., 2014). These findings suggested that learning and assessment formats should be congruent in order to maximize student performance.

Administering computerized assessments may also impact a student's motivation to perform well, which may affect student achievement on assessments. Yan Piaw and Don (2013) used a Solomon four-group experimental research design to explore the impact of a computer-based biology assessment on achievement and student motivation. While they did not find a testing effect related to student performance based on the assessment mode, the data analysis showed that the computerized assessment had a significant positive effect on student motivation. The researchers contended that a computerized assessment format has the ability to encourage students to answer questions with higher levels of motivation in comparison to a paper-pencil assessment method. Consistent with this research, using a similar research design, Yan Piaw (2012) found that using a computer based assessment format "increased self-efficacy, intrinsic and social motivation of the test takers in challenge, efficacy, curiosity, involvement and social dimensions" (p. 1585), while also reducing the amount of time testing.

Using a quasi-experimental pre-post test design, Nikou and Economides (2016) explored the effect of different testing modes on high school science students' performance and motivation as well. Specifically, the researchers were exploring paper-pencil, computer-based, and mobile testing formats. While the results should be interpreted cautiously due to the small sample size of 66 students, data analysis showed that students' motivation was higher when completing assessments on computer-based or mobile assessment formats. Specifically, there were significant differences in students' intrinsic motivation, extrinsic motivation, overall motivation, and self-efficacy when using a computer-based assessment format. These differences were not found for students who took the assessment in a paper-pencil format. The researchers also found a significant difference in motivation and performance for lower achieving students who were assessed using the computer-based format. In addition, participants in this study, especially lower achieving students, who participated in the computer-based or mobile assessment formats, reported greater interest and self-efficacy. Results from this study provided evidence that using computer based and mobile self-assessment formats positively impacted lower achieving students by increasing their overall motivation to perform as well as student achievement.

However, the results found by Nikou and Economides (2016) were not consistent with a recent study exploring fourth grade students' writing performance on the computer-based 2012 National Assessment of Educational Progress (NAEP) assessment conducted by White, Kim, Chen, Liu, and National Center for Educational Statistics (2015). These researchers found that the computer-based format of this assessment may have actually widened the achievement gap between the highest and lowest performing students. Fourth grade students performing in the lowest 20% wrote fewer words (60) than students in the middle (104) and high (179) performing subgroups. Findings also showed that prior experience using computers was related to text length, mode preference, use of editing tools and some demographic characteristics. Moreover, 31% of students who never or rarely completed writing assignments on the computer had lower scores when compared to students who had experienced computerized writing assignments. At risk students such as students eligible for the National Lunch Program were more likely to not have experience with written assignments on a computer. In addition, findings from this study indicated that student's preference for the assessment mode as well as unequal prior experiences using computers when writing may be linked to the widening gap related to achievement. The researchers concluded that computerized writing assignments, using the Internet to search for information, writing to family and friends online, and writing school assignments on the computer had some relationship to writing performance. Keyboarding instruction did not appear to make a significant difference in writing performance. However, the researchers argued that students who had prior experiences writing on a computer may have lower performance anxiety and increased self-efficacy, which may indirectly impact their writing scores.

Other researchers have also suggested that if students have limited experience in a technology-rich environment they may experience high anxiety when asked to perform on a technology based platform which could lead to discomfort and ultimately lower performance (Greiff, Kretzschmar, Müller, Spinath, & Martin, 2014). For example, a study comparing student performance on computerized and paper pencil assessments found that students who took the assessment using the computer consistently outperformed the group using paper and pencil (Maguire, Smith, Brallier, & Palm, 2010). The researchers suggested that these findings might be a result of students feeling more comfortable interacting with the computerized platform thereby potentially decreasing testing anxiety (Maguire et al., 2010). Using a case study approach, Fluck, Pullen, and Harper (2009) also found that students' preference for computer-based assessments was strongly correlated to a successful prior experience with a computerized assessment with an effect size of .621. More specifically, 63% of participants who had a prior experience with computer-based testing preferred that medium, whereas only 37% of students who took a computerized assessment for the first time preferred the computer-based assessment mode.

Consequently, student familiarity with the testing environment has been found to be a significant factor in student performance (Bennett et al., 2008; Flowers, Do-Hong, Lewis, & Davis, 2011; Horkay et al., 2006). A study exploring eighth grade writing performance as measured by the NAEP found that results from a computer-based assessment compared to a paper-pencil based assessment may vary based on the student's familiarity with computers (Horkay et al., 2006). Additionally, students with higher levels of keyboarding and more hands-on computer proficiency scored higher when controlling for writing proficiency (Horkay et al., 2006). These results suggested that students who have little practice using computers to write may not score as high when performing on an online assessment in comparison to peers who routinely practice word processing within the learning environment (Horkay et al., 2006).

Similarly, a study exploring the performance of eighth grade students on the NAEP assessment administered in both computer-based and paper pencil formats found that high student computer-familiarity scores predicted higher math online assessment scores when controlling for math performance (Bennett et al., 2008). In this study, some students took the computerized assessment on school computers and others used laptops provided by NAEP (Bennett et al., 2008). The type of computer used was also found to be a significant predictor related to student performance (Bennett et al., 2008).

Flowers et al. (2011) conducted a study that examined computer based and paper-pencil assessment formats as well as the academic performance of students with disabilities. The analysis included 47,404 test scores in math, reading, and science for students ranging from third to 11th grade. The researchers found that students in the paper pencil group scored higher than the computer-based group in almost all grades and subject areas with effect sizes ranging from small to very large. The only groups that scored higher on the computer-based assessment were grade three math and grade 11 science. However, students in this study reported limited experience working with the computer text reader in the classroom, and this was the first time that the majority of students experienced an assessment using a technology platform. Thus, it is plausible that the familiarity with the testing environment and tools impacted the achievement of students taking the computerized assessment as indicated by the researchers. On a positive note, 79% staff members who administered the computer-based format of the assessment reported that students were more engaged in the assessment, while 89% said "students appeared to prefer taking the test on the computer" (p. 8). Students liked that they could work independently as well as work at their own speed when taking the assessment, and 79% reported a preference to use the computer in the future for assessments. Accordingly, the results from earlier research confirmed that students who have prior experience with computer-based assessments might have less anxiety about the format due to an increased familiarity with the assessment mode, which may result in higher performance scores.

In conclusion, research has distinctly shown that student performance on computer-based assessments may be connected to the instructional environment, familiarity with the assessment format, prior experience with computerized assessment formats as well as student motivation. Based on the results of the research indicated above, fifth grade elementary students were selected for the current study because they were most likely to have the greatest amount of prior experience with computer based assessments as well as a higher level of familiarity with the testing environment when compared to third and fourth grade students.

The Socio-Economic Achievement Gap

Recently, a comprehensive study that explored family income and the achievement of students in the United States found that the socio-economic achievement gap has grown substantially in the last thirty years (Reardon, 2013). The results revealed that the gap in achievement related to family income has now exceeded the minority achievement gap (Reardon, 2013). Welner and Carter (2013) further argued that gaps in opportunities are widening as the inequality in wealth increases. Gaps are also increasing between students from low and high socio-economic families in college entry, perseverance, and graduation (Bailey & Dynarski, 2011). For example, the college completion rate increased by 18 percent for students from high socio-economic backgrounds of students born in the 1980 cohort compared with the 1960 cohort, whereas the graduation rate for students from low socio-economic families for the corresponding cohorts only increased by four percent (Bailey & Dynarski, 2011). Bailey and

Dynarski (2011) argued that disparities in high school graduation between high and low income families accounted for 50 percent of the gap related to college entry.

The fourth grade reading results of the 2015 NAEP assessment reinforced the persistent achievement gap in reading for students from low and high-income families. The data showed that the average scaled score for students eligible for the National School Lunch Program was 209, while the scaled score for students who were not eligible for this program was 237 (National Center for Educational Statistics, 2015). This achievement gap may be even wider based on recent research related to the impacts of computer-based assessments on reading and writing achievement (Leu et al., 2015; White et al., 2015). Leu et al. (2015) argued that assessments such as the NAEP might considerably underestimate the achievement gap based on family income because the assessment has historically been administered in a paper-pencil format. In their study of online and off-line reading achievement gaps, Leu et al. (2015) found that current gaps are underestimated by a minimum of one year due to the effect of an online reading achievement gap. These results suggest that lower socio-economic status students may be at a greater disadvantage as a result of an already established reading gap, an online reading gap, as well as the evolving digital divide.

Similarly, a recent study that examined the writing scores of approximately 10,400 fourth grade students on the 2012 NAEP writing pilot assessment found that students in the top 20 percent scored significantly higher when performing on a computer-based assessment with an effect size of .56 (White et al., 2015). The computer-based format did not appear to benefit low and middle performing students (White et al., 2015). The researchers found that using a computer-based assessment to measure writing performance of fourth grade students may have widened the achievement gap (White et al., 2015). The increasing gap in achievement appeared to be associated with unequal prior experiences with using computers for writing as well as student preference for the assessment mode (White et al., 2015). In an attempt to reduce achievement gaps related to the digital divide, some researchers have recommended rich technology initiatives as a measure to even the playing field (Dolan, 2016; Warschauer & Matuchniak, 2010).

Although there is an insufficient amount of empirical research related to the impact of technology on at-risk students (Zheng et al., 2013), there are a few recent studies that have found that 1:1 laptop programs have been successful in narrowing the achievement gap for students from low socio-economic backgrounds (Rosen & Manny-Ikan, 2011; Zheng et al., 2013; Zheng et al., 2014). Zheng et al. (2013) studied how a full and partial year laptop program impacted the writing achievement of upper elementary students from diverse socio-economic backgrounds in Colorado and California. The researchers found that writing achievement increased in both the California and Colorado schools with significant gains for low socio-economic learners and Hispanic students. Additionally, findings suggested that at-risk learners used the laptops more frequently compared to other students. In a quasi-experimental study on laptop use and fifth grade science achievement in Southern California, Zheng et al. (2014) found that 1:1 laptop programs could assist in narrowing the achievement gap of at risk students, as increased achievement was limited to the English Language Learners, Hispanic population, and students from lower socio-economic backgrounds. These empirical findings provide some evidence that 1:1 laptop environments can positively impact the student achievement of diverse populations as suggested by Zheng et al. (2013). However, based on the inadequate amount of research in this area and the potential of a larger achievement gap in reading due to the possibility of an online achievement gap, additional investigation is needed, specifically related to English language arts performance and students from low socio-economic backgrounds.

Laptop Initiatives and Student Achievement

It is not surprising that 1:1 laptop environments and student achievement have been a focus for researchers in the educational field. Due to the high stakes standardized testing environment and the national school reform efforts established by the No Child Left Behind legislation in 2001 and the Every Student Succeeds Act of 2015, educators are continuously searching for innovative ways to transform learning and increase student achievement. However, despite the growing utilization of technology and 1:1 technology initiatives, research evidence on the impact of 1:1 laptop environments on student achievement is inconclusive and mixed at best.

Laptop initiatives and positive outcomes. Several researchers have found that 1:1 laptop environments produce positive effects on student achievement (Bebell et al., 2014; Keengwe, Schnellert, & Mills, 2012; Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Shapley et al., 2010; Spektor-Levy & Granot-Gilat, 2012; Suhr et al., 2010; Zheng et al., 2014). However, it should be noted that the results from Keengwe et al. (2012) were based on self-reported perceptions of high school students and staff using voluntary surveys with no control group. Although Keengwe et al. (2012) found that 92% of students believed that having access to laptops made school assignments easier and 85% of students agreed that laptops improved their work, the methodology and design weaknesses within this study warrant cautious interpretation of the positive results. Suhr et al. (2010) used a stronger quasi-experimental design to determine the impact of a 1:1 laptop initiative on fourth grade students' literacy achievement using the California Standards Test (CST), but only found a small positive effect.

A similar small positive effect was found on two subtest scores related to writing strategies and literary response and analysis for students who received instruction in the 1:1 laptop environment (Suhr et al. 2010).

In contrast, using an unmatched case-control design, Kposowa and Valdez (2013) found that fourth and fifth grade students participating in a 1:1 laptop program in Southern California scored significantly higher on the state-administered CST in English Language Arts and mathematics when compared to students who did not participate in the laptop program. Comparably, using a mixed method approach, Rosen and Beck-Hill (2012) found that students in a 1:1 technology environment that received instruction using a constructivist's approach significantly outperformed the control students in both reading and math on the Texas Assessment of Knowledge and Skills (TAKS). Shapley et al. (2010) also found that "student access and use (of technology) was a stronger and more consistent predictor" (p. 39) for reading and math achievement for middle school students based on the TAKS assessment.

In a study exploring 1:1 technology using cloud-based software, researchers found that sixth grade students made greater gains in achievement on the Massachusetts Comprehensive Assessment System (MCAS) when compared to their peers who received instruction using traditional methods (Bebell et al., 2014). Moreover, using a quasi-experimental design to explore the use of laptops, Discovery Education interactive software, and science achievement for fifth grade students, Zheng et al. (2014) found that the increased access to technology through the 1:1 program assisted in narrowing the achievement gap in science for diverse at-risk learners.

While numerous studies related to 1:1 laptop initiatives utilized state standardized assessments to identify positive growth in student learning outcomes (Bebell et al., 2014;

Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Shapley et al., 2010; Suhr et al., 2010; Zheng et al., 2013), it is important to note that Spektor-Levy and Granot-Gilat (2012) "used a complex, computer-based learning task" (p. 83) to determine student outcomes based on a 1:1 laptop program. Spektor-Levy and Granot-Gilat found that seventh and ninth grade students who participated in the 1:1 laptop environment significantly outperformed students in the control group, thereby demonstrating stronger learning and informational literacy skills. Interestingly, this study was one of only four studies found that measured student performance using a technology based platform rather than a paper pencil assessment when exploring the impacts of a 1:1 laptop initiative. Consequently, the decision to use a complex technology-enhanced assessment may have impacted the positive result.

Laptop initiatives and mixed outcomes. Several studies have also reported mixed results related to 1:1 laptop environments and student achievement (Bebell & Kay, 2010; Clariana, 2009; Dunleavy & Heinecke, 2007; Harris et al., 2016; Hur & Oh, 2012; Silverman, 2005; Zheng et al., 2013). For example, Dunleavy and Heinecke (2007) found no main effect on math achievement for middle school students learning in a 1:1 laptop environment based on a state standardized assessment. In contrast, a small effect was reported relative to science achievement based on the 1:1 laptop program within the same study. Using a quasi-experimental design, Clariana (2009) found that sixth grade math students who were taught in a 1:1 laptop environment outperformed students in the control setting on quarterly benchmarks. However, these same students did not perform better on the Pennsylvania System of School Assessment. According to the researcher, the lack of consistent performance could have been due to inconsistent testing formats as the quarterly benchmark assessments were administered on a computerized platform consistent with the instructional environment whereas the state assessment was administered using a paper-pencil format.

Using a pre-post comparative design, Bebell and Kay (2010) found mixed results related to a pilot laptop program in five middle schools located in Massachusetts. They found that increases in student scores in the 1:1 pilot program were statistically greater than the comparison group for English Language Arts, but these gains did not hold true for mathematics. Concerned with the state assessment being administered in a paper pencil format, Bebell and Kay (2010) also included a computer based mock writing prompt to measure student performance. Based on the writing prompt results, students who participated in the 1:1 laptop program wrote longer and higher quality essays when provided a computer-based assessment rather than a paper-pencil assessment. The results suggested that topic development and standard English conventions were areas that students scored substantially higher on when writing the essay on a computerized platform (Bebell & Kay, 2010).

Additionally, Zheng et al. (2013) examined the effects of daily access to laptops on the digital writing achievement of elementary students in a Colorado school system. They found that overall writing score gains were not statistically significant. Yet, students who participated in the 1:1 laptop program who were from low socio-economic backgrounds and students who were Hispanic did make significant gains in writing achievement compared to other students. The researchers also explored a laptop program in a school system in California and found that students demonstrated increased writing achievement in partial and full year laptop programs. Consistent with this finding, 64% of students reportedly agreed that having access to laptops improved their writing quality and 60% reported being more organized as well as increased interest in schoolwork and improved schoolwork overall.

Using a quantitative design, Harris et al. (2016) sought to determine if a 1:1 laptop program impacted the math achievement of fourth grade students in Central Illinois. Although some of the data suggested that the technology rich environment may increase scores, results overall did not confirm a significant difference in achievement. Similarly, Hur and Oh (2012) found no significant difference in student achievement in the areas of science and English of middle school students who were taught in a 1:1 environment compared with those who were not.

Summary of laptop initiatives and student outcomes. In summary, most research on 1:1 laptop initiatives and student achievement suggests that the benefits of such programs are not yet conclusive. While some researchers report gains in student achievement, none of the reviewed studies utilized true experimental designs or methodology and a high percentage of studies reported mixed results, thus making it difficult to determine with certainty that 1:1 laptop environments significantly improve student achievement. Moreover, the majority of data used to measure student achievement as a result of 1:1 laptop programs was collected from paper-pencil, state-standardized assessments, which may not be appropriate to measure technology-rich environments such as 1:1 programs (Bebell & Kay, 2010; Clariana, 2009; Russell, 2002; Silverman, 2005; Suhr et al., 2010). With the development and use of the technology-enhanced PARCC assessment, researchers now have an opportunity to evaluate the impact of rich technology environments on 21st century learning outcomes using a measure that will better capture the benefits of a 1:1 laptop environment.

Laptop Initiatives and Student Engagement

Student achievement as measured by standardized assessments is only one way to determine the impact of 1:1 laptop environments on student learning. Researchers, school leaders, and policy makers can also glean information on the effectiveness of technology-rich environments based on other factors that influence student learning such as student engagement, motivation, and attitudes towards learning. For this reason, many studies on 1:1 laptop environments involve some form of inquiry related to student engagement.

As a result, there is overwhelming evidence that suggests that increased student engagement and motivation are strongly associated with 1:1 laptop environments (Bebell et al., 2014; Bebell & Kay, 2010; Clariana, 2009; Keengwe et al., 2012; Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Suhr et al., 2010; Zheng et al., 2014). For example, results from a 1:1 laptop program implemented at a midwestern high school revealed that 76.9% of teachers stated that students were able to work more independently while also demonstrating greater student engagement after laptops were integrated into the learning process (Keengwe et al., 2012). Comparably, in a study exploring a 1:1 laptop program and fourth grade reading literacy, Suhr et al. (2010) found that teachers reported higher student engagement in the laptop environment. For example, students appeared to enjoy writing papers, using multi-media, and searching for information on the Internet. According to the student surveys, 83.8% of students favored learning with computers, "79.9% said that school work became more interesting once they received laptops, and 71.5% said that they revised their work more once they had laptops" (Suhr et al., 2010, p.25). Bebell and Kay (2010) also reported that 83% of teachers believed that engagement increased in the 1:1 laptop classroom for the average student.

The results from Clariana's (2009) research of sixth grade math students in a 1:1 laptop environments suggested that most students willingly took responsibility for their own learning while using a comprehensive math software on laptops which created an environment that positively enhanced student engagement and the learning process. Likewise, numerous researchers reported that 1:1 laptop programs positively enhanced student motivation towards learning (Bebell & Kay, 2010; Rosen & Beck-Hill, 2012; Zheng et al., 2014). Bebell et al. (2014) also described higher levels of student engagement in their research investigating 1:1 computing, cloud-based software, and student achievement. Student engagement in the 1:1 computing environments remained over 90% throughout the school year, where the control group's student engagement declined (Bebell et al., 2014).

According to the survey results collected by Kposowa and Valdez (2013), 42.2% of students revealed that using laptops made work more interesting and 37.8% of students reported that the quality of their work was higher when using laptops. Interestingly, only 2.2% of students reported preferring to write assignments using paper and pencil, suggesting a preference for using technology when completing written assignments (Kposowa & Valdez, 2013). These results add further evidence to the argument that digital natives (students born after 1980) "think and process information fundamentally differently from their predecessors" (Prensky, 2012, p.68). Subsequently, when educators infuse technology into the learning environment effectively, student engagement and motivation is positively impacted because student's learning needs are being met.

Student Use and Laptops

Prior research has clearly documented that student use of technology increases in 1:1 laptop environments (Bebell et al., 2014; Clariana, 2009; Keengwe et al., 2012; Zheng et al., 2013). Based on observations, Bebell et al. (2014) found that students' technology use grew from 23% to 61% when learning in 1:1 laptop environments, while the use of technology decreased slightly in the comparison group. Additionally, students in the 1:1 laptop environment "reported that their average frequency of computer use in the classroom more than doubled during the year-long pilot" (Bebell et al., 2014, p. 138). This increased technology use was reported across all subject areas with the largest increases the areas of English and social studies. Likewise, Keengwe et al. (2012) found that implementing a 1:1 laptop program increased the amount student's used technology in the classroom and at home. Zheng et al. (2013) argued that at-risk students such as students from low-income families used laptops more frequently than their classmates when participating in a 1:1 laptop program, and Clariana (2009) discovered that students enrolled in laptop classrooms utilized technology more often to complete lessons using *CompassLearning LLC* when compared to the control group. Research conducted by Jing and Yong (2008) found that 1:1 computing environments could also increase students' proficiency in using technology due to the increased opportunities gained from completing various learning tasks using computers.

In addition, numerous studies described how students utilized laptops within the classroom. According to teachers, fourth grade students most often used laptops in class for writing, locating information using the Internet, and creating multimedia presentations (Suhr et al., 2010). Students reported similar results while adding "maintaining a personal calendar (iCal), managing photos (iCal), working with movies (iMovie), and taking quizzes" (Suhr et al., 2010, p. 23). Other studies found that students utilized technology to find information on the Internet, access their teacher's website, take notes, play educational games, and edit papers (Bebell & Kay, 2010) as well as complete research, create presentations and write papers using a word processor (Shapley et al., 2010). Fourth and fifth grade students most frequently reported using their computers for writing assignments followed by finding information using the Internet, playing educational games, and learning how to use new software as well as basic computer use (Zheng et al., 2013). Jing and Yong (2008) revealed that students used laptops in imaginative and creative ways to complete tasks related to "learning, communication, expression and exploration" (p. 117).

Zheng et al. (2014) also argued that the 1:1 laptop program allowed for increased differentiation and individualized instruction while also supporting positive peer interactions with students. Comparably, Bebell et al. (2014) and Mouza (2008) found that student collaboration and peer interaction increased in the 1:1 laptop environment. Bebell et al. (2014) also discovered that student's use of technology in a 1:1 computing environment went beyond written assignments. Students were observed using laptops to develop a wide array of artifacts, while students in the comparison group primarily used technology for writing assignments. Most of the observations conducted in the 1:1 learning environment found students creating multi-media products. Bebell et al. (2014) found that students in the 1:1 computing environment developed student webpages most frequently. Moreover, students were "three times more likely to make presentation slides and four times as likely to give presentations" (Bebell et al., 2014, p. 140) compared to students that were not participating in the 1:1 environment.

In a study exploring 1:1 learning environments in 18 schools in North Carolina, Corn et al. (2011) also found that learning in a 1:1 environment allowed students to connect with worldwide audiences by writing using a variety of mediums such as digital magazines, newsletters, and class blogs. Teachers further reported that access to 1:1 laptops helped students complete higher-level activities as well as individualized learning opportunities while also increasing communication between teachers and students through the use of Google docs and email (Corn et al., 2011). In addition, results from research on 1:1 laptop environments conducted by Mouza (2008) indicated that teachers utilized technology to create authentic tasks to engage students in purposeful learning opportunities. Interestingly, Mouza also found that students preferred writing on the computer compared to traditional handwriting.

Implementation Factors Related to 1:1 Laptop Initiatives

When implementing a 1:1 laptop initiative, school systems need to consider prior research findings related to implementation factors as well as challenges related to 1:1 programs in order to increase their chances of success towards program goals. Consequently, schools need to acknowledge the importance of teacher buy-in as well as teacher beliefs towards technology and readiness for technology integration, as these factors may impact the success of 1:1 initiatives (Dunleavy & Heinecke, 2007; Inan & Lowther, 2010; Shapley et al., 2010). Inan and Lowther (2010) found that teacher beliefs and readiness to use laptops within instruction strongly predicts teacher's laptop use, while school factors such as technical support, professional development, and support for school technology has an indirect influence on the integration of laptops by teachers. Other researchers contended that teacher buy-in is critical to the success of technology integration programs as teachers largely control technology use within the classroom (Shapley et al., 2010). Likewise, Bebell and Kay (2010) stated that, "it is impossible to overstate the power of individual teachers in the success and failure of 1:1 computing" (p. 48) as teachers are considered the gatekeepers of technology use within the teaching and learning process.

According to previous research, several instructional challenges exist when implementing 1:1 programs as well (Corn et al., 2011; Dunleavy & Heinecke, 2007). Teachers reported concerns including: (a) insufficient time to learn how to incorporate technology in new ways, (b) hardware issues, (c) classroom management concerns, (d) different degrees of technology skills amongst students, and (e) lack of knowledge related to how to use specific technology within lessons (Corn et al., 2011; Dunleavy & Heinecke, 2007). Consequently, many researchers have advocated for high quality ongoing and sustained professional development when implementing 1:1 programs (Corn et al., 2011; Dunleavy &Heinecke, 2007; Mouza, 2008; Shapley et al., 2010; Zheng et al., 2014).

In their study exploring 1:1 laptop environments in North Carolina public schools, Corn et al. (2011) revealed that schools with the greatest percentage of teachers with negative reactions towards the 1:1 laptop program "were those who had ill-planned professional development or who taught at schools in which not all students had laptops" (p. 19-20). Inan and Lowther (2010) found that school level factors such as professional development could positively impact teacher readiness towards technology integration as well as teacher beliefs suggesting that negative reactions towards 1:1 initiatives could be mitigated by high-quality professional development in addition to other school factors. This research provides additional evidence towards the importance and impact of professional development on teacher beliefs and readiness for technology integration.

Other factors that contribute to the effective implementation of 1:1 technology initiatives include having a robust infrastructure as well as a school culture that supports technology integration (Zheng et al., 2014). Shapley et al. (2010) further contended that timely technical support to assist teachers with technical problems is also important. Ultimately, Shapley et al. (2010) found that the most successful schools with 1:1 technology integration reported that "committed leaders, thorough planning, teacher buy-in, preliminary professional development for teachers, and commitment to the transformation of student learning" (p. 46) were critical components that led to effective program implementation.

Summary

Based on this literature review, it is clear that 1:1 laptop initiatives are gaining increased attention by researchers, school leaders, and policy makers. However, prior research has produced mixed results related to student achievement, and there is limited research exploring the impact of 1:1 initiatives on students from diverse socio-economic backgrounds. Additionally, there appears to be an expanding digital divide between students from diverse backgrounds that may be increasing the socio-economic achievement gap. Since most educational investments are based on student achievement as measured by state standardized assessments, it is important to continue investigating the impact of 1:1 laptop environments on student achievement in order to understand the most effective ways to close the socio-economic achievement gap and provide all students with an equal opportunity for success.

CHAPTER THREE: METHODS

Overview

The purpose of this chapter is to provide a detailed description of the research design, participants and setting, instrumentation, procedures, and the statistical analysis techniques used within the current study. A summary of the effect size and alpha level for the statistical analysis is also provided.

Design

A non-experimental ex post facto causal comparative research design was utilized to investigate differences between fifth grade ELA scores based on learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS). This design was selected because causal comparative research is utilized to determine how particular groups differ on a dependent variable, based on the presence or lack of presence of certain independent variables (Gall, Gall, & Borg, 2007), which aligns with this study. Additionally, when researchers explore cause and effect relationships between variables a causal comparative research design is often selected (Gall et al., 2007).

The current study is non-experimental because one independent variable (learning environment) has already occurred and therefore cannot be manipulated, and the second independent variable (socio-economic status) naturally occurs within the student population, which aligns with an ex-post facto research design (Gall et al., 2007). When using a causal comparative design, independent variables should be categorical and measured using nominal or ordinal scales (Gall et al., 2007). Due to the categorical nature of the independent variables used in this study, a nominal scale was utilized to measure student's socio-economic status as well as their learning environment.

The first independent variable, learning environment, was defined as classrooms with or without 1:1 laptop access. For the purposes of this study, a 1:1 laptop environment had three core features including: (a) individual student access to a laptop with word processing and spreadsheet capacity, (b) the ability to access the school's wireless Internet, and (c) student use of laptops to complete academic tasks within the classroom (Penuel, 2006). Examples of hardware included: Chrome Books, MacBook Airs, etc. Cloud-based software was utilized on some laptops. Classrooms without a 1:1 laptop ratio accessed technology through computer labs or by signing out school-wide mobile laptop carts.

The second independent variable, socio-economic status, was determined based on the student's eligibility for free and reduced meals according to the National School Lunch Program (United States Department of Agriculture, 2016). Students qualified for free meals when their family income was "at or below 130 percent of the poverty level" and reduced meals when a family's income was "between 130 percent and 185 percent of the poverty level" (United States Department of Agriculture, 2013, p. a2). Effective July 1, 2015, a family of four with an annual gross income of less than $31,525 was considered eligible for free meals (Tribiano, 2015). A family of four with an annual income of less than $44,863 was considered eligible for reduced meals (Tribiano, 2015). Thus, a family of four with an annual income greater than $44,863 was not eligible for free or reduced meals. The dependent variable, fifth grade ELA achievement was measured using the technology-enhanced, state-administered ELA PARCC assessment, which was designed to assess student performance related to the ELA CCSS with the goal of measuring progress towards college and career readiness (Educational Testing Service et al., 2016).

Research Questions

The following research questions were explored within this study.

RQ1: Is there a significant difference in the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not?

RQ2: Is there a significant difference in the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not?

RQ3: Is there a significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS).

Hypotheses

The corresponding null hypotheses are as follows:

$H_0$1: There is no statistically significant difference between the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not as measured by the state-administered, technology-enhanced assessment.

$H_0$2: There is no statistically significant difference between the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not as measured by the state-administered, technology-enhanced assessment.

$H_0$3: There is no statistically significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS) as measured by the state-administered, technology-enhanced assessment.

Participants and Setting

This study took place in a northeastern state within the United States. The Local Educational Agencies (LEAs) within the identified state were dependent agencies that relied on the availability of local, state, and federal funding for operating costs. The local Boards of Education did not have authority over taxes, and funding was determined solely on a wealth-based formulaic calculation according to the law. The target population for the current study included fifth grade students who attended traditional public schools in five different school systems who took the computer-based PARCC assessment during the 2015-2016 school year.

All five school systems included in this study were categorized amongst the smaller school systems within the state. The school systems were located in rural, distant town, suburban, as well as small city communities (National Center for Education Statistics, 2016) and served families from diverse socio-economic backgrounds. The target population consisted of 1,936 fifth grade students, which included 988 boys and 948 girls enrolled in 39 different elementary schools within five school systems. The demographics of the target population included 79.4% Caucasian, 10.3% African American, 4.6% Hispanic, 4.6% multiple races, .8% Asian, .2% Native Hawaiian/Other Pacific Islander, and .1% American Indian/Alaskan. Moreover, 48.5% of the target population qualified for free and reduced meals. The median income for the communities served by the selected school systems ranged from $40,551 to $85,963. Moreover, the poverty rate ranged from 7.2% to 20%. Of the 39 elementary schools in the selected school systems, 11 schools had implemented 1:1 laptop programs. Subsequently, within the target population, 758 students were learning in a 1:1 laptop environment and 1,177 were not learning in a 1:1 laptop environment.

These sites were chosen because the school systems were similar in population size and they met the necessary criteria for this study, which required sites that were implementing 1:1 laptop programs and sites that were not implementing 1:1 laptop programs. The selected school systems also had diverse student populations related to socio-economic status, which was a necessary component for this study. Specifically, three of the counties were classified as high in wealth and two of the counties were considered low in wealth, thereby providing a setting with a student population with diverse socio-economic backgrounds. Moreover, two of the sites had comprehensive 1:1 laptop programs for fifth grade students, one was piloting a 1:1 laptop program for some fifth grade students, and two sites were not interested in moving towards a 1:1 laptop model. The two sites that did not have 1:1 laptop programs were selected because they held similar beliefs related to a collaborative approach to technology integration, which involved higher student to technology ratios.

All identified sites provided instruction intended to align with the state ELA standards, which were assessed using the ELA PARCC assessment. In addition, daily instruction in English language arts by teachers who were highly qualified according to the guidelines set by the State Department of Education was provided. One to one laptop classrooms provided students with individual access to laptops and Internet access. Additionally, laptops were utilized to complete various instructional tasks that were intended to support the development of complex 21st century skills. Classrooms without 1:1 laptop access had to sign out school-wide laptop carts or travel to the computer lab to complete assignments using technology. All sites administered the PARCC assessment online.

A nonproportional stratified random sampling procedure was used to select fifth grade students from the target population using the 2016 PARCC database stored within each of the five school systems. This sampling process was implemented to ensure an adequate number of participants for each subgroup within the total sample (Gall et al., 2007). School systems were asked to provide student PARCC data that was stripped of all student and teacher identifiers to ensure anonymity. Moreover, school systems were asked to screen the data to ensure only data from students who were taught by highly qualified teachers were provided. Once the PARCC data files were received from each school system, the researcher merged all of the data into one comprehensive database. Then, data linked to any fifth grade student enrolled at the researcher's school was removed. There were six data points provided that were not complete and therefore were also removed from the sample.

Next, all remaining fifth grade students were divided into two groups based on their instructional environment (1:1 laptop vs. not 1:1 laptop). Students within both instructional groups were then sorted based on socio-economic status (FARMS and non-FARMS). The outcome included two groups of students (FARMS vs. non-FARMS) who participated in 1:1 laptop environments and two groups of students (FARMS vs. non-FARMS) who received instruction without 1:1 laptop access. All students within each group were assigned a computer-generated random number in Excel that the researcher then sorted from smallest to largest. Then, the researcher selected the first 100 participants for each group, resulting in 400 total participants.

Participants within this study included fifth grade students enrolled in traditional public schools located within five identified school systems in a northeastern state during the 2015-2016 school year. According to Gall et al. (2007), a minimum sample of 126 participants was needed for a medium effect size with a statistical power of .7 at the .05 alpha level. For the current study, the number of participants sampled was 400, which exceeded the required minimum needed for a medium effect size. The demographics of the sample population consisted of 78.5% Caucasian, 12.5% African American, 4.3% Hispanic, 4.0% multiple races, and .8% Asian. Of the 400 participants, 192 were female and 208 were male. In addition, 200 participants qualified for free meals and reduced meals while 200 participants paid full price for their meals during the 2015-2016 school year. Of the 39 elementary schools identified within the target population, 37 are represented in the sample population data.

Instrumentation

The state-administered standardized ELA PARCC assessment was used to measure the ELA achievement of fifth grade students in this study. All public schools within the identified northeastern state were required to administer this yearly assessment to monitor student progress in ELA and satisfy requirements established under ESSA legislation during the 2015-2016 school year. Since the data required for the current study was historical and routinely collected by the state and school systems for other purposes, the researcher sought permission through the Institutional Review Board (IRB) process to use the student data collected from the 2016 PARCC assessment from the five LEAs represented within this study.

The purpose of the ELA PARCC assessment was to measure student progress towards college and career readiness as well as assess student performance related to the ELA CCSS (Educational Testing Service et al., 2016). The PARCC assessment aimed to assess student's ability to independently read and comprehend a variety of complex text as well as write effectively using sources (Educational Testing Service et al., 2016). The assessment included the following subscales: (a) reading literature, (b) reading informational text, (c) vocabulary, interpretation and use, (d) written expression, and (e) knowledge of language and conventions (Educational Testing Service et al., 2016). Information on the PARCC assessment was presented using multi-media text as well as print text (Partnership for Assessment of Readiness for College and Careers [PARCC], 2014). Additionally, some items were technologically enhanced, requiring students to organize data, categorize information, place a series of events in order, plot data, highlight text, and fill in a blank (Educational Testing Service et al., 2016). The fifth grade ELA PARCC assessment that was administered in 2014-2015 consisted of 33-34 reading items and six written items for a total of 39-40 items (Educational Testing Service et al., 2016). It is important to note that PARCC made some design changes after the first operational year in 2014-2015 including shortening the ELA assessment by 30 minutes in addition to having one testing window instead of two (PARCC, 2016b). However, assurances related to the comparability of scores between the 2014-2015 and 2015-2016 administration of the PARCC assessment have been established using standard psychometric equating methods (Maryland State Archives, 2016). Information related to sample released ELA PARCC items for fifth grade can be found in Appendix A.

The development of the PARCC assessment began in 2010 when thousands of educators and higher education representatives began working collaboratively to develop a next generation assessment (Educational Testing Service et al., 2016). The PARCC consortium took numerous steps to ensure construct validity, which looks at the degree to which the assessment measures what it aims to measure (Educational Testing Service et al., 2016). First, the PARCC consortium involved hundreds of teachers, assessment experts, as well as professionals on bias and sensitivity throughout the item development process to ensure assessment content was validated (Educational Testing Service et al., 2016). Moreover, several studies, including the Student Task Interaction Study and the Rubric Choice Study, were conducted in the early stages of the development process (Educational Testing Service et al., 2016).

Construct validity was further assessed through a field test that was conducted in 2014 (Educational Testing Service et al., 2016). Prior to conducting the field test, committees composed of K-12 educators and higher education professionals collaborated to determine standard alignment, content accuracy, accessibility, and developmental appropriateness of PARCC items (PARCC, 2014). During this process, items were reviewed by at least 30 professionals before being approved for the field test (PARCC, 2014). During the field test administration, over 11,000 items were tested across all grade levels and subjects with roughly 4,600 of those items falling into the ELA category (PARCC, 2014). After a rigorous review by 80 educators from PARCC states who were trained to interpret item-level statistics such as fairness and difficulty in a weeklong review of field test data, 78 percent of the ELA items were found to have strong construct validity and were approved for the PARCC assessment (PARCC, 2014).

Data from the 2014-2015 administration of the PARCC assessment offers an additional opportunity to determine the validity of the PARCC assessment. During this testing administration, the internal structure of the PARCC assessment was found to be unidimensional with moderate to high intercorrelations between ELA subscales (Educational Testing Service et al., 2016). Evidence of validity was also supported through a benchmarking study, content evaluation study, mode comparability study, as well as a device comparability study (Educational Testing Service et al., 2016). Moreover, an independent study evaluating the content and quality of the PARCC assessment reported that the PARCC ELA assessment earned an excellent match to the new criteria set by the Council of Chief State School Officers, providing additional evidence of validity (Doorey & Polikoff, 2016). This finding suggested that the PARCC assessment places a strong emphasis on the content that is the most important within the CCSS while also effectively assessing students' readiness for college and careers (Doorey & Polikoff, 2016).

The reliability of the PARCC assessment was evaluated using the data from the 2014-2015 testing administration as well (Educational Testing Service et al., 2016). Stratified alpha was used to determine reliability, which is a weighted average of Cronbach's alpha (Educational Testing Service et al., 2016). Stratified alpha was the most appropriate reliability statistic in this case due to the mixed item types and different parts of the assessment (Educational Testing Service et al., 2016). The computer based fifth grade ELA PARCC assessment was found to be reliable with an average reliability of .91 (Educational Testing Service et al., 2016). The major claim related to reading complex text had an average reliability of .88, while the major writing claim was a .82 (Educational Testing Service et al., 2016). The subscales for reading included reading literature (.75), reading information (.75), and reading vocabulary (.63), and the writing subclaims included written expression (.76) and writing knowledge, language and conventions (.81) (Educational Testing Service et al., 2016).

The PARCC consortium scored items using machines as well as human scorers (Educational Testing Service et al., 2016). Human scorers were required to complete online training modules and demonstrated proficiency in correctly scoring written responses according to the established criteria (Educational Testing Service et al., 2016). During the 2014-2015 test administration, at least 10 percent of student responses were randomly distributed for a second scoring to monitor human scoring (Educational Testing Service et al., 2016). If the scores were not congruent, a third and sometimes a fourth score would be determined to resolve the difference (Educational Testing Service et al., 2016). Since around 90% of student responses only received one score, the initial score was always the score reported even if additional scores were applied (Educational Testing Service et al., 2016). Validity responses were also used to help ensure that scorers applied the same standards throughout the assessment period (Educational Testing Service et al., 2016). The perfect inter-rater agreement expectation for ELA was 65% and the perfect agreement result was 65% (Educational Testing Service et al., 2016). The within one point inter-rater agreement expectation for ELA was 96% and the reported result was 98%, which suggested a high level of inter-rater reliability (Educational Testing Service et al., 2016).

Range finding to establish performance level scores was conducted in 2015 by panels of professionals who were nominated from each PARCC state (PARCC, 2016c). Performance level descriptors were utilized to guide this work in addition to test results and empirical studies (PARCC, 2016c). Panels participated in at least three rounds of review prior to determining performance level ranges (PARCC, 2016c). PARCC scaled scores ranged from 650 to 850. A scaled score of 650 was the lowest score possible and it means that the student did not yet meet expectations related to the mastery of knowledge and skills covered within the CCSS at their grade level (Educational Testing Service et al., 2016). A scaled score of at least 750 or higher means that the student met or exceeded academic expectations related to the mastery of knowledge and skills covered within CCSS at their grade level (Educational Testing Service et al., 2016). A scaled score of 850 was the highest score possible and means that the student exceeded expectations related to the mastery of knowledge and skills covered within the CCSS at their grade level (Educational Testing Service et al., 2016). The PARCC scaled score can be converted into the following performance levels: (a) level one- did not yet meet expectations, (b) level two- partially met expectations, (c) level three- approached expectations, (d) level four- met expectations, and (e) level five- exceeded expectations (Educational Testing Service et al., 2016).

The cut scores for each level are based on a student's scaled score and are identified as 700 for level two, 726 for level three, 750 for level four, and 799 for level five (Educational Testing Service et al., 2016). All of the performance levels indicated above are based on guidelines set for the 2015-2016 school year.

The first round of PARCC data was released in December 2015. Consequently, there has not been an opportunity for this standardized assessment tool to be utilized in peer-reviewed studies to date. However, several studies similar to the one proposed here have utilized state-administered standardized assessments when exploring student achievement and 1:1 laptop environments (Bebell et al., 2014; Clariana, 2009; Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Shapley et al., 2010; Suhr et al., 2010; Zheng et al., 2014).

Procedures

Due to the ex post facto nature of this research, the PARCC assessment was administered to fifth grade students during the 2015-2016 school year. The PARCC testing environment is detailed below and was based on the 2015-2016 administration guidelines provided by the state. The online elementary PARCC administration window for 2015-2016 was determined by each school system and was required to be scheduled for 30 consecutive school days between April 4, 2016 and June 10, 2016 (PARCC, 2016d). Prior to PARCC testing, all eligible test administrators and proctors were required to receive training regarding the proper administration of the assessment as well as administering the test securely according to the standardized guideline provided by the PARCC consortium (PARCC, 2016d). According to the guidelines, test administrators were responsible for: (a) administering the assessment using the appropriate protocols, (b) monitoring the testing environment throughout the testing session, (c) ensuring the testing environment was free of cheating, (d) ensuring that students did not receive any form of assistance that may impact their answers, and (e) following all test security protocols for delivering accommodations or accessibility features (PARCC, 2016e). According to the state guidelines, a test administrator could be any individual that was currently employed by the school system as a teacher or administrator as well as other certified professionals within the school system (PARCC, 2016d).

The 2015-2016 fifth grade PARCC ELA assessment was broken into three 90-minute units (PARCC, 2016d). It was highly recommended that students were not scheduled for more than two units in any given school day (PARCC, 2016d). The testing environment was required to be quiet and free from all prohibited items, which included personal electronic equipment, any instructional resource that may provide unauthorized assistance to students, posters detailing how the testing platform (TestNav) functions, or any unapproved manipulative (PARCC, 2016d). In addition, each testing location had to have a clock, a do not disturb testing sign, and a timing box that included the unit name, unit testing time, starting time, and stopping time (PARCC, 2016e).

During testing, each school was to provide each student with his or her own computer, student testing ticket, No. 2 pencil(s) with eraser(s), blank scratch paper, head phones, and any necessary materials needed for accommodations or accessibility features to complete the assessment (PARCC, 2016e). Once testing was about to begin and students were seated, the testing administrator was required to verify attendance (PARCC, 2016e). Then, the test administrators were required to read from the script found in the 2016 Test Administrator's Manual for grades three through five and distribute student test tickets and scratch paper according to the directions (PARCC, 2016e). Information regarding the 2016 Test Administrator's Manual can be found in Appendix B. During the testing session, the test administrator was expected to keep track of time, monitor students, and ensure test security

(PARCC, 2016e). The test administrator could choose to provide a three-minute stretch break for the entire class during each unit of testing (PARCC, 2016e). During breaks, students were not permitted to talk and a visual barrier was placed over the computer screens according to the guidelines (PARCC, 2016e). If a break was provided, the testing administrator adjusted the end of the unit time by up to three minutes (PARCC, 2016e). At the end of the test session, the testing administrator was required to read directions from the script to ensure students submitted their assessment properly and logged out of TestNav.

In order to access the necessary PARCC results, the researcher contacted the superintendent of each school system represented within this study by letter with the goal of obtaining permission to conduct the current research within their school system and to secure the necessary documents needed for the IRB process. Phone conferences were scheduled with superintendent's designees as needed in order to answer questions and obtain the necessary permissions. Even though the Institutional Review Board did not consider this research study human subjects research, permission to conduct the research in each school system represented in the study was required before IRB would provide approval. Obtaining the necessary permissions from the five school systems took approximately two months. Once the researcher secured IRB approval through Liberty University's Institutional Review Board, data collection took another month to complete. The IRB approval letter can be found in Appendix C.

After receiving IRB approval, the researcher requested the PARCC data files from the 2015-2016 school year for fifth grade students from each school system represented in this study. The PARCC data files included each student's ELA scaled score, school, testing format/mode, and demographic information (ethnicity, gender, FARMs). As a measure to protect student and teacher privacy, the researcher requested that each student's name be removed along with the teacher or group name. The researcher asked each school system to verify that the data shared was for students who were taught by highly qualified teachers. Information related to 1:1 laptop initiatives was also verified. Then, data connected to fifth grade students who attended the school where the researcher was an administrator were eliminated from the data set. There were six data points provided that were not complete and therefore were also removed from the sample. The researcher then sorted students into two groups according to those who participated in 1:1 laptop environment and those who did not. After that, these two groups were sorted per the student's socio-economic status. The data files obtained from the school districts were immediately recorded using the Statistical Package for the Social Sciences software (SPSS), and the data was stored on a password-protected computer as well as an external hard drive that was kept in a locked filing cabinet in the researcher's home.

Data Analysis

The researcher computed descriptive statistics of the total sample as well as for each subgroup being explored using SPSS. These statistics included the number of participants in each subgroup, participant's ELA scaled score, gender, ethnicity, and FARMs status. The mean scores and standard deviations of the ELA scaled scores were evaluated for the total sample and for each subgroup.

In this study, the first null hypothesis investigated the main effect of the first independent variable (students who learned in a 1:1 laptop environment and those who did not) on the mean levels of the ELA PARCC scaled scores (dependent variable). The second null hypothesis investigated the main effect of the second independent variable (students who qualified for FARMS and those who did not) on the mean levels of the ELA PARCC scaled scores. Additionally, the third null hypothesis investigated the interaction of the effect the two independent variables cited above had on the mean levels of the ELA PARCC scaled scores. To test all three null hypotheses, a non-experimental ex post facto causal comparative research design utilizing a two-way ANOVA statistical analysis was implemented. A non-experimental causal comparative design was selected because one independent variable (socio-economic status) occurs naturally within the environment and the second independent variable has already occurred and was not manipulated.

According to Gall, Gall, and Borg (2010), "analysis of variance is commonly used in group comparison research" (p. 250). Additionally, a two-way analysis of variance (ANOVA) is utilized to ascertain how two or more independent variables affect a dependent variable both individually and together (Gall et al., 2007). A significant advantage of the two-way ANOVA statistic is the capacity to identify potential interactions between variables (Warner, 2013). For the current study, the independent variables included instructional environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS). A two-way ANOVA was the most appropriate statistical analysis for the current study as the researcher sought to determine how the independent variables stated above impacted the ELA achievement scores of fifth grade students independently or in combination, which strongly aligns with the purpose of a two-way ANOVA.

There are some basic assumptions that need to be considered when conducting a two-way ANOVA. To examine these assumptions, preliminary data screening procedures were implemented according to the recommendations of Green and Salkind (2011) and Warner (2013). First, the researcher examined histograms to determine the normality of distributions of the dependent variable (ELA scaled scores) for the total sample and each subgroup as well as boxplots to screen data for extreme outliers within all subgroups and the sample as a whole.

Additionally, the researcher utilized the Kolmogorov-Smirnov statistic to evaluate normality since the sample size was greater than 50. Next, the researcher used Levene's test for equality of variance to assess the variance of the dependent variable across all subgroups. A two-way ANOVA "assumes that the variances of scores are reasonably homogeneous across groups" (Warner, 2013, p. 507). Additionally, the researcher implemented a random sampling process and the ELA scaled scores were independent from one another, which is an important assumption to satisfy for a two-way ANOVA (Green & Salkind, 2011).

After the assumptions were satisfied, the researcher conducted a two-way ANOVA analysis. The *F* value was utilized to determine the main effects and was considered statistically significant with an alpha level that was $< .05$, which was used to reject or accept the null hypotheses within this study. Based on the results, post hoc tests to evaluate pairwise differences were not necessary. The effect size was calculated using partial eta squared to determine the practical significance of the statistical findings. The following guidelines were implemented to evaluate the partial eta squared results: partial $\eta^2 = .01$ was considered a small effect, partial $\eta^2 =.06$ was considered medium effect, partial $\eta^2 = .138$ was considered large effect. The number (*N*) of participants, degrees of freedom, significance level (*p*), and power were also calculated and are reported in Chapter Four.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to explore the impact of 1:1 laptop environments on the ELA achievement of fifth grade students from diverse socio-economic backgrounds using a standardized, state-administered 21st century computerized assessment. This chapter will review the research questions explored within this study while also providing descriptive statistics related to the sample population as well as inferential statistics related to the collected data. The statistical analysis was performed using IBM® SPSS statistics version 24. The dependent variable in this study was fifth grade PARCC ELA scores. The independent variables included socio-economic status (FARMS vs. non-FARMS) and learning environment (1:1 laptop and not 1:1 laptop).

Research Questions

The following research questions were explored within this study.

RQ1: Is there a significant difference in the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not?

RQ2: Is there a significant difference in the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not?

RQ3: Is there a significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS).

Hypotheses

The corresponding null hypotheses are as follows:

$H_0$1: There is no statistically significant difference between the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not as measured by the state-administered, technology-enhanced assessment.

$H_0$2: There is no statistically significant difference between the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not as measured by the state-administered, technology-enhanced assessment.

$H_0$3: There is no statistically significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. Non-FARMS) as measured by the state-administered, technology-enhanced assessment.

Descriptive Statistics

The data used within this study was acquired from the PARCC ELA assessment, which is a state-administered standardized assessment that is given yearly to satisfy state and federal regulations in the northeastern state where this study took place. The researcher gained permission from five school systems to access the PARCC ELA scores of fifth grade students from the 2015-2016 school year. After receiving IRB approval and once the PARCC data files were received from each school system, the researcher merged all of the data into one comprehensive database. Then data linked to any fifth grade student enrolled at the researcher's school was removed. There were six data points provided that were not complete and therefore were also removed from the target population sample.

A stratified random sampling process was utilized to identify 400 participants (*N*=400) from a total of 1,936 fifth grade students who were enrolled in public schools located in five school systems in a northeastern state during the 2015-2016 school year. The demographics of the sample population (*N*=400) consisted of 78.5% Caucasian, 12.5% African American, 4.3% Hispanic, 4.0% multiple races, and .8% Asian, which was very similar to the demographics of the target population. Of the 400 participants, 192 were female and 208 were male. A stratified random sampling process ensured that 200 participants qualified for free meals and reduced meals, while 200 participants paid full price for their meals during the 2015-2016 school year. Of the 39 elementary schools identified within the target population, 37 are represented in the sample population data.

PARCC standard scores can range from 650-850, with a score of 650 qualifying as the lowest possible score and 850 qualifying as the highest possible score. The PARCC ELA scores for the sample population (*N*=400) within this study ranged from 650 to 827 resulting in a range of 177 points. The descriptive statistics for the PARCC ELA standard scores for the sample population are shown in Table 1.

Table 1

Descriptive Statistics for ELA PARCC Scores for the Sample Population

Variable	*M*	*SD*	*N*
ELA PARCC Scores (Sample Population)	736.95	32.507	400

Descriptive statistics were also calculated for each subgroup explored including the mean PARCC ELA score and the standard deviation. These results are shown in Table 2. The mean PARCC ELA score for students in a 1:1 laptop environment (*N*=200) was 735.90 (*SD*=33.328), which was slightly lower than the mean ELA PARCC score for students who did not learn in a 1:1 environment (*N*=200), which was 738.10 (*SD*= 31.714). The mean ELA scaled score for students who learned in a 1:1 laptop environment who did not qualify for FARMS (*N*=100) was 745.98 (*SD*=34.092), whereas the mean ELA scored score for students who did not learn in a 1:1 environment who did not qualify for FARMS (*N*=100) was 749.91 (*SD*=31.189). The mean score of students who qualified for FARMS, who also learned in a 1:1 environment (*N*=100) was 725.82 (*SD*=29.413), which was very similar to the mean score of FARMS students who did not learn in a 1:1 environment, which was 726.10 (*SD*=27.616). It should be noted that the mean scores of non-FARMS students were always higher than FARMS students, regardless of the instructional method used. In addition, the mean score of students who did not qualify for FARMS (*N*=200) was 747.94 (*SD*=32.650), which was much higher than the mean score of students who did qualify for FARMS (*N*=200), which was 725.96 (*SD*=28.457).

Table 2

Descriptive Statistics for ELA PARCC Scores by Factors

Type of Delivery	Social Economic Status	*M*	*SD*	*N*
1:1 Laptop	Non-FARMS	745.98	34.092	100
1:1 Laptop	FARMS	725.82	29.413	100
1:1 Laptop	All Students	735.90	33.328	200
Not 1:1 Laptop	Non- FARMS	749.91	31.189	100
Not 1:1 Laptop	FARMS	726.10	27.616	100
Not 1:1 Laptop	All Students	738.01	31.714	200
Both Delivery Types	Non-FARMS	747.94	32.650	200
Both Delivery Types	FARMS	725.96	28.457	200
Both Delivery Types	All Students	736.95	32.507	400

Results

Assumption Tests

According to Green and Salkind (2011), the two-way ANOVA inferential statistic requires that three assumptions be met including the normal distribution of the dependent variable for each population, homogeneity of variances between the scores of the dependent variable, and a random sampling process with all scores being independent from one another. Normality for the total sample in this study was evaluated using a histogram (shown in Figure 1 below) as well as the Kolmogorov-Smirnov statistic. Based on the Kolmogorov-Smirnov statistic, the assumption of normality was found tenable for the sample population (*N*=400) with a significance level of .200.

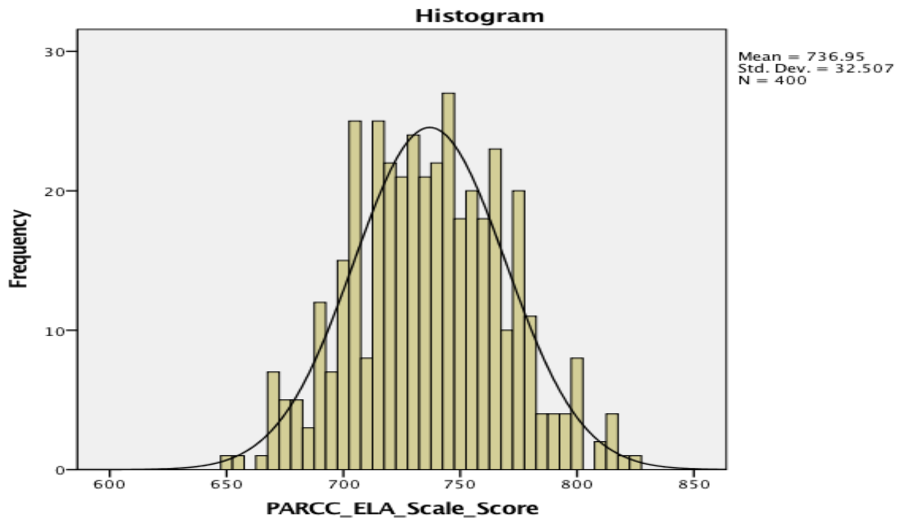

Figure 1. Histogram of PARCC ELA Scaled Scores for the Total Sample.

Normality was also found to be tenable for each subgroup with a significance level of .200 using the Kolmogorov-Smirnov statistic for all groups. In addition, histograms for each subgroup displayed a normal bell shaped curve similar to the one shown above, indicating normality. Box plots were also explored in order to screen data for extreme outliers in the total sample as well as each subgroup. No outliers were found for the total sample. When examining the box plots for each subgroup, one outlier was found specific to the subgroup that included participants that were non-FARMS and who learned in a 1:1 laptop environment. However, the outlier was not considered to be extreme. Based on procedures outlined by Warner (2013), the researcher ran the two-way ANOVA analysis with and without the outlier score. It was determined that the outlier did not have a significant effect on the results of the statistical analysis used in this study and therefore the score was not removed from the sample. Levene's test of equal variances was utilized to evaluate the homogeneity of variance across groups and was found to be tenable ($F(3,396)= 1.170$, $p=.321$). A non-proportional stratified random sampling procedure was used, and all PARCC ELA scores were independent of one another, thereby satisfying the third assumption for a two-way ANOVA.

Two-way ANOVA Results

A two-way ANOVA was utlized to explore the possible effects of learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS) on the ELA PARCC scores of fifth grade students who were assessed using a technology-based assessment. The dependent variable in this study was the fifth grade PARCC ELA scores. Learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS) were independent variables and were entered into the two-way ANOVA as factors. A significance level of $p < .05$ was utilized. The results of the two-way ANOVA are shared in Table 3 below.

Table 3

Tests of Between-Subjects Effects with Dependent Variable: PARCC ELA Score

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig	Noncent. Parameter	Observed Power
Corrected Model	49110.188[a]	3	16370.063	17.402	.000	52.206	1.00
Intercept	217239595	1	217239595	230933.540	.000	230933.540	1.00
Learning Environment	443.102	1	443.102	.471	.493	.471	.105
Socio-Economic Status	48334.023	1	48334.023	51.381	.000	51.381	1.00
Learning Environment * Socio-Economic Status	333.063	1	333.063	.354	.552	.354	.091
Error	372517.910	396	940.702				
Total	217661223	400					
Corrected Total	421628.098	399					

Notes. [a] R Squared= .116 (Adjusted R Squared = .110). [b] Computed using alpha = .05

As shown in Table 3, the independent variable (socio-economic status) was significantly related to the student's PARCC ELA scores ($F(1,396) = 51.381$, $p < .001$, partial $\eta^2 = .115$). The effect size of partial $\eta^2 = .115$, was found to be on the upper end of a medium effect size. The power was found to be very high at 1.00 as well. This suggests that the sample size was more than adequate to provide very strong statistical power.

Research Question and Null Hypothesis One

The first research question explored in this study asked if there was a significant difference in the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not. The first null hypothesis stated that there is no statistically significant difference between the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not as measured by the state-administered, technology-enhanced assessment. A two-way ANOVA was utilized to test this hypothesis and a significance level of $p < .05$ was utilized to evaluate the results.

The main effect related to the independent variable identified as learning environment (1:1 laptop vs. not 1:1 laptop) on the dependent variable (PARCC ELA scores) was not statistically significant ($F(1,396) = .471$, $p = .493$, partial $\eta^2 = .001$) (see Table 3). The mean PARCC ELA score of students in a 1:1 learning environment (M=735.90) was slightly less than the mean PARCC ELA score of students who did not participate in a 1:1 learning environment (M=738.01). However, the differences between means were not statistically significant. Thus, the researcher failed to reject the first null hypothesis.

Research Question and Null Hypothesis Two

The second research question asked if there was a significant difference in the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not. The second null hypothesis stated that there is no statistically significant difference between the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not as measured by the state-administered, technology-enhanced assessment. A two-way ANOVA with a significance level of $p < .05$ was utilized to test this hypothesis.

The main effect related to the independent variable identified as socio-economic status (FARMS vs. non-FARMS) on the dependent variable (PARCC ELA scores) was statistically significant ($F(1, 396)= 51.381$, $p < .001$, partial $\eta^2 = .115$) (See Table 3). The mean PARCC

ELA score for non-FARMS students (*M*= 747.94) was significantly higher than the mean PARCC ELA score for FARMS students (*M*= 725.96). The effect size of partial $\eta^2 = .115$ was found to be on the upper end of a medium effect size. This suggests that 11.5 percent of variance between PARCC ELA scores can be explained by a student's socio-economic status. Therefore, the researcher rejected the second null hypothesis.

Research Question and Null Hypothesis Three

The third research question asked if there was a significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS). The third null hypothesis stated there is no statistically significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS) as measured by the state administered technology enhanced assessment. A two-way ANOVA with a significance level of $p < .05$ was utilized to test this hypothesis.

The interaction effect related to the two independent variables identified as learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS) on the dependent variable (PARCC ELA scores) was not statistically significant ($F(1, 396) = .354$, p = .552, partial $\eta^2 = .001$) (See Table 3). The mean score of non-FARMS students learning in a 1:1 learning environment was 745.98, while the mean score of non-FARMS students not learning in a 1:1 learning environment was 749.91. Moreover, the mean score of FARMS students learning in a 1:1 environment was 725.82, while the mean score of FARMS students not learning in a 1:1 learning environment was 726.10. These results indicated that there was no significant interaction between learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. non-FARMS) on PARCC ELA scores. Thus, the researcher failed to reject the third null hypothesis.

Summary

Chapter Four provided a detailed description of the sample population as well as the descriptive and inferential statistics used to evaluate the research questions and hypotheses within this study. A two-way ANOVA was utilized to explore possible differences in PARCC ELA scores based on learning environment (1:1 laptop vs. not 1:1 laptop) and student's socio-economic status (FARMS vs. non-FARMS). Table 4 below summarizes the findings for each research question and null hypothesis.

Table 4

Summary of Research Findings by Question with Significance Levels

Research Question	Null Hypothesis	*p*-value	Reject Null Hypothesis
RQ1	$H_0 1$	.493	No
RQ2	$H_0 2$	< .001	Yes
RQ3	$H_0 3$	.552	No

The learning environment (1:1 laptop vs. not 1:1 laptop) did not have a statistically significant impact on PARCC ELA scores, and the researcher failed to reject null hypothesis one. However, socio-economic status (FARMS vs. non-FARMS) appeared to influence PARCC ELA scores as a statistically significant difference was found between the PARCC ELA scores of FARMS and non-FARMS students. Thus, null hypothesis two was rejected. Finally, there was no statistically significant interaction between learning environment (1:1 laptop vs. not 1:1

laptop) and socio-economic status (FARMS vs. non-FARMS) in the results of the PARCC ELA scores. Therefore, the researcher failed to reject null hypothesis three.

CHAPTER FIVE: CONCLUSIONS

Overview

This chapter provides an in-depth discussion regarding the results of the current study in relationship to previous research on 1:1 laptop environments and student achievement. The implications of the findings are discussed as well as the limitations of the current study. Finally, recommendations for future research are shared.

Discussion

The purpose of this investigation was to explore the impact of 1:1 laptop environments on the ELA achievement of fifth grade students from diverse socio-economic backgrounds using a standardized, state-administered 21st century computerized assessment. The study included 400 fifth grade students from five school systems located in a northeastern state. A non-experimental ex-post facto causal comparative research design was utilized within this study.

Earlier research has found weak evidence to support the argument that 1:1 laptop environments increase student achievement (Fleischer, 2012). Moreover, prior research related to 1:1 laptop environments and student achievement is inconclusive and includes conflicting results. Most research on this topic also measured achievement using a multiple-choice paper pencil format, which may not be the most reliable or valid way to assess the effect of a 21st century, technology-oriented environment (Bebell & Kay, 2010; Clariana, 2009; Russell, 2002; Silverman, 2005; Suhr et al., 2010). In addition, there is limited research exploring 1:1 learning environments and the achievement of students from different socio-economic backgrounds. As such, the current study explored the impact of 1:1 laptop environments specifically related to students from different socio-economic backgrounds using a computerized 21st century assessment to measure achievement.

Findings for Research Question One

The first research question in this study explored the impact of 1:1 laptop environments on the ELA achievement of fifth grade students as measured by the technology-enhanced PARCC assessment. The first null hypothesis stated there is no statistically significant difference between the ELA scores of fifth grade students who learn in a 1:1 laptop environment and those who do not as measured by the state administered technology enhanced assessment. The results from the two-way ANOVA indicated that there was no statistically significant difference between the ELA scores of students learning in a 1:1 laptop environment compared to those who did not. Therefore, the researcher failed to reject null hypothesis one using a significance level of $p < .05$. These findings suggested that students were similarly prepared to demonstrate their ELA knowledge on the technology-enhanced PARCC assessment in either learning environment (1:1 laptop or not 1:1 laptop). Additionally, results indicated that students learning in a 1:1 laptop environment did not perform statistically higher than students who did not learn in a 1:1 laptop environment.

These results support and contradict earlier research. Although many studies related to 1:1 technology and student achievement used a paper pencil format to measure performance, there were a few previous studies found that explored 1:1 laptop environments and student achievement that used a technology-enhanced measurement tool (Bebell & Kay, 2010; Clariana, 2009; Harris et al., 2016; Spektor-Levy & Granot-Gilat, 2012). However, none of these studies utilized a computerized state-administered assessment to measure the results of student achievement. Harris et al. (2016) investigated the impact of a 1:1 laptop environment on the math achievement of fourth grade students as measured by Pearson Topic Tests and a computerized Discovery Education Assessment. The results suggested that technology was not the only contributing factor to higher assessment scores. They found that the mean scores of the first three Pearson topic tests in math showed that the students in the 1:1 classroom scored higher than students in the traditional classroom (Harris et al., 2016). However, the mean scores of topic tests four, five, and six indicated that the students learning in the traditional classroom scored higher than those in the 1:1 classroom (Harris et al., 2016). A similar trend occurred when comparing the mean scores of the Discovery assessments in science. The 1:1 implementation classroom had higher mean scores on Discovery assessments A and B, while the traditional classroom had higher mean scores on Discovery assessment C (Harris et al., 2016).

Accordingly, the data showed that as the school year progressed, the achievement of students in the 1:1 implementation classroom became lower than the achievement of students in the traditional classroom. Although in some instances, the 1:1 laptop environment seemed to influence achievement, the data did not support the argument that technology increased the achievement of students (Harris et al., 2016). In fact, some of the variance between scores could have been from the novelty of using technology within the 1:1 laptop environment (Harris et al., 2016). Accordingly, the results of the current study align with these findings.

Bebell & Kay (2010) and Clariana (2009) both reported mixed results in their studies exploring 1:1 laptop environments and student achievement of middle school students. Both of these studies utilized paper pencil and computer-based assessments to measure student achievement. Clariana (2009) found a statistically significant difference in math achievement for students learning in a 1:1 learning environment on quarterly benchmarks that were given on the computer but no significant difference on the state standardized assessment, which was given in a paper pencil format. Bebell & Kay (2010) found statistically significant differences for ELA achievement but not for mathematics on a state standardized assessment. Additionally, a mock-computerized writing sample was administered and the results also supported increased achievement for students in the 1:1 laptop environment (Bebell & Kay, 2010). Although Bebell & Kay (2010) stated that their results are "far from conclusive," (p. 44) their findings suggested that 1:1 laptop environments might increase student achievement in ELA. Also, the research conducted by Clariana (2009) suggested that students from 1:1 laptop environments may perform better on computerized assessments. These findings are in alignment with research from Spektor & Granot-Gilat (2012), who also found that students in 1:1 classrooms scored significantly higher on a technology-enhanced assessment measuring informal literacy skills such as reading comprehension and information processing. In comparison, the results from the current study contradict these findings, as the researcher found no statistically significant difference in ELA achievement of fifth grade students based on learning environment (1:1 laptop vs. not 1:1 laptop) as measured by a state-administered technology based assessment.

There were also some studies that explored 1:1 laptop environments and student achievement as measured by a paper-pencil state administered standardized assessment (Bebell, et al., 2014; Kposowa & Valdez, 2013; Rosen & Beck-Hill, 2012; Shapley et al., 2010; Suhr et al., 2010). These studies consistently found that students in 1:1 learning environments showed increased growth in achievement in comparison to students who were not in a 1:1 environment. In contrast, there were also additional studies that reported mixed results or no statistically significant differences in achievement relative to 1:1 laptop environments (Dunleavy & Heinecke, 2007; Hur & Oh, 2012; Zheng et al., 2013). For example, while Zheng et al. (2013) found improved ELA achievement based on a partial year and full year laptop program within one school district, they also found that writing scores were not statistically different based on a 1:1 laptop program in another district. Similarly, Hur and Oh (2012) also concluded that test scores in science and English were not statistically different for students learning in a 1:1 laptop program compared to those who did not. Dunleavy & Heinecke (2007) found mixed results associated with a 1:1 laptop program and student achievement. They found that a 1:1 laptop environment could be associated with a small positive effect on science achievement, but no effect was found on math scores. Again, these studies did not measure student achievement using a technology-enhanced format. In conclusion, due to the conflicting results obtained in previous research on 1:1 laptop environments, the results of this study are consistent with some studies, while inconsistent with others.

Finally, the results from this study do not support nor contradict Lave's (1988) theory of situated learning. Situated learning theory suggests that students who experience learning in an authentic context (Batson, 2011; Brown et al., 1989; Lave & Wenger, 1991; Thoonen et al., 2011) while also utilizing the technology and tools within a relevant culture of practice (Lave & Wenger, 1991) may be able to more effectively apply knowledge to new situations (Brown et al., 1989; Catalano, 2015; Lave, 1988). Consequently, students learning in a 1:1 laptop environment may perform higher on a computerized 21st century assessment due to the congruence of the learning environment and testing platform. While students learning in a 1:1 laptop environment did not perform higher than students that were not learning in a 1:1 environment, there also was not a statistically significant difference between the two groups. In other words, the mean scores were statistically similar for students who learned in a 1:1 laptop environment and those who did not. Furthermore, it is important to recognize that students who were not learning in a 1:1 laptop environment did have some access to technology through school-wide computer labs and shared technology carts. This access could have minimized the potential impact of the 1:1 learning environment as it relates to situational learning and student achievement on computerized assessments.

Findings for Research Question Two and Three

The second research question in this study explored whether there was a difference in fifth grade students ELA scores based on socio-economic status (FARMS vs. non-FARMS). The corresponding null hypothesis stated, there is no statistically significant difference between the ELA scores of fifth grade students who qualify for free and reduced meals (FARMS) and those who do not as measured by the state-administered, technology-enhanced assessment. Based on the two-way ANOVA, results indicated that there was a statistically significant difference between the mean PARCC ELA scores of FARMS student (M= 725.96, SD= 28.457, N=200) and non-FARMS students (M= 747.94, SD= 32.650, N= 200) with a difference of 21.98 points. The effect size of partial $\eta^2 = .115$, was found to be on the upper end of a medium effect size. Furthermore, the mean score of non-FARMS students was higher than FARMS students regardless of the learning environment (1:1 laptop vs. not 1:1 Laptop). Therefore, the researcher rejected null hypothesis two.

These results are not surprising as they support previous research that has shown considerable evidence of a strong correlation between socio-economic status and student achievement (Jehangir, Glas, & Van den Berg, 2015; Leu et al., 2015; Reardon, 2013; Sirin, 2005; White et al., 2015). In fact, in his meta-analysis, Sirin (2005) concluded that the socio-economic status of a family has a “strong impact on students’ academic achievement” (p. 438). White et al. (2015) and Leu et al. (2015) went a step further as they argued that the existing gap in ELA performance associated with socio-economic status might even be widened due to computerized assessments. While the results of this study cannot confirm a widened gap, the findings do align with the commonly held assertion of an achievement gap related to socio-economic status.

The third research question in the current study explored whether there was a significant interaction between student ELA scores based on learning environment (1:1 laptop vs. not 1:1 laptop) and socio-economic status (FARMS vs. Non-FARMs). Accordingly, the researcher sought to determine if a 1:1 learning environment could decrease the academic achievement gap between low and high-income students on the ELA PARCC assessment. The corresponding null hypothesis stated there is no statistically significant interaction between the ELA scores of fifth graders who learn in a 1:1 laptop environment and those who do not and their socio-economic status (FARMS vs. non-FARMS) as measured by the state-administered, technology-enhanced assessment. Based on the two-way ANOVA, the results indicated that there was no statistically significant interaction between the ELA scores of students learning in a 1:1 laptop environment compared to those who were not and socio-economic status. While the achievement gap appeared to be smaller between FARMS and non-FARMS students who learned in a 1:1 learning environment compared to those who did not learn in a 1:1 environment, the difference was not statistically significant. In addition, the mean scores of FARMS students were similar based on the learning environment (1:1 laptop vs. not 1:1 laptop), as were the mean scores of non-FARMS students. Table 7 below shows the mean scores organized by socio-economic status for the current study.

Table 5

Mean Scores Organized by Socio-Economic Status

Type of Delivery	Social Economic Status	*M*	*SD*	*N*
1:1 Laptop	Non-FARMS	745.98	34.092	100
Not 1:1 Laptop	Non- FARMS	749.91	31.189	100
1:1 Laptop	FARMS	725.82	29.413	100
Not 1:1 Laptop	FARMS	726.10	27.616	100

Consequently, the researcher failed to reject null hypothesis three using a significance level of $p < .05$. These results suggested that 1:1 laptop environments might not contribute to closing the socio-economic achievement gap in ELA scores as suggested by prior research (Rosen & Manny-Ikan, 2011; Zheng et al., 2013; Zheng et al., 2014). Rosen & Manny-Ikan (2011) found that the 1:1 laptop program associated with the Time To Know program significantly narrowed the achievement gap between low-income students in Israel. Moreover, they found that the 1:1 laptop program increased scores in all areas including math, Hebrew, and English as a foreign language. Similarly, Zheng et al. (2013) found that while overall writing scores were not statistically different based on a 1:1 laptop environment, low-income students as well as Hispanic students did show significant gains. Consistent with these results, Zheng et al. (2014) also found that 1:1 programs helped narrow achievement gaps related to at-risk learners including low-income students in the area of science. The current study contradicts these findings as the results suggested that 1:1 programs may not decrease the gap in performance between FARMS and non-FARMS students.

Conclusion

In conclusion, while the results of this research study provided additional support related to the existence of an achievement gap based on socio-economic status, the results also showed that 1:1 laptop environments may not increase student achievement or close the gap in achievement due to socio-economic status as measured by the ELA PARCC assessment. Due to the mixed results associated with prior research on 1:1 laptop environments and student achievement, the findings of this study support and contradict earlier research.

Implications

Earlier research studies exploring the impact of 1:1 laptop environments on student achievement have produced varied results. The findings of this study suggest that 1:1 laptop environments do not increase student performance nor decrease the achievement gap between low and high socio-economic students, based on a state-administered, technology-enhanced assessment. These results suggest that while equal access to technology is an essential component of learning in the 21st century, the discussion needs to go beyond access and focus on the most effective ways to implement technology to transform learning in order to prepare students to meet the demands of a rigorous 21st century curriculum and assessment platform.

Technology provides a vehicle for customized learning opportunities within a student centric model (Christensen et al., 2011). Bebell et al. (2014) found that when 1:1 technology programs are implemented successfully, learning can move from teacher-centered to student-centered. However, in order to accomplish this, "teachers must continue to be learners themselves to produce the best teaching methods and introduce technology that works for their classroom" (Harris et al., 2016, p. 380). As such, the successful implementation of technology programs are uniquely connected to the growth of teachers and the ability to integrate the technology into personalized learning opportunities. Consequently, without the proper support and training for teachers, technology programs may not produce the desired academic benefits.

By providing 1:1 laptop programs, school systems can ensure that all students regardless of socio-economic status have similar access to devices. Yet, additional focus is needed on ensuring equal learning opportunities for all students regardless of background. Warschauer & Matuchniak (2010) argued that, "drill and practice programs that are disproportionately used with low-SES students are generally geared narrowly on acquisition of academic content or basic literacy and numeracy skills" (p. 208). Additionally, Rafalow (2014) found that teachers in high socio-economic schools promoted student use of whiteboards in dynamic ways, while teachers at a low-income school utilized the whiteboard as a traditional blackboard. In their study focused on the added value of 1:1 technology, Dunleavy et al. (2007) found that the second highest use of laptops by students incorporated skill and drill exercises. In light of the results of the current study, these trends are concerning and warrant additional attention as educators strive to close achievement gaps between socio-economic groups and ensure all students reap the benefits of high quality instruction in technology-rich environments.

Even though this study found no significant increases in achievement for students who learned in a 1:1 environment regardless of socio-economic background, the results do contribute to the current knowledge of 1:1 learning environments in several significant ways. First, most prior research on this topic relied on paper pencil assessments to measure student learning in technology rich environments. Consequently, several researchers have discussed the need for an appropriate tool to be utilized when measuring the possible impact of a technology-rich learning environment (Jing & Yong, 2008; Russell, 2002; Schnellert & Keengwe, 2012; Warschauer & Matuchniak, 2010). This study utilized the new technology-enhanced, standardized PARCC assessment that is administered at the state level to measure the ELA achievement of elementary students thus providing an appropriate tool to measure 21st century skills fostered through technology-rich environments.

Additionally, this study provides insight regarding how 1:1 laptop programs impact students from diverse socio-economic backgrounds thereby addressing the gap in the literature in this area (Fleischer, 2012). There has also been limited research on the potential benefits of 1:1 programs as it relates to student achievement on computerized statewide assessments at the elementary level. Accordingly, Bebell et al. (2014) argued the need for further research related to 1:1 computing and state test scores. By utilizing a standardized, state-wide computerized assessment to measure student performance, the current study responds to calls for additional research in this particular area (Bebell et al., 2014). Finally, the results of this study provide practical insight to leaders and administrators regarding how to move forward with technology integration in order to prepare all students to be successful within the current high stakes accountability system.

Limitations

This study has several limitations that may have impacted the results. First, a non-experimental casual-comparative research design was implemented and therefore participants were not randomly assigned to intervention groups (Rovai, Baker, & Ponton, 2013). This type of design is not as strong as an experimental design and does not "permit strong conclusions about cause-and-effect" relationships (Gall et al., 2007, p. 306). Therefore, the researcher was unable to conclude with certainty that cause and effect relationships existed between the independent variables (learning environment and socio-economic status) and dependent variable (PARCC ELA scores).

Moreover, threats to internal validity existed due to extraneous variables not controlled for that may provide alternative explanations of the results (Gall et al., 2007; Rovai et al., 2013). Teachers within this study were highly qualified in the area of English language arts according to the State Department of Education, and the intent was for ELA instruction to be aligned to the state standards. However, the State Department of Education does not prescribe a statewide curriculum. Each district is given the latitude to develop curriculum and resources aligned to the state prescribed standards, which could not be controlled within this study. Moreover, there is no assurance that technology-based instruction was aligned to the state standards. While it is assumed that teachers integrated technology-based PARCC aligned lessons, controlling for this factor was outside the scope of this study. Also, because this study utilized data collected from the second year of the PARCC administration it is possible that teachers were still adjusting to the new instructional and technological demands posed by the new technologically enhanced assessment. These factors could have impacted the final results within this study.

In addition, due to the ex post facto nature of the research design, the quality of instruction, the implementation factors related to the 1:1 laptop programs, and the amount of time students used laptops were not controlled for throughout this investigation. These confounding variables posed threats to the internal validity of this study. According to Rovai et al. (2013), internal validity can also be threatened by a small sample size. They stated that, "large sample sizes on the order of 30 participants or more per group are required for causal-comparative studies" (Rovai et al., 2013, p. 84). The researcher controlled for this threat by ensuring 100 participants per group with a total of 400 participants.

External validity is described as the degree to which results from a study can be generalized or applied to other settings and people not participating in the study (Gall et al., 2007). One way to increase external validity is to utilize a random selection process when determining participants (Rovai et al., 2013). In order to control for external validity, this study utilized a stratified random sampling procedure. Moreover, descriptive statistics suggested that the sample population was similar to the target population represented within the current study. However, the target population was a convenience sample of five school systems within a northeastern state. The demographics and characteristics of this specific group are not representative of all American students or schools. For this reason, the findings from this study are not generalizable beyond the target population within this study.

Recommendations for Future Research

Due to the fast pace in which technology integration is evolving within schools and the high cost associated with implementing 1:1 programs, it is essential that educators continue to research the most effective methods related to using technology to increase student achievement. This becomes especially important as school systems are now required to use technology to administer computer-based assessments to measure student learning (Every Student Succeeds Act of 2015, 2015). There are several areas where future research is recommended related to 1:1 technology programs. First, future studies that use an experimental design that also control for particular technology practices, types of technology use, or instructional strategies that may impact the success of the program would contribute richly to the conversation on 1:1 technology use. This type of design would help educators determine which conditions related to 1:1 programs support increased achievement. Specific to this study, it would be interesting to control for computerized, PARCC-aligned tasks within ELA instruction in 1:1 classrooms to determine if this would impact student performance. Additionally, longitudinal studies are needed to understand the impact of 1:1 programs over time on student achievement. It would also be advantageous to explore how 1:1 programs may impact female and male students in different ways.

It is clear based on earlier research that 1:1 laptop programs produce mixed results. This may be due to implementation factors related to 1:1 initiatives. Consequently, many researchers have advocated for high quality ongoing and sustained professional development when implementing 1:1 programs (Corn et al., 2011; Dunleavy & Heinecke, 2007; Mouza, 2008; Shapley et al., 2010; Zheng et al., 2014). Although outside the scope of their research, Bebell et al. (2014) concurred that training and resources contributed to the successful implementation of a 1:1 environment within their study. Accordingly, additional research is needed to identify specific planning and professional development strategies that are effective in assisting teachers transform learning practices when implementing 1:1 programs.

Future research is also needed to determine how 1:1 programs impact students from low socio-economic backgrounds. For example, Rafalow (2014) contended that teacher beliefs related to students' social class and institutional perceptions may be related to how students use technology within the learning environment. More research is needed to understand teacher perceptions about students in poverty in relationship to technology use within the classroom and the impact this may have on the existing achievement gap. By understanding best practices related to technology integration and students from low socio-economic backgrounds, educators can implement strategies that provide all students with equal opportunities.

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Appendix A: Sample ELA PARCC Released Items

Sample ELA PARCC released items for fifth grade can be found at http://parcc-assessment.org/released-items.

Appendix B: ELA PARCC Scripted Directions

The 2016 grades 3-5 computer-based PARCC Test Administrator Manual, which includes the scripted directions for the ELA PARCC assessment can be found at https://parcc.pearson.com/manuals-training/.

Appendix C: IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

March 14, 2017

Nicole Gilner Miller
IRB Application 2754: The Impact of 1:1 Laptop Environments on the English Language Arts Achievement of Fifth Grade Students from Diverse Socio-Economic Backgrounds

Dear Nicole Gilner Miller,

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,

Administrative Chair of Institutional Research
The Graduate School

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Liberty University Training Champions for Christ since 1971