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# Computer Ratio and Student Achievement in Reading and Math in a North Carolina School District

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Computer Ratio and Student Achievement in Reading and Math in a North Carolina School  
District

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A dissertation

presented to

the faculty of the Department of Educational Leadership and Policy Analysis

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education in Educational Leadership with a Concentration in School Leadership

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by

Erica Preswood

December 2017

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Dr. Cecil Blakenship

Dr. Don Good

Dr. Hal Knight

Keywords: Reading Achievement, Math Achievement, Student Engagement, Professional  
Development, Computer Ratio, Learner Management System

## ABSTRACT

Computer Ratio and Student Achievement in Reading and Math in a North Carolina School District

by

Erica Preswood

This longitudinal research project explored the relationship between a 1:1 computing initiative and student achievement on the North Carolina End of Grade Reading Comprehension and Math tests in the study school district. The purpose of this research study was to determine if the implementation of a 1:1 computing initiative impacted student performance on standardized tests. This study used secondary, longitudinal data to follow a sample of the district's 2012-2013 3rd grade students through the 2015-2016 school year. The study used student grade level proficiency on the North Carolina End of Grade Reading Comprehension and Math tests for both the district and state levels. The data revealed that in the 2012-2013 school year the study school district was not significantly below the state mean in student grade level proficiency reading or math. At the end of the four-year study period, the district was not significantly below the state mean in student grade level proficiency in either reading or math, but the district did have significant growth in both subject areas.

## DEDICATION

To all of the teachers, both in the study school and out of school, who have influenced my life, thank you for instilling in me the passion and courage to be an educator.

## ACKNOWLEDGEMENTS

“All the world's a stage, and all the men and women merely players; they have their exits and their entrances” (William Shakespeare). Thank you, seems much too trivial to say to such an extraordinary cast of characters who have helped me to the closing curtain in my “play.”

To my co-director, my husband, thank you for tolerating my stress, my moods, and long hours of homework. Thank you for all of the encouragement. You continued to believe in me, even when I doubted. To my parents, thank you for all of the babysitting, dinners, love, and encouragement. To my brother and sister-in-law and mother and father-in-law, thank you for always filling in the gaps and helping me get the kiddos where they needed to go. To my kiddos, Peyton and Eli, thank you for understanding that I couldn't always play games, be at games, or watch movies, but know that I always loved you and wanted what was best for you. I began this journey with you in mind; I wanted to set an example for you and to show you that you can do anything that you set your mind to accomplish.

To my producers, my committee, thank you for everything that you have done to help me along the way.

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## CHAPTER 1

### INTRODUCTION

The Race to the Top competitive grant program, as part of the American Recovery and Reinvestment Act of 2009, led to the transition to and implementation of Common Core State Standards for Math and English Language Arts and a more stringent teacher evaluation process in North Carolina. North Carolina was one of 12 grant winners in 2010. A caveat of receiving federal award money was that award-winning states agreed to adopt and implement rigorous common standards; in other words, states were required to support and utilize the Common Core State Standards (Klein, 2014).

North Carolina adopted the Common Core State Standards in June 2010. The development of the Common Core State Standards was spearheaded by the Council of Chief State School Officers and the National Governor's Association and was a continuation of the previous College and Career Readiness Standards.

As a natural outgrowth of meeting the charge to define college and career readiness, the Standards also lay out a vision of what it means to be a literate person in the twenty-first century. Indeed, the skills and understandings students are expected to demonstrate have wide applicability outside the classroom or workplace. (Public Schools of North Carolina, 2010, p. 1)

Specifically, a student who is college and career ready can read, comprehend, and respond to a variety of media including digital media and technology (Public Schools of North Carolina, 2010). The English Language Arts Common Core State Standards integrate research and media skills into traditional content standards; this integration challenges teachers to foster the research and technology skills of students (Public Schools of North Carolina, 2010).

North Carolina is also a P21 Leadership State, which means that the state has formed an alliance with the Partnership for 21<sup>st</sup> Century Learning (P21). P21 is a coalition of educators and business leaders along with legislators who share the common goal of preparing today's students for life and work in the 21<sup>st</sup> century. As a member of the alliance, North Carolina encourages educators to implement the P21 Framework for 21<sup>st</sup> Century Learning. The framework is structured around key subjects and 21<sup>st</sup> century themes which include: Information Literacy, Media Literacy, and ICT (Information, Communications, and Technology) Literacy (Partnership for 21<sup>st</sup> Century Learning, 2016). P21 states,

When a school, district, or state builds on this foundation, combining knowledge and skills with the necessary support systems of standards, assessments, curriculum and instruction, professional development, and learning environments - students are more engaged in the learning process and graduate better prepared to thrive in today's digitally and globally interconnected world (Partnership for 21<sup>st</sup> Century Learning, 2016, para. 3).

This framework was highly emphasized in the North Carolina Teacher Evaluation process.

Another caveat of receiving federal grant funding was the implementation of a stringent teacher evaluation system which utilized student data as a component of teacher evaluation (Klein, 2014). The North Carolina Teaching Standards also required that teachers focus on 21<sup>st</sup> century skills including "critical thinking, problem solving, and information and communications technology (ICT) literacy" (North Carolina Department of Public Instruction, 2013, p. 2).

Teachers are tasked in the North Carolina Professional Teaching Standards with increasing engagement, rigor, relevance, and 21<sup>st</sup> Century skills in their classrooms. Specifically, Standard Four, Teachers Facilitate Learning for Their Students, states, "Teachers know when and how to use technology to maximize student learning. Teachers help students use technology to learn content, think critically, solve problems, discern reliability, use information, communicate, innovate, and collaborate" (North Carolina Department of Public Instruction, 2013, p. 6).

Standard Four also encompasses the requirement for teachers to revolutionize assessments. “Teachers use 21st century assessment systems to inform instruction and demonstrate evidence of students’ 21st century knowledge, skills, performance, and dispositions” (North Carolina Department of Public Instruction, 2013, p. 7). The standards for 21st Century Learning include information, media, and technology skills; specifically, “Effective citizens and workers must be able to exhibit a range of functional and critical thinking skills, such as: information literacy, media literacy, and ICT Literacy” (Partnership for 21st Century Learning, 2016, para. 8).

North Carolina is currently transitioning state testing to an online format. “The North Carolina Department of Public Instruction (NCDPI) encourages districts/schools to continue to move toward online assessments as much as their local technical infrastructure will allow” (North Carolina Department of Public Instruction, 2016, p. 1). Student access to technology in the form of a 1:1 computing initiative could impact student achievement on state assessments, which are administered online.

The emergence of affordable technology in conjunction with more stringent Common Core State Standards, North Carolina Information and Technology Essential Standards (ITES), and North Carolina Professional Teaching Standards have prompted many North Carolina school districts to adopt 1:1 computing initiatives. A 1:1 computing initiative provides each student in a school, access to internet capable personal computing devices such as iPads and laptops. The North Carolina school district in this study was no exception. In 2011, the district’s school board and county commissioners agreed to begin a digital conversion in the form of a 1:1 computing initiative. The district’s goals were to equip each student K-12 with internet connected technology, equip teachers with laptops, to provide professional develop for teachers to fully

implement the technology, and to provide technical support for teachers and students. The initial phase of technology placement began in October 2011 when the study school district's Technology Team distributed MacBooks to teachers. Teachers then participated in professional development provided by Apple, trainers from the Mooresville Graded School District, and the Buck Institute. Trainings provided by Apple were focused, instructional sessions on how to operate the new technology; whereas trainers from the Mooresville Graded School District provided logistical and policy guidance. The Buck Institute sessions exposed teachers to the Project Based Learning (PBL) model. By January of 2012, all student devices were deployed. Each student in grades K-5 was assigned an iPad that remained at school. Each student in grades 6-12 was assigned a MacBook Air, which the student could take home.

To explore the possible relationship between the implementation of the study school district's 1:1 computing initiative and reading and math scores on the North Carolina End of Grade (NC EOG) Reading and Math Tests, an ex post facto quantitative design was used. This design utilized secondary data (McMillan & Schumacher, 2010) obtained from the school district. The study followed a sample of the school district's 2012-2013 third grade students through the sample's 2015-2016 sixth grade year. The sample group's NC EOG reading and math scores were used for the study.

In addition to the data from the sample group from the study school district, the state grade level proficiency (GLP) percentages for third grade on the NC EOG Reading and Math Tests in 2012-2013 along with the state level GLP percentages for sixth grade on the NC EOG Reading and Math Tests in 2015-2016 were used as comparison data. This comparison allowed the researcher to explore the possible relationship between 1:1 computing initiatives and student achievement on the NC EOG Reading and Math Tests in the study school district. The

comparison to the state GLP percentage allowed the researcher to monitor state trends that were potentially related to the increased rigor of new state standards.

Reading and math scores were selected for use in this study because they have been used since the authorization of the 2001 *No Child Left Behind* (NCLB) legislation to measure the effectiveness of public schools in America. The act required public schools to develop and assess more stringent curricula in math and reading with the overall goal of all students meeting proficiency goals in reading and math within a 12-year period. “Schools that fail to make adequate yearly progress ...will, over time, be subject to improvement, corrective action, and restructuring measures” (U.S. Department of Education, 2002, p. 1). In 2015, President Obama updated NCLB with the passage of the Every Student Succeeds Act (ESSA). Similar to NCLB, ESSA required that states develop, implement, and assess rigorous standards in English Language Arts and Math (U.S. Department of Education, n.d.).

### **Purpose**

Educators in the state of North Carolina are being evaluated using more encompassing professional standards which require the implementation of more rigorous learning standards that include technology literacy. The state’s testing platform is also transitioning from paper pencil assessments to online assessments. As a result of these factors, many school districts are investing in and implementing 1:1 computing initiatives. The purpose of this study was to explore the possible relationship between the implementation of the 1:1 computing initiative in the study school district and the NC EOG reading and math scores of the 2012-2013 third grade sample through the sample’s 2015-2016 sixth grade reading and math scores.

## **Research Questions**

The following research questions explore the longitudinal data of the study school district to examine the possible relationship between the implementation of the district's 1:1 computing initiative and student scores on the NC EOG Reading and Math Tests. The research questions also examine the differences between the GLP percentages for both the NC EOG Reading and Math Tests for the sample from the study school district and for the state of North Carolina.

Research Question 1: Is there a significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

Research Question 2: Is there a significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

Research Question 3: Is there a significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

Research Question 4: Is there a significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years?

Research Question 5: Is there a significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school and the NC EOG Reading Test scores for the state?

Research Question 6: Is there a significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state?

Research Question 7: Is there a significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

Research Question 8: Is there a significant difference between the NC EOG Math Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

Research Question 9: Is there a significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

Research Question 10: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school year?

Research Question 11: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the NC EOG Math Test scores for the state?

Research Question 12: Is there a significant difference between the NC EOG Math Test scores of sixth graders during the 2015-2016 school year and the NC EOG Math Test scores for the state?

### **Significance**

New teaching standards along with a more rigorous teacher evaluation process in North Carolina have created a critical need for teachers to improve classroom instruction and ultimately improve test scores on the NC EOG Reading and Math Tests. Specifically, teachers need to enhance the quality of activities and materials. Many North Carolina school districts, including the study school district, are implementing 1:1 computing initiatives to provide teachers and students with technology tools to meet the higher expectations. It is imperative to determine the efficacy of technology integration into classrooms to both increase teacher effectiveness and student achievement.

### **Definitions of Terms**

The following definitions are key to the comprehension of this study:

1. *1:1 Computing*- computing that has “three core features common to a wide variety of initiatives as defining characteristics of one-to-one computing in the classroom” (Penuel, 2006, p. 331). Penuel’s three key features of 1:1 computing include: providing students with a personal computing device such as an iPad or laptop, providing wireless connectivity for the devices at school, and a thorough integration of technology use in classroom tasks and lessons.
2. *Learner Management Systems (LMS)* - web based platforms that “utilize synchronous and

asynchronous technologies to facilitate access to learning materials and administration” (Black, Beck, Dawson, Jinks, & DiPietro, 2007, p. 36). The study school district has implemented the use of PowerSchool Learning as the district’s LMS.

3. *North Carolina EOG Math Test*- a test that contains 54-60 multiple choice and gridded response questions which assess a student’s grade level mathematics knowledge based on the state standards (North Carolina Department of Public Instruction Division of Accountability Services, 2017)
4. *North Carolina EOG Reading Test*- a test that contains 52-56 multiple choice questions which assess a student’s ability to read a grade level passage and answer questions based on the state standards (North Carolina Department of Public Instruction Division of Accountability Services/ North Carolina Testing Program, 2016).
5. *Professional Development*- “a vast range of activities and interactions that may increase their knowledge and skills and improve their teaching practice, as well as contribute to their person, social, and emotional growth as a teacher” (Desimone, 2009, p. 182). Professional development for the purposes of this study included formal trainings concerning the use and implementation of new technologies, Professional Learning Community meetings and projects, and project evaluation.

### **Limitations and Delimitations**

This study contains limitations that are consistent with those of other ex post facto studies. According to Cohen, Manion, and Morrison (2013), “There is a problem of lack of control in that the researcher is unable to manipulate the independent variable” (p. 309). This study solely examined the potential relationship between a school district’s 1:1 computing

initiative and student test scores on the NC EOG Reading and Math Tests. Many other components to student learning could potentially influence student test scores.

“One cannot know for certain whether the causative factor has been included or even identified” (Cohen et al., 2013, p. 309). The longitudinal nature of this study increases the potential impact of outside variables. One of these factors could include teacher quality and variety which is not explored in this study. The sample group of students were randomly chosen from multiple schools within the district and were exposed to a variety of teachers throughout the five years of the study. The various teachers could potentially have varying degrees of student engagement in the classroom; thus, student engagement in classroom instruction could also have influenced test scores.

The longitudinal design of the study gathered data from students at varying developmental stages. The study began with elementary students and concluded with middle school students. A meta-analysis by Sung, Chang, and Liu (2016) reported that elementary age students showed higher effect sizes in the use of mobile devices than older students. The range of ages included in the study could potentially have an influence on test scores.

“It may be that no single factor is the cause” (Cohen et al., 2013, p. 309). Conversion to Common Core State Standards could also influence student test scores. In June of 2010, the North Carolina Board of Education formally adopted the Common Core State Standards for ELA and for Math. These standards require students,

To be ready for college, workforce training, and life in a technological society, students need the ability to gather, comprehend, evaluate, synthesize, and report on information and ideas, to conduct original research...to analyze and create a high volume and extensive range of print and non-print texts in media forms old and new. (Public Schools of North Carolina, 2010, p. 2)

The new standards could have strengthened classroom instruction and increased rigor which could have potentially influenced test scores.

Another factor to consider is socio economic status (SES) which could also influence student learning. This variable accompanies students to school and teachers/schools have very little control. “Socioeconomic status (SES) is strongly associated with cognitive ability and achievement during childhood and beyond” (Noble, Norman, & Farah, 2005, p. 74). Sixty percent of students in the study school district qualified for Free or Reduced Lunch, which means that those students are considered in the low SES (Berner, Vazquez, & McDougall, 2016).

It should also be noted that this study was not designed as nor intended to be a program evaluation for the school district’s 1:1 computing initiative. The sample utilized in the study was purposefully selected to include students who have historical state testing data in reading and math. The study did not use state science testing data because of gaps in assessments. Another critical admission is the acknowledgement that I was employed with the school district during the initial implementation of the 1:1 computing initiative. It is important to note that I served as a curriculum coach responsible for providing professional development, technical assistance, lesson planning support, team teaching, and modeling of technology lessons. It is also important to note that at no point during the study was I the classroom teacher of record for the study participants.

### **Chapter Summary**

In 2010, North Carolina was the recipient of competitive grant funding from the Race to the Top grant program. A requirement of the funding was that the state develop, implement, and assess rigorous standards, in essence the Common Core Standards for English Language Arts

and Math. Another requirement was that the state would implement a comprehensive teacher evaluation system. The new learning standards and teaching standards called for a change in instruction with the movement to the integration and utilization of technology in the classroom.

In 2011-2012, the school district began the implementation of a digital conversion through a 1:1 initiative. As part of this initiative, each K-5 student received an iPad, while each 6-12 student received a MacBook. The initiative also included devices for teachers, professional development, and the adoption of the PowerSchool Learning Learner Management System. The purpose of this ex post facto study was to explore the possible relationship between the implementation of the school district's 1:1 computing initiative and scores on the NC EOG Reading and Math Tests.

Due to the nature of the ex post facto research design, there were limitations to the study. The researcher could not isolate the variable of 1:1 computing. There were many components to learning that impact students. Because the study used longitudinal data, students experienced different teachers and different schools during different developmental stages of their lives. In addition to the implementation of the 1:1 initiative, North Carolina transitioned to Common Core State Standards in 2010. It is also critical to remember, "The relationship of two factors does not establish cause and effect" (Cohen et al., 2013, p. 309).

## CHAPTER 2

### REVIEW OF LITERATURE

In 2007, the North Carolina State Board of Education passed the School Connectivity Initiative Implementation and Operating Plan (SCI). With this plan, North Carolina set the foundation for future 1:1 computing initiatives in the state. According to a North Carolina Department of Public Instruction Technology Services Area legislative report (2016), the 2007 initiative prompted the creation of a Technology Master Plan, a Governance and Funding Plan, Client Network Engineering Services, and an E-rate Filing Assistance Bureau. Since 2007, the North Carolina Department of Public Instruction and the State Board of Education have prepared annual reports for the North Carolina Legislature. The reports evaluated yearly progress and the initiative while setting new goals for the upcoming year. “[I]n 2015, the SCI expanded school support to include the procurement of wireless equipment and related internal network infrastructure and services” (p. 5). The SCI initiative set into motion the creation of infrastructure to support 1:1 computing programs.

In conjunction with the 2007 SCI initiative, in 2008, North Carolina embarked on the NC 1:1 Learning Technology Initiative, a collaborative endeavor with both public and private stakeholders providing funding, evaluation, and implementation/support. This initiative sought to provide 1:1 computing for 9,500 students and 600 staff in 18 pilot North Carolina public high schools. The goal of the program was “for the use of technology to improve teaching practices, increase student achievement, and better prepare students for work, citizenship, and life in the 21<sup>st</sup> century” (Corn, Huff, Halstead, & Patel, 2011, p. 2). Corn et al. (2011) conducted a three-year program evaluation of the initiative, and according to the report, student engagement

increased in the 1:1 schools, graduation rates slightly increased, and students developed 21<sup>st</sup> century learning skills. The report also revealed that the 1:1 implementation did not have a significant impact on school attendance or student standardized test scores. Since the 2011 report, other studies on 1:1 computing initiatives and student learning outcomes have revealed mixed results.

### **1:1 Computing Initiatives**

Affordable technology and changing standards have prompted many schools and districts to develop and implement technology initiatives. In 2001, Maine became the first state in the nation to fund and implement a state wide 1:1 computing initiative, the Maine Learning Technology Initiative (MLTI). The first phase of the program equipped 7<sup>th</sup> and 8<sup>th</sup> grade students and teachers with laptops. Each additional phase of the program expanded the placement of laptops to high school students state wide. In 2010, the MLTI had placed computers in the hands of 100% of all middle school students and 55% of all high school students (Maine Department of Education, n.d.). Other states including Michigan, Pennsylvania, Texas, and South Dakota have also developed 1:1 technology initiatives (Lei & Zhao, 2008). According to a Friday Institute report, Hawaii implemented a statewide 1:1 computing initiative in 2013. The report also noted that many states have opted to provide funding for educational technology innovation including 1:1 computing initiatives to individual districts via competitive grants instead of statewide initiatives. These states include: “Colorado, Connecticut, Florida, Georgia, Hawaii, Indiana, Kentucky, Massachusetts, Minnesota, New York, Ohio, Texas, and West Virginia” (Acree & Fox, 2015, p. 12).

Sutton (2015) reviewed literature concerning 1:1 initiatives.

Each of the research articles either directly or indirectly discussed the existence of a subjective educational belief that giving each child in a school a computer will not only increase academic achievement, but it is becoming an absolute necessity due to the nature of an ever-changing technological society. (para. 9)

Sutton raised the issue of conflicting research and results from the Maine and Texas state initiatives. In reference to the Main initiative, “Research has shown that not all schools had implemented the program to the same degree and when 8<sup>th</sup> grade state assessment scores were examined no significant increase had been demonstrated” (Weston & Bain, 2010, p. 6). The Texas 1:1 program showed similar results with varied levels of impact on student academic achievement (Sutton, 2015).

The following meta-analyses discuss the mixed results from the body of research on 1:1 computing initiatives; in addition, implications for implementation of 1:1 programs emerged from the literature.

A meta-analysis by Higgins, Xiao, and Katsipataki (2012) explored the impact of digital technology on student academic achievement. The report stated, “The research evidence over the last forty years about the impact of digital technologies consistently identifies positive benefits”; however, the report goes on to clarify that because the research has been so varied that it is exceedingly difficult to produce “clear and specific implications for educational practice in the study schools” (p. 3). The report discussed the limitations of the research by highlighting the inability of the research to establish a causal link between use of digital technology and student attainment.

In another meta-analysis, Sung et al. (2016) discussed trends that emerged in their analysis of 110 journal articles/studies. The study considered initiatives that explored the use of mobile devices such as tablets and laptops and revealed “learning with mobiles is significantly more effective than traditional teaching methods that only use pen and paper” (p. 257).

Sung et al. (2016) also explored the variables of hardware, intervention duration, and age of learner. The authors examined a relationship between the type of mobile device students used and effect size for learning achievement. Handheld devices such as tablets and cell phones showed a medium size effect while laptops showed a small effect. For the purposes of the current study, “It is important to note here that most of the research on handhelds in education has involved only short-term interventions” (p. 261). Interventions of greater than six months were reported as having a “non-significant effect size” (p. 263). Cheung and Slavin (2013) provided possible reasons for longer duration interventions having lower effect sizes. These included, “novelty factors, a better controlled environment, and the likely use of tests biased toward content studied by experimental but not control students” (p. 92). The significance of these findings is that implementation of 1:1 programs should include professional development, which allows for reflection, evaluation, and continued growth and development of the educator and student.

Finally, Sung et al. (2016) also examined the possible relationship between the age of the learner and effect size on learning; the authors reported that elementary students showed more positive results than secondary students. Overall, younger students showed greater growth in learning outcomes than secondary students. Sung et al. also noted that mixed age groups did not exhibit statistically significant positive results. “The possible reason may be that it is difficult to design appropriate teaching method or material for students with different needs and competence in the same group” (p. 260).

## **iPads**

A review of the literature revealed that iPads positively impacted instruction at all levels of education from K-12+ in a variety of content areas. From increased engagement to increased content mastery, the literature revealed encouraging data for the implementation of iPads in classroom instruction. Cubelic and Larwin (2014) investigated iPad use and early literacy skill acquisition with 281 Kindergarteners. The researchers used a control group which received traditional instruction in early literacy and a treatment group which received the same instruction with the exception of iPad learning apps to reinforce instruction.

Since both groups of students received the same type of instruction, with the exception of the use of the iPads for during weekly instructional time for each student in the treatment classrooms, these results suggest, that potentially, the use of iPads had a significant positive impact on the treatment group student's learning of these higher-order skills. (pp. 56-57)

Batista (2014) investigated the impact of iPads on 5<sup>th</sup> grade social studies instruction. The purpose of the study was to study the effects of using iPads in teaching state capitals. Batista concluded, "88% of the students felt as if they were more engaged in social studies when they had the opportunity to use the iPads, while none of the students responded that they were less engaged" (p. 63).

Godzicki, Godzicki, Krofel, and Michaels (2013) sought to increase student engagement and motivation through technology enhanced learning. "Overall, the students' behavior was more animated towards the learning objectives when technology was used. The technology-supported learning environment improved student motivation and engagement by 9% after the intervention period" (p. 108).

A high school focused study conducted by Ward, Finley, Keil, and Clay (2013) revealed that the utilization of iPads in a sophomore level ecology class resulted in positive impacts. "The

feedback from students was highly positive regarding the tablet-based lesson, with most asking when the next iPad lesson would be. Student engagement was anomalously high, especially among those students who typically struggle to participate in regular classroom activities” (p. 383).

Diemer, Fernandez, and Streepey (2012) discussed similar findings in a college setting. The study involved 209 undergraduate students at IUPUI from a variety of degree programs. Select classes implemented iPad enhanced lessons up to seven times in the semester. At the end of the semester, students were asked to complete a survey. The authors reported, “A large percentage (85.1%) of students also reported a preference for moderate or extensive use of e-learning technology in the classroom...Students, on average, reported high levels of perceived learning and moderate levels of perceived engagement” (p. 19).

## **Laptops**

The research concerning 1:1 computing initiatives that utilized laptops has themes that are similar to those of 1:1 programs that utilized iPads. Lei and Zhao (2008) found that laptops enhanced student learning by providing more educational experiences (p. 117). In a meta-analysis, Zheng, Warschauer, Lin, and Chang (2016) examined 65 journal articles and 31 doctoral dissertations all of which focused on the issue of 1:1 laptop programs. The analysis calculated the overall impact of the 1:1 laptops programs in 10 of the selected studies. “In summary, the impact of one-to-one laptop programs on academic achievement is generally positive across subject areas, with an overall effect size of 16...Among all five subjects, the largest effect size appears in science” (p. 1063). Other subject areas such as writing, math, and

English also exhibited a small but statistically significant effect size. Reading however did not show a significant effect size.

In a meta-synthesis, Sell, Cornelius-White, Chang, McLean, and Roworth (2012) reviewed 131 studies that explored 1:1 technology programs. Laptops were used the most in the studies. The research revealed that writing was the subject area that exhibited the greatest positive significant difference; whereas, other subject areas revealed non-conclusive results.

Weston and Bain (2010) explored the mixed results from research concerning 1:1 computing initiatives. Overall, they concluded that 1:1 computing programs have had perhaps the greatest impact on educational change than any other program/initiative. “Arguably, no other efforts have reached the impact point represented by every teacher and student in a school, district, or state having a laptop computer, receiving training, being evaluated, and getting media coverage” (p. 9).

### **Professional Development**

Higgins et al. (2012) provided educators with recommendations to further improve the implementation of educational technology. Included in these recommendations was professional development. Specifically, continuous professional development that is “inquiry-based” instead of skills based; moreover, the professional development should engage and support teachers in implementing meaningful technology into the classroom (p. 4). Sell et al.’s (2012) meta-analysis also concluded that professional development was a critical component to the implementation of 1:1 computing initiatives.

Lemke, Coughlin, and Reifsneider (2009) reviewed the research on the topic of educational technology and the impact on student learning. In the realm of 1:1 computing, the

authors concluded that effective 1:1 initiatives included professional development, academic goals and standards, and student evaluation. Bebell and O’Dwyer (2010) reviewed five key studies that investigated 1:1 computing and identified common themes. “Given that nearly all of the studies reported that 1:1 programs depend largely on teachers for success, it was not surprising that teacher preparation through professional development was important for successful implementation” (p. 10).

One of the studies reviewed by Bebell and O’Dwyer was the Shapley, Sheehan, Maloney, and Caranikas-Walker (2010) study that examined the Technology Immersion Pilot (TIP) in Texas. Shapely et al. explored the technological immersion of 21 schools. The immersion plan included: an internet capable device for each student and teacher, office software, online curriculum support and assessments, and technical support. In addition, the immersion plan included strategic professional development that was used to enhance and support technology implementation in the classroom. This study also revealed that professional development was statistically significant in the level of classroom immersion; “Core-subject teachers’ extent of Classroom Immersion was associated at a statistically significant level with their perceptions of the strength of...the quality of professional development” (Shapley et al., 2010, p. 33).

### **Buck Institute and Project Based Learning**

The Buck Institute for Education (BIE) is a non-profit organization with the goal of supporting teachers in the development and use of Project Based Learning (PBL). BIE provides educators with access to vetted PBL strategies and projects. For a fee, BIE can provide school districts with professional development and other services (The Buck Institute for Education, 2017). Project Based Learning fosters the development of 21<sup>st</sup> century skills through the use of

highly engaging real-world projects that encourage students in, “critical thinking/problem solving, collaboration, communication in a variety of media, and speaking and presentation skills” (The Buck Institute, 2017, para.2).

In a 2010 report, Bell discussed the research and implementation of PBL. The report discussed the use of technology with PBL. Bell claimed that real-world use of technology enhanced student learning. Bell cited a study by Geier et al. (2008) which reported that students involved in the use of PBL scored higher on state standardized tests than students not engaged in PBL work. Geier et al. stated, “That well-aligned standards-based reform efforts of this type can positively impact urban student results on distal standardized achievement tests” (p. 934).

### **Student Engagement and Learning**

Student engagement for the purposes of this study has been defined as a multifaceted construct that includes cognitive, intellectual, academic, social, behavioral, and emotional aspects. “It is promising that across varied conceptualizations of student engagement with school, there is promising empirical support for the construct’s relations with important social, emotional, and academic outcomes” (Appleton, Christenson & Furlong, 2008, p. 383). Klem and Connell (2004) remarked, “Research links higher levels of engagement in school with improved performance. Researchers have found student engagement a robust predictor of student achievement and behavior in school regardless of socioeconomic status” (p. 262). Appleton et al. (2008) also claimed that student engagement as a construct has a multitude of definitions and components, yet regardless of the composition of the definition, student engagement still influences student learning on some level.

Carini, Kuh, and Klein (2006) studied the connection between student engagement and student learning. Carini et al.'s results were consistent with those of other studies in that student engagement can positively impact learning, critical thinking, and academic success. Even in college, student engagement is a critical factor in student success.

Skinner and Pitzer (2012) discussed student engagement as being a multi-layered concept. The first component of engagement consisted of being involved in an organization such as school or church. Skinner and Pitzer went on to define engagement as participation in physically active and mentally active learning tasks including activities outside of the classroom. The authors concluded, "No matter how many extra-curriculars students undertake or how attached they are to school, they will not learn or achieve unless they are constructively engaged with the academic work of the classroom" (pp. 22-23).

### **Student Engagement and Teachers**

Skinner, Belmont, and Levin (1993) expounded the importance of teacher behavior and student engagement and learning. Skinner et al. (1993) categorized teacher behavior into three categories: involvement, structure, and autonomy support. Structure specifically referred to the organization of the class and clear expectations. Autonomy support referred to the teacher's ability to and willingness to allow students to make choices and self-regulate. Involvement referred to relationship that teachers had with students. The researchers predicted that teachers would adjust their behavior based on their perception of an individual student's engagement, and students would change their level of engagement based on teacher behavior. The study revealed, "Teachers' interactions with students predicted students' behavioral and emotional engagement in the classroom, both directly and through their effects on students' perceptions of their

interactions with teachers” (p. 577). The importance of student engagement has previously been established in the literature review; Skinner et al.’s findings are critical in that teachers can directly impact student engagement and ultimately student learning.

Marks (2000) also discussed the relationship between student engagement and learning. “Students who are engaged with school are more likely to learn...Much of the research has attributed the lack of engagement to factors ...weak instruction, and low expectations for student learning” (p. 154). Shernoff et al. (2016) studied the connection between the quality of the learning environment and the quality of students’ experiences. One hundred and eight 9th-12th graders participated in the study. Students were asked to complete Record of Experience surveys after each 25 minutes of instruction. Students were also videoed while in class. Researchers used student responses and coding from video observations to determine levels of perceived and observed student engagement. The study revealed that, “Environmental complexity had a significant effect [on] student engagement...This suggests that the learning environment is an important factor influencing student engagement and the quality of other, related aspects of student experience in public high school classrooms” (Shernoff et al., 2016, p. 58).

### **Chapter Summary**

More affordable technology, changing educational standards, teacher expectations, and assessments has led to the increased adoption of 1:1 computing initiatives by many states and individual school districts throughout the country. The acceptance of federal Race to the Top grant funding set the stage for technology implementation in North Carolina. As a result of the grant funding, the state was required to implement the Common Core State Standards that incorporate media literacy and research skills. In addition to the adoption of new content

standards, North Carolina was also required to create a more rigorous teacher evaluation process. This new process centered around the 21<sup>st</sup> Century Framework from P21. This emphasis on 21<sup>st</sup> century skills challenged teachers to engage students with collaborative, higher order, real-life project based learning.

The literature revealed several meta-analyses that showed small, yet statistically significant results for the impact of technology use on student academic achievement; however, several of the studies revealed mixed results. Upon further investigation, the studies also revealed trends in 1:1 program implementation that fostered greater success. These trends included professional development, technical support, and engaging instruction.

## CHAPTER 3

### RESEARCH METHODS

An ex post facto quantitative design was chosen for this study to explore the possible relationship between the implementation of the 1:1 computing initiative in the study school district and the NC EOG reading and math scores of the 2012-2013 third grade sample through the sample's 2015-2016 sixth grade reading and math scores.

An ex post facto design is used to explore possible causal relationships among variable that cannot be controlled by the researcher. The investigator designs the study to compare two or more samples that are comparable except for a specified fact that occurred (McMillan & Schumacher, 2010, p. 23).

The “occurrence” in this study is the school district’s 1:1 computing initiative. “The investigator designs the study to compare two or more samples that are comparable except for a specified factor that occurred in the past” (McMillan & Schumacher, 2010, p. 23). The researcher analyzed longitudinal test data for the study school district to explore possible relationships between student access to technology and student scores on the NC EOG Reading and Math Tests. In addition, this study used test data from the North Carolina web archives to access GLP percentages of state level test scores to compare to the study school district.

#### **Research Questions and Null Hypotheses**

RQ1: Is there a significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

H<sub>0</sub>1: There is no significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years.

RQ2: Is there a significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

H<sub>0</sub>2: There is no significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years.

RQ3: Is there a significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

H<sub>0</sub>3: There is no significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years.

RQ4: Is there a significant difference between the NC EOG Reading Test scores of third graders between the 2012-2013 school year and the sixth graders during the 2015-2016 school years?

H<sub>0</sub>4: There is no significant difference between the NC EOG Reading Test scores of third graders between the 2012-2013 school year and the sixth graders during the 2015-2016 school years.

RQ5: Is there a significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and the NC EOG Reading Test scores for the state?

H<sub>0</sub>5: There is no significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and the NC EOG Reading Test scores for the state.

RQ6: Is there a significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state?

H<sub>0</sub>6: There is no significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state.

RQ7: Is there a significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

H<sub>0</sub>7: There is no significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years.

RQ8: Is there a significant difference between the NC EOG Math Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

H<sub>0</sub>8: There is no significant difference between the NC EOG Math Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years.

RQ9: Is there a significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

H<sub>0</sub>9: There is no significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years.

RQ10: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years?

H<sub>0</sub>10: There is no significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years.

RQ11: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the GLP percentage for the state?

H<sub>0</sub>11: There is no significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the NC EOG Math Test scores for the state.

RQ12: Is there a significant difference between the NC EOG Math Test scores of sixth graders during the 2015-2016 school year and the GLP percentage for the state?

H<sub>0</sub>12: There is no significant difference between the NC EOG Math Test scores of sixth graders during the 2015-2016 school year and the NC EOG Math Test scores for the state.

### **Population**

The study school district is located in rural Western North Carolina in the Appalachian Mountains. According to the district's webpage, the district has one high school, two middle schools, and five elementary schools with approximately 2,000 students. Sixty percent of students qualify for the Free or Reduced Lunch Program (Berner et al., 2016). The district is one of the county's largest employers, employing approximately 400 people. Seventy percent of the district's elementary teachers have taught for 10+ years, while 49% of the district's middle school teachers have taught for 10+ plus years (Public Schools of North Carolina, 2016b).

In September 2011, the district's school board and county commissioners agreed to begin a digital conversion in the form of a 1:1 computing initiative. In October 2011, the study school district's Technology Team distributed MacBooks to teachers. Teachers then participated in professional development provided by Apple, trainers from the Mooresville Graded School District, and the Buck Institute. Trainings provided by Apple were focused instructional sessions

on how to operate the new technology; whereas trainers from the Mooresville Graded School District provided logistical and policy guidance. The Buck Institute sessions exposed teachers to the PBR model. By January 2012, all student devices were deployed. Each student in grades K-5 was assigned an iPad that remained at school. Each student in grades 6-12 was assigned a MacBook Air, which the student could take home.

The study school district was chosen for this study because the district implemented a K-12 1:1 computing program which allowed for the study of longitudinal data from the 2012-2013 school year to the 2015-2016 school year. The 2012-2013 third graders were chosen as the cohort to study because in the first full year of implementation the cohort took their first NC EOG Reading and Math Tests. This allowed the researcher to begin with a baseline test. This study utilized archival data which contained cohort numbers and NC EOG Reading and Math Test scores obtained from the study school district's Director of Accountability. This study followed the 2012-2013 third grade cohort through the 2015-2016 school year, the cohorts' sixth grade year.

### **Instrumentation**

Student scores on the NC EOG Reading and Math Tests from 2012-2013, which was the first year of the study school district's 1:1 computing initiative implementation through the 2015-2016 school year, were utilized in this study. In addition, it is important to note that the 2012-2013 NC EOG Reading and Math Tests were the first year of more rigorous assessments based on Common Core State Standards in English Language Arts and Math (North Carolina Department of Public Instruction, 2013b). The testing and accountability model in North Carolina is managed and implemented by the division of Accountability Services of North

Carolina Public Schools. The mission of the Accountability Services division is to measure student learning in North Carolina and compare to national standards.

The major thrust of this mission is three-fold: the design and development of reliable and valid assessment instruments, the uniform implementation of and access to suitable assessment instruments for all students; and the provision of accurate and statistically appropriate reports. (Public Schools of North Carolina Accountability Services, 2005, para. 1)

The NC EOG testing program assesses grades 3-8. As part of the EOG program, students are tested in English Language Arts, math, and science.

Students in North Carolina in grades three through eight are tested annually in the areas of English Language Arts/reading, math, and science. “The North Carolina READY End-of-Grade (EOG) Assessments are curriculum-based achievement tests” (Public Schools of North Carolina, 2016a, p. 1). Specifically, the NC EOG Reading Test contains 52-56 multiple choice items which assess a student’s ability to read a grade level passage and answer questions based on the state standards (North Carolina Department of Public Instruction Division of Accountability Services/ North Carolina Testing Program, 2016). The NC EOG Math Test contains 54-60 multiple choice and gridded response questions which assess a student’s grade level mathematics knowledge based on the state standards (North Carolina Department of Public Instruction Division of Accountability Services, 2017).

The North Carolina Public Schools’ Division of Testing and Accountability defines reliability as “the consistency of a measure when the testing procedure is repeated on a population of individuals or groups” (Public Schools of North Carolina, 2014, p. 1). Specifically, the agency reports that the internal consistency coefficient is the standard that is used to “quantify reliability for the End-of-Grade (EOG) English Language Arts/Reading” (p. 1). The agency defines the internal consistency coefficient as, “coefficients based on the relationships

among scores derived from individual items or subsets of the items with a test, all data accruing from a single administration of the test” (p. 1). The Division of Testing and Accountability used a test of coefficient alpha to estimate the reliability of the current NC EOG tests; all tests were reported to have higher than industry norms for reliability. As such, the agency states that the scores from the NC EOG tests can be used to make valid inferences on student performance.

### **Data Collection**

The first step of this research study was to obtain approval from my dissertation committee. Once approval was granted, approval was obtained from ETSU’s Institutional Review Board (IRB). With permissions granted and ethical considerations handled, archival data was obtained from the study school district’s Director of Accountability. The dataset from the study school district was used to determine the actual cohort, or group of students who remained consistent from the 2012-2013 third grade year through the 2015-2016 sixth grade year. Once the cohort was established, a dataset was created in SPSS to collect and organize the study school district’s cohort performance scores on the NC EOG Reading and Math Tests from the 2012-2013 school year’s third grade cohort through the 2015-2016 school year’s sixth grade cohort. In addition to the data for the study school district, the state level GLP percentages for the NC EOG Reading and Math Tests were obtained from the Public Schools of North Carolina’s web archives.

For the current study, the datasets provided by the study school district’s Director of Accountability did not contain any personally identifiable information; therefore, informed consent was not required. The Director of Accountability was provided with the purpose of the study, research methods, and at the conclusion of the study, findings. “Social researchers must

take into account the effects of the research on participants, and act in such a way as to preserve their dignity as human beings” (Cohen et al., 2013, p. 84). For the current study, the actual name of the school district was masked with the pseudonym study school district in order to protect the study population and the district’s leaders and teachers.

### **Data Analysis**

For Research Questions 1-4, the researcher conducted paired *t*-tests to explore the possibility of significant differences between NC EOG Reading Test scores beginning with third graders in the 2012-2013 school year through sixth graders in the 2015-2016 school year.

Research Questions 5 and 6 utilized data for the study school district and data for the state of North Carolina. The researcher conducted single sample *t*-tests to compare the NC EOG Reading Test results of the study school district and the test results of North Carolina. Research Question 5 explored third grade test scores from 2012-2013; Research Question 6 explored sixth grade test scores from 2015-2016.

For Research Questions 7-10, the researcher conducted paired *t*-tests to investigate the possibility of significant differences between the NC EOG Math Test scores of third graders in the study school district in 2012-2013 through the sample’s sixth grade year in 2015-2016.

Research Questions 11 and 12 utilized data for the study school district and data for the state of North Carolina. The researcher conducted single sample *t*-tests to compare the NC EOG Math Test results of the study school district and the test results of North Carolina. Research Question 11 explored third grade test scores from 2012-2013; Research Question 16 explored sixth grade scores from 2015-2016.

## **Chapter Summary**

To explore the relationship between student access to technology and student performance on the NC EOG Reading and Math Tests for students in the study school district from the 2012-2013 school year through the 2015-2016 school year, an ex post facto design was utilized. The NC EOG Reading and Math Tests were chosen as the instrument for this study because the tests have been vetted by North Carolina using industry standards for validity and reliability. In addition, the tests were chosen for this study because students in North Carolina are tested annually in grades 3-8 in the areas of reading and math. This is noteworthy because students in the sample have test data that coincides with the implementation of the 1:1 initiative; thus, providing the means for the researcher to conduct longitudinal research.

The study population was comprised 118 third grade students who were continuously enrolled in the study school district from 2012-2013 through 2015-2016. Paired t-tests were utilized to investigate the relationship between annual test scores in reading and math. Single sample t-tests were used to further explore the relationship between the study school district's annual test scores in reading and math and those of the state.

## CHAPTER 4

### FINDINGS

This ex post facto quantitative study was conducted to explore the possible relationship between the implementation of the 1:1 computing initiative in the study school district and the NC EOG Reading and Math scores of the 2012-2013 third grade sample through the sample's 2015-2016 sixth grade reading and math scores. In addition, state level test scores were utilized to further explore the relationship between the study school district's annual test scores in reading and math and those of the state.

#### **Results**

Statistical tests were utilized to explore the possible relationships between the 1:1 computing initiative in the study school district and the NC EOG reading and math scores.

RQ1: Is there a significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

H<sub>0</sub>1: There is no significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of third grade students between the 2012-2013 and 2013-2014 school years. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was significant,  $t(115) = 5.764, p < .001$ . Therefore, the null hypothesis was rejected. During the 2013-2014 school year, the study school district had a

significantly higher number of students proficient on grade level ( $M = 1.59$ ,  $SD = .49$ ) than during the 2012-2013 school year ( $M = 1.37$ ,  $SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was .15 to .30. The standardized effect size index,  $d$ , was .54 which indicated a medium effect size. Figure 1 shows the distribution for grade level proficiency for the two school years.

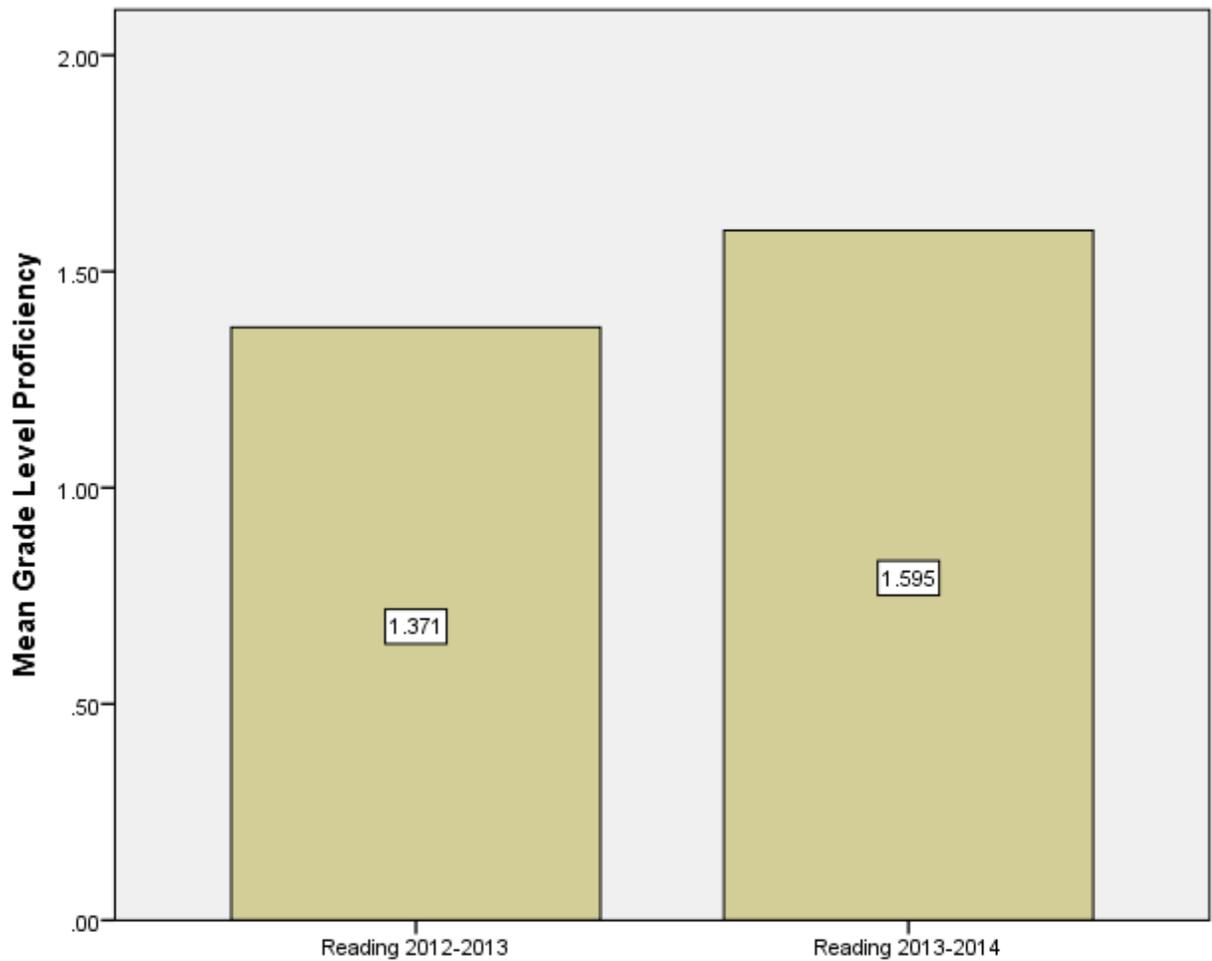


Figure 1. Grade Level Proficiency in Reading between 2012-2013 and 2013-2014.

RQ2: Is there a significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

H<sub>0</sub>2: There is no significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years. Grade level proficiency was the test variable, and the grouping variable was the year of testing. The test was not significant,  $t(115) = 1.420, p = .16$ . Therefore, the null hypothesis was not rejected. During the 2014-2015 school year, the study school district did not have a significantly higher or lower number of students proficient on grade level ( $M = 1.61, SD = .49$ ) than during the 2013-2014 school year ( $M = 1.59, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was -.01 to .04. The standardized effect size index, *d*, was .13, which indicated a small effect size. Figure 2 shows the distribution for grade level proficiency for the two school years.



Figure 2. Grade Level Proficiency in Reading between 2013-2014 and 2014-2015.

RQ3: Is there a significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

H<sub>0</sub>3: There is no significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years. Grade level proficiency was the test variable and the grouping variable

was the year of testing. The test was significant,  $t(115) = -2.276, p = .025$ . Therefore, the null hypothesis was rejected. During the 2015-2016 school year, the study school district had a significantly lower number of students proficient on grade level ( $M = 1.57, SD = .50$ ) than during the 2014-2015 school year ( $M = 1.61, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was  $-.08$  to  $-.08$ . The standardized effect size index,  $d$ , was  $.21$ , which indicated a small effect size. Figure 3 shows the distribution for grade level proficiency for the two school years.

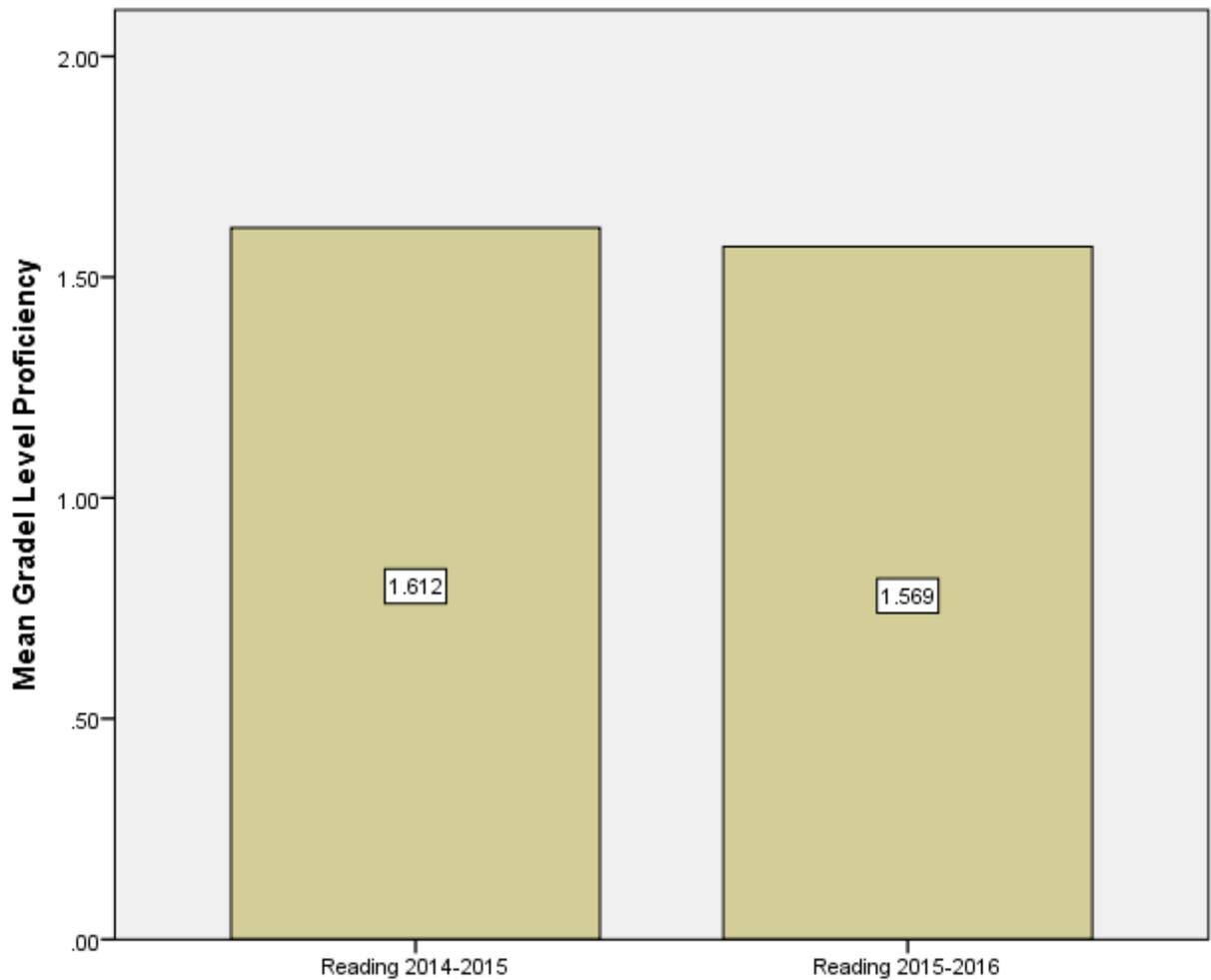


Figure 3. Grade Level Proficiency in Reading between 2014-2015 and 2015-2016.

RQ4: Is there a significant difference between the NC EOG Reading Test scores of third graders between the 2012-2013 school year and the sixth graders during the 2015-2016 school years?

H<sub>0</sub>4: There is no significant difference between the NC EOG Reading Test scores of third graders between the 2012-2013 school year and the sixth graders during the 2015-2016 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of third graders between the 2012-2013 school year and the sixth graders during the 2015-2016 school years. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was significant,  $t(115) = 5.333, p < .001$ . Therefore, the null hypothesis was rejected. During the 2015-2016 school year, the study school district had a significantly higher number of students proficient on grade level ( $M = 1.57, SD = .50$ ) than during the 2012-2013 school year ( $M = 1.37, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was .12 to .27. The standardized effect size index, *d*, was .50, which indicated a medium effect. Figure 4 shows the distribution for grade level proficiency for the two school years.

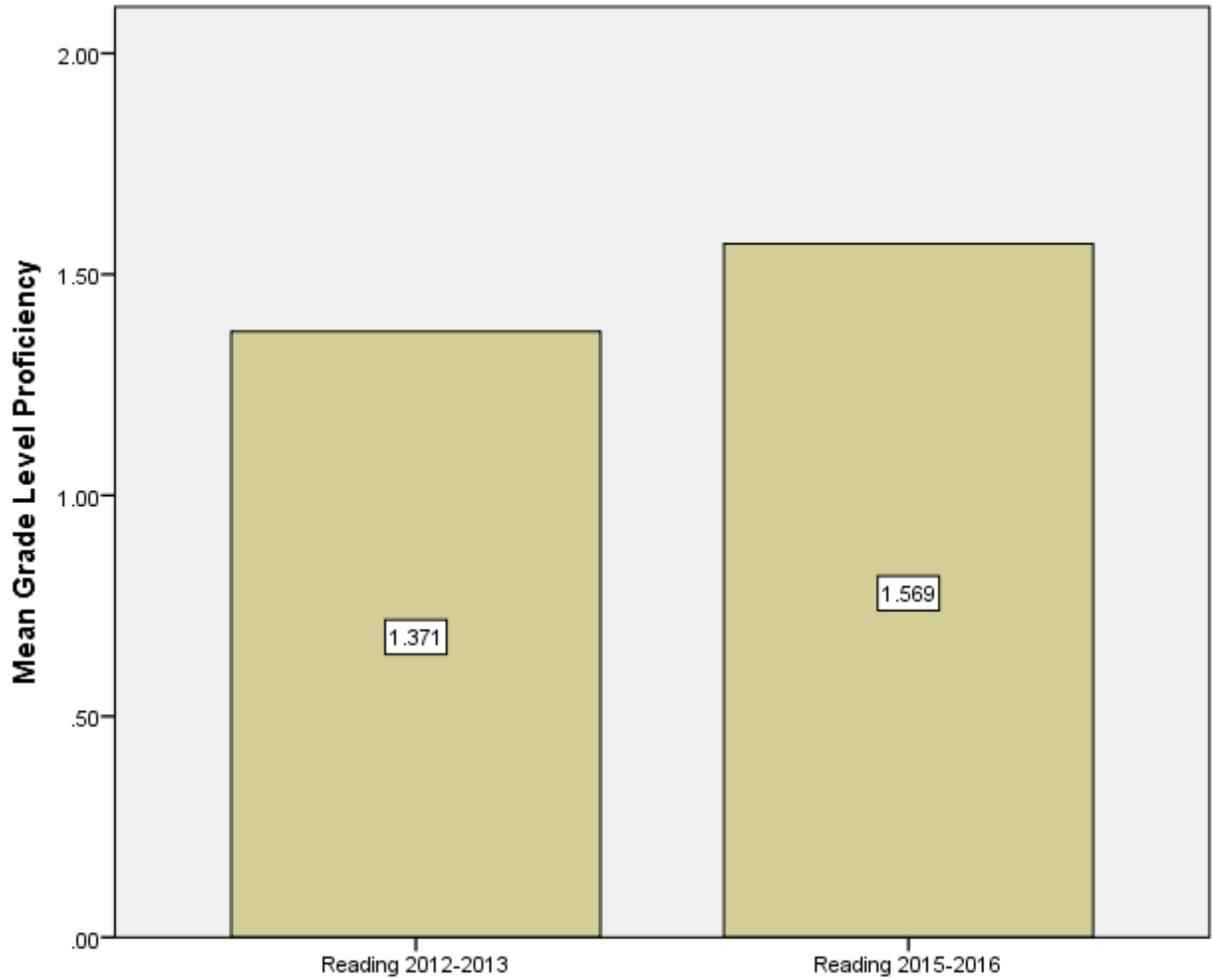


Figure 4. Grade Level Proficiency in Reading between 2012-2013 and 2015-2016.

RQ5: Is there a significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and the NC EOG Reading Test scores for the state?

H<sub>0</sub>5: There is no significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and the NC EOG Reading Test scores for the state.

A single-sample *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of third graders during the 2012-2013 school year and

the NC EOG Reading Test scores for the state. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was not significant,  $t(115) = -1.761$ ,  $p = .081$ . Therefore, the null hypothesis was not rejected. During the 2012-2013 school year, the study school district did not have a significantly lower number of students proficient on the NC EOG Reading Test ( $M = 1.37$ ,  $SD = .49$ ) than during the 2012-2013 state GLP ( $M = 1.45$ ,  $SD = .50$ ). The 95% confidence interval for the mean difference between the two scores was  $-.17$  to  $.01$ . The standardized effect size index,  $d$ , was  $.16$ , which indicated a small effect size. Figure 5 shows the distribution for grade level proficiency for the 2012-2013 school year for the study school district and the state.

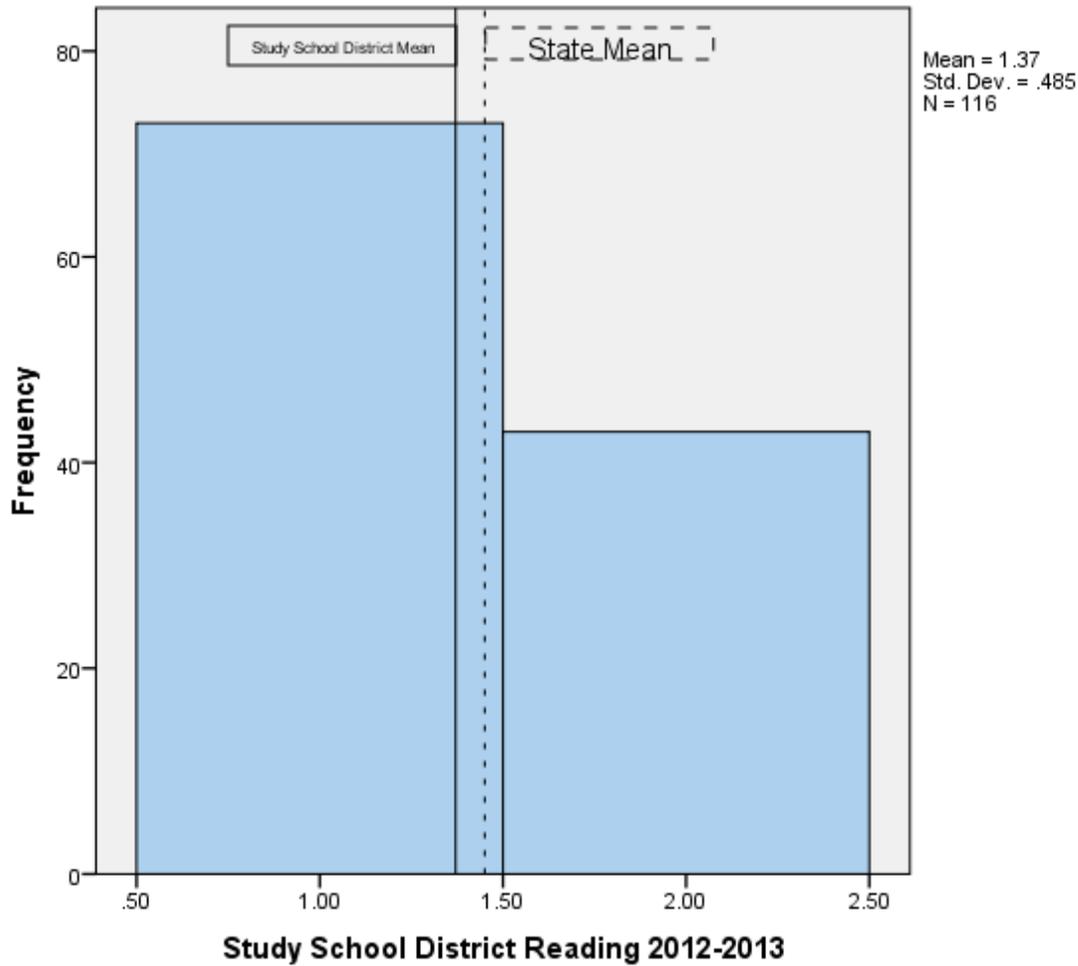


Figure 5. 2012-2013 Grade Level Proficiency in Reading between the Study School District and the State.

RQ6: Is there a significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state?

H<sub>0</sub>6: There is no significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state.

A single-sample *t* test was conducted to determine if there was a significant difference between the NC EOG Reading Test scores of sixth graders during the 2015-2016 school year and the NC EOG Reading Test scores for the state. Grade level proficiency was the test variable and

the grouping variable was the year of testing. The test was not significant,  $t(115) = -.239$ ,  $p = .812$ . Therefore, the null hypothesis was not rejected. The 2015-2016 study school district did not have a significantly lower number of students proficient on the NC EOG Reading Test ( $M = 1.57$ ,  $SD = .50$ ) than the 2015-2016 state GLP ( $M = 1.58$ ,  $SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was  $-.10$  to  $.08$ . The standardized effect size index,  $d$ , was  $.02$ , which indicated a small effect size. Figure 6 shows the distribution for grade level proficiency for the 2015-2016 school year for the study school district and the state.

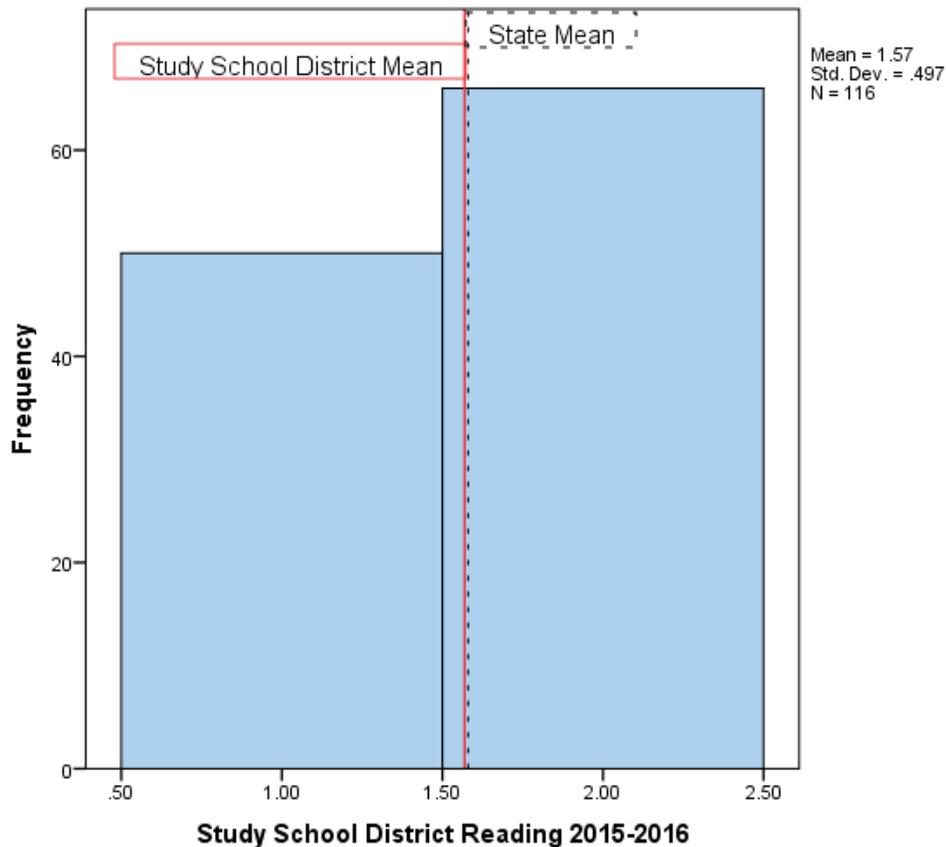


Figure 6. 2015-2016 Grade Level Proficiency in Reading between the Study School District and the State.

RQ7: Is there a significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years?

H<sub>0</sub>7: There is no significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of third grade students between the 2012-2013 and 2013-2014 school years. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was significant,  $t(115) = 3.471, p < .001$ . Therefore, the null hypothesis was rejected. During the 2013-2014 school year, the study school district had a significantly higher number of students proficient on grade level ( $M = 1.50, SD = .50$ ) than during the 2012-2013 school year ( $M = 1.41, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was .04 to .15. The standardized effect size index, *d*, was .32, which indicated a small effect size. Figure 7 shows the distribution for grade level proficiency for the two school years.

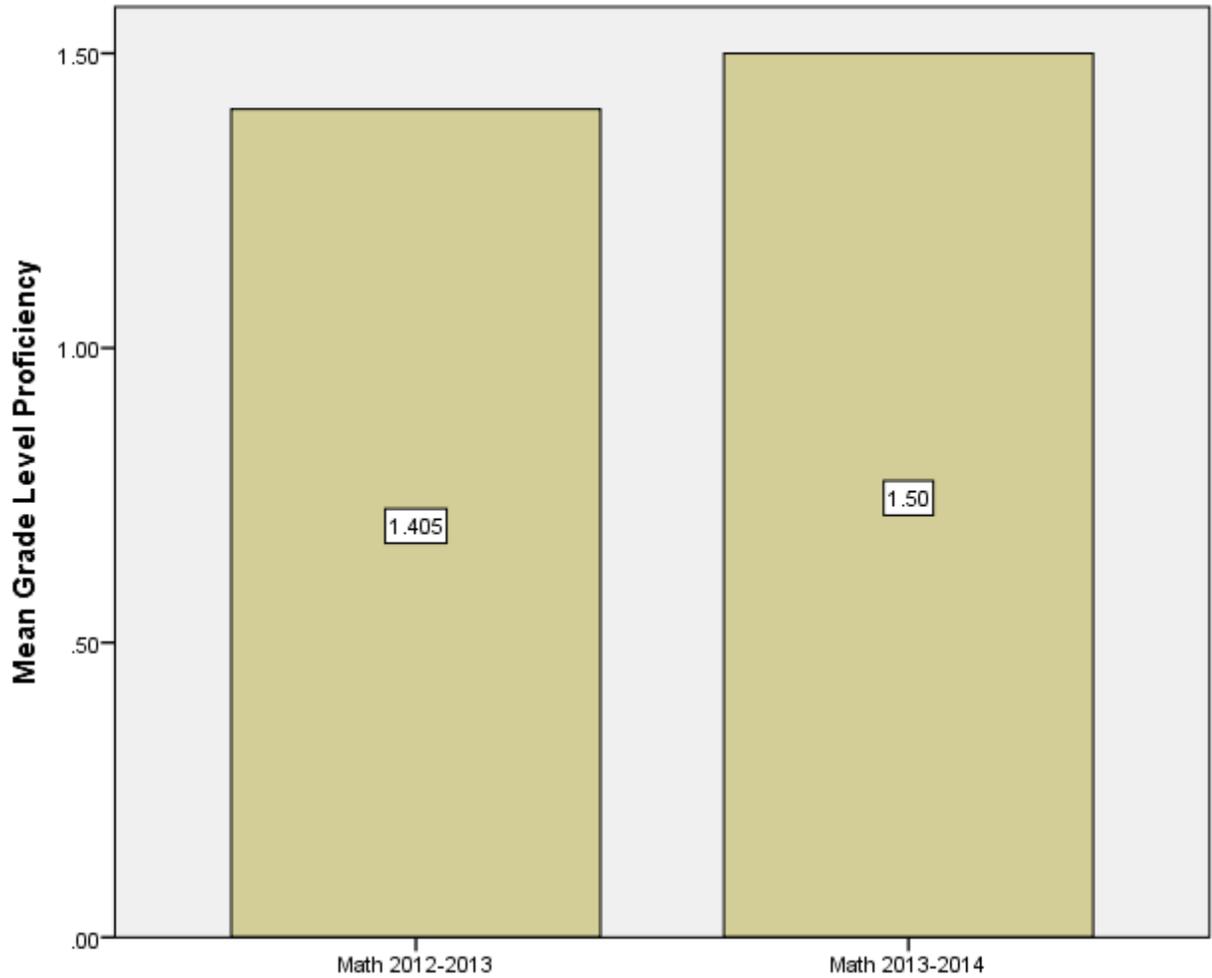


Figure 7. Grade Level Proficiency in Math between 2012-2013 and 2013-2014.

RQ8: Is there a significant difference between the NC EOG Math Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years?

H<sub>0</sub>8: There is no significant difference between the NC EOG Math Test scores of fourth grade students between the 2013-2014 and 2014-2015 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of third grade students between the 2013-2014 and 2014-2015 school years. Grade level proficiency was the test variable and the grouping variable was

the year of testing. The test was significant,  $t(115) = 3.973, p < .001$ . Therefore, the null hypothesis was rejected. During the 2014-2015 school year, the study school district had a significantly higher number of students proficient on grade level ( $M = 1.62, SD = .49$ ) than during the 2013-2014 school year ( $M = 1.50, SD = .50$ ). The 95% confidence interval for the mean difference between the two scores was .06 to .18. The standardized effect size index,  $d$ , was .37, which indicated a small effect size. Figure 8 shows the distribution for grade level proficiency for the two school years.

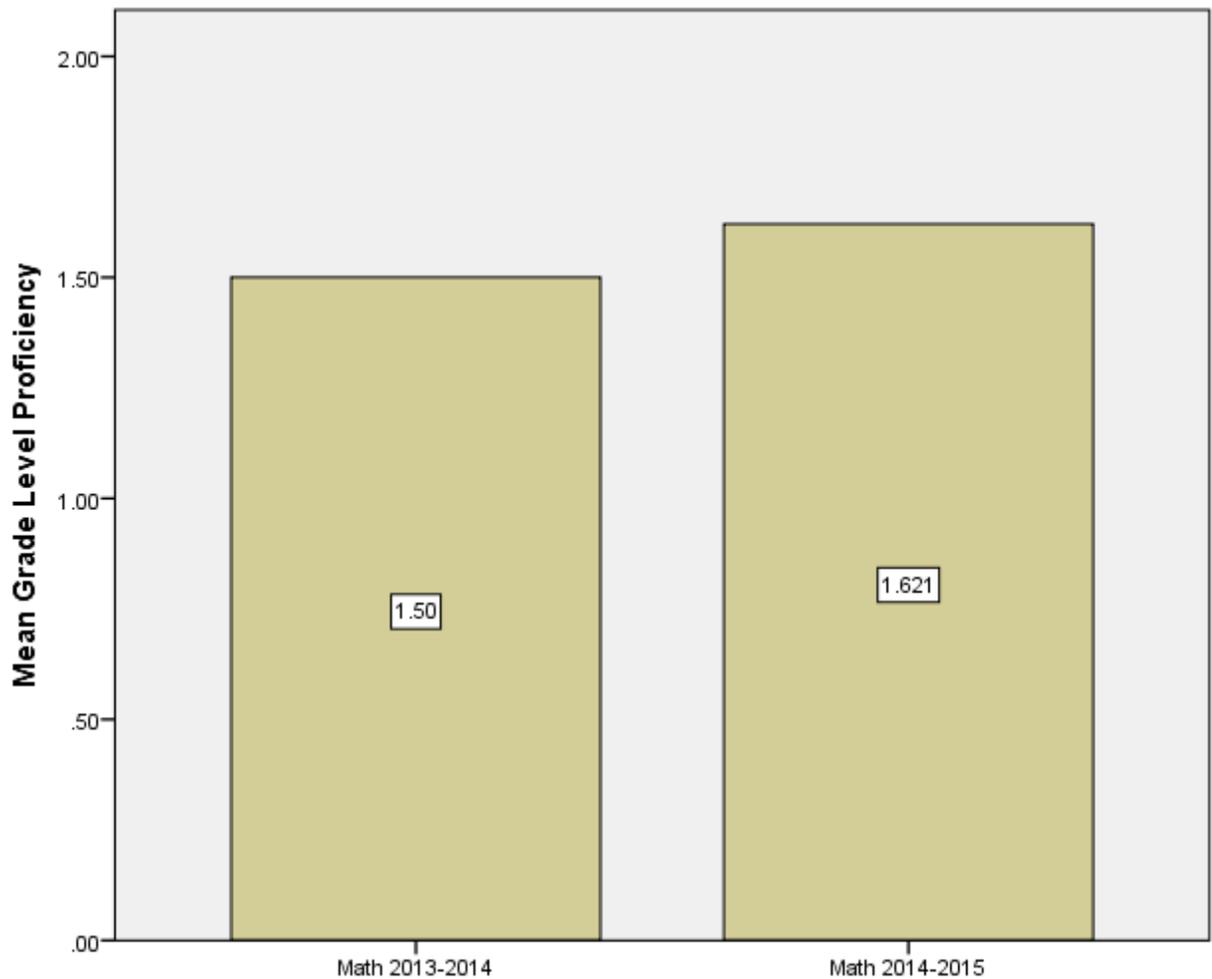


Figure 8. Grade Level Proficiency in Math between 2013-2014 and 2014-2015.

RQ9: Is there a significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years?

H<sub>0</sub>9: There is no significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of fifth grade students between the 2014-2015 and 2015-2016 school years. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was significant,  $t(115) = -3.973, p < .001$ . Therefore, the null hypothesis was rejected. During the 2015-2016 school year, the study school district had a significantly lower number of students proficient on grade level ( $M = 1.50, SD = .50$ ) than during the 2014-2015 school year ( $M = 1.62, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was -.18 and -.06. The standardized effect size index, *d*, was .37, which indicated a small effect size. Figure 9 below shows the distribution for grade level proficiency for the two school years.

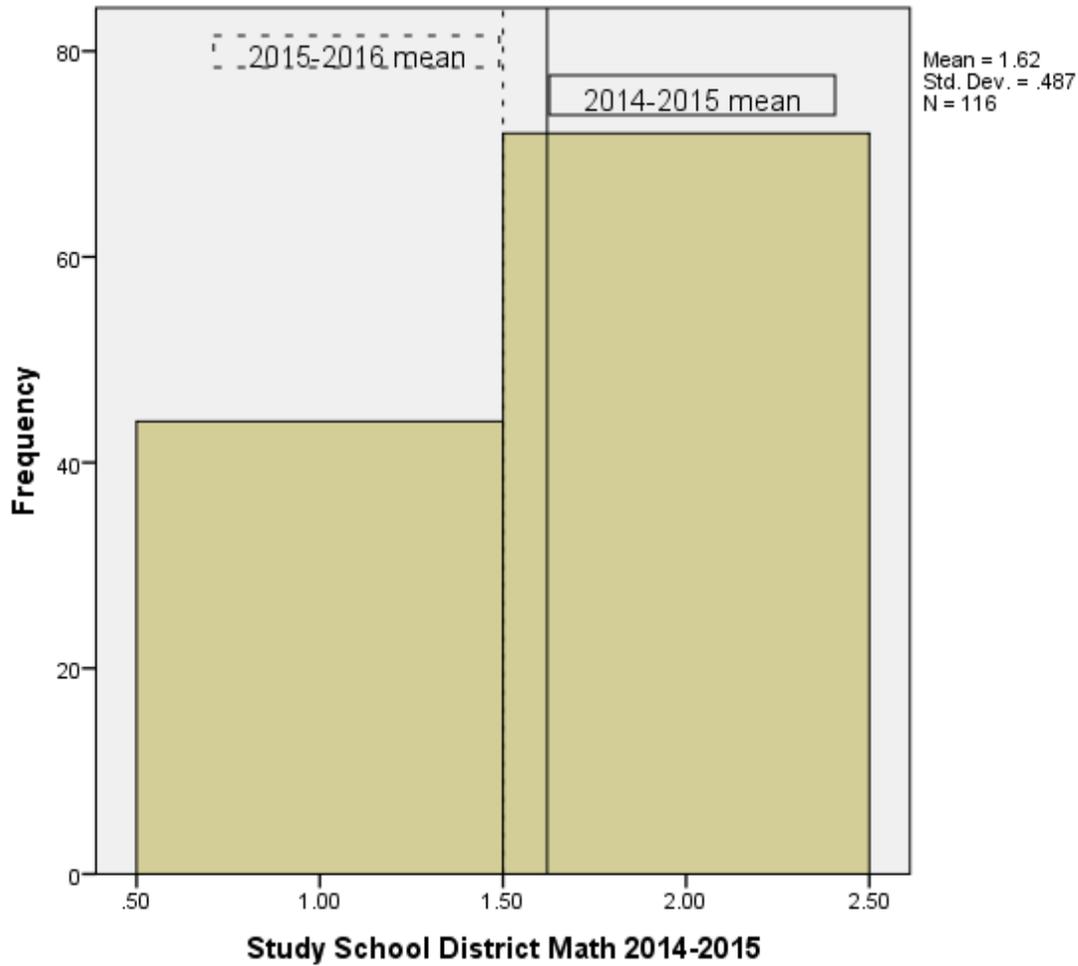


Figure 9. Grade Level Proficiency in Math between 2014-2015 and 2015-2016.

RQ10: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years?

H<sub>0</sub>10: There is no significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years.

A paired-samples *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the sixth graders during the 2015-2016 school years. Grade level proficiency was the test

variable and the grouping variable was the year of testing. The test was significant,  $t(115) = 3.471, p < .001$ . Therefore, the null hypothesis was rejected. During the 2015-2016 school year, the study school district had a significantly higher number of students proficient on grade level ( $M = 1.50, SD = .50$ ) than during the 2012-2013 school year ( $M = 1.41, SD = .49$ ). The 95% confidence interval for the mean difference between the two scores was .04 to .15. The standardized effect size index,  $d$ , was .32, which indicated a small effect. Figure 10 below shows the distribution for grade level proficiency for the two school years.

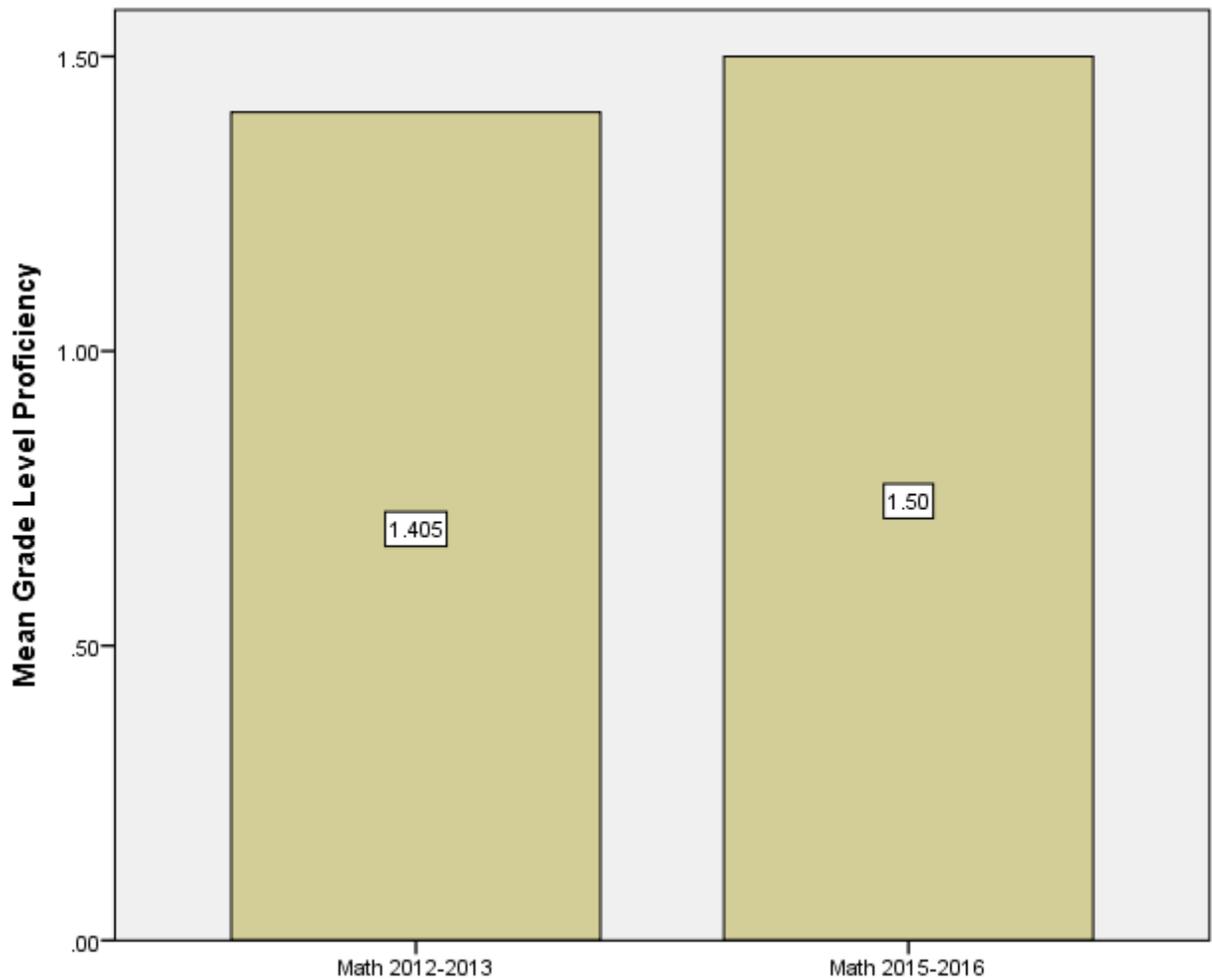


Figure 10. Grade Level Proficiency in Math between 2012-2013 and 2015-2016.

RQ11: Is there a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the NC EOG Math Test scores for the state?

H<sub>0</sub>11: There is no significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the NC EOG Math Test scores for the state.

A single-sample *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of third graders during the 2012-2013 school year and the NC EOG Math Test scores for the state. Grade level proficiency was the test variable and the grouping variable was the year of testing. The test was not significant  $t(115) = -1.416, p = .159$ . Therefore, the null hypothesis was not rejected. The 2012-2013 study school district did not have a significantly lower number of students proficient on the NC EOG Math Test ( $M = 1.41, SD = .49$ ) than the 2012-2013 state GLP ( $M = 1.47, SD = .50$ ). The 95% confidence interval for the mean difference between the two scores was  $-.16$  and  $.03$ . The standardized effect size index, *d*, was  $-.13$ , which indicated a small effect size. Figure 11 shows the distribution for grade level proficiency for the 2012-2013 school year for the study school district and the state.

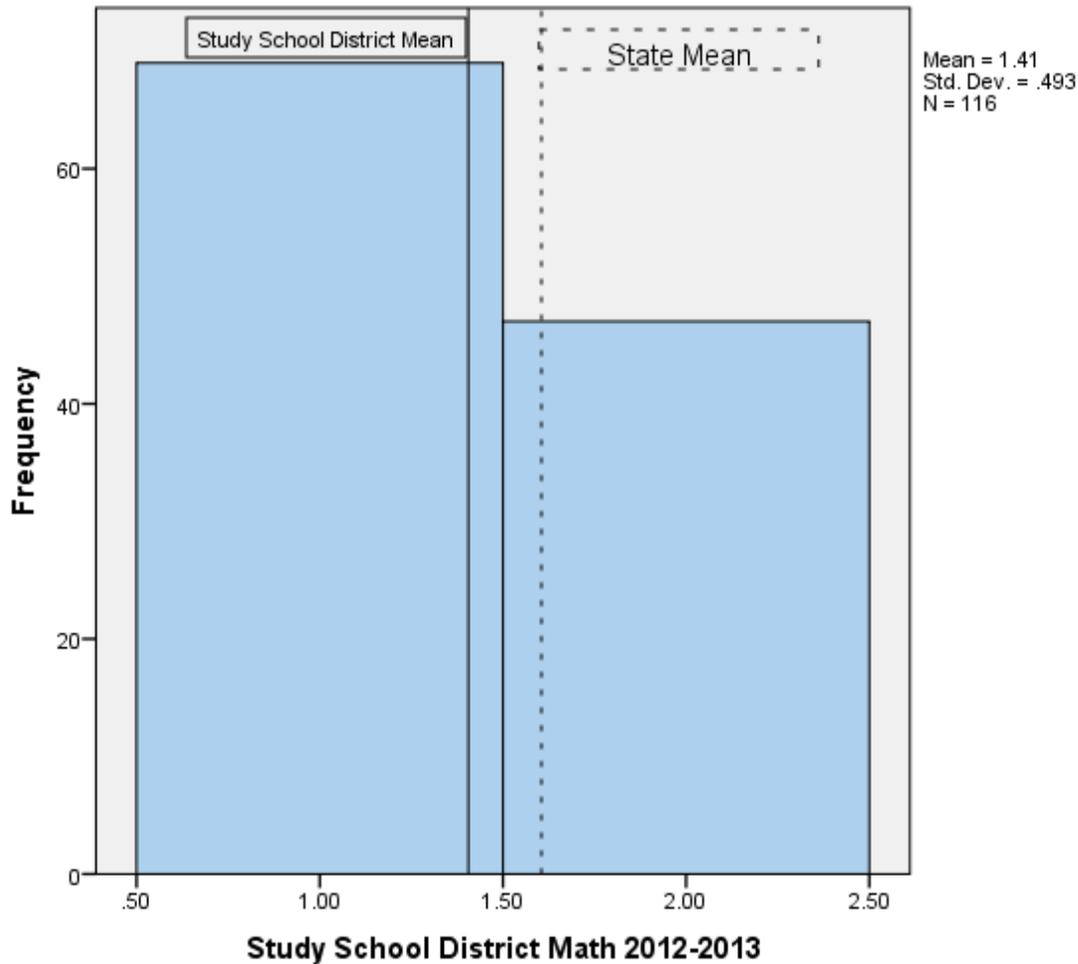


Figure 11. 2012-2013 Grade Level Proficiency in Math between the Study School District and the State.

RQ12: Is there a significant difference between the NC EOG Math Test scores of sixth graders during the 2015-2016 school year and the NC EOG Math Test scores for the state?

H<sub>0</sub>12: There is no significant difference between the NC EOG Math Test scores of sixth graders during the 2015-2016 school year and the NC EOG Math Test scores for the state.

A single-sample *t* test was conducted to determine if there was a significant difference between the NC EOG Math Test scores of third graders during the 2015-2016 school year and the NC EOG Math Test scores for the state. Grade level proficiency was the test variable and the

grouping variable was the year of testing. The test was not significant,  $t(115) = -.429, p = .669$ . Therefore, the null hypothesis was not rejected. The 2015-2016 study school district did not have a significantly lower number of students proficient on the NC EOG Math Test ( $M = 1.50, SD = .50$ ) than the 2012-2013 state GLP ( $M = 1.52, SD = .50$ ). The 95% confidence interval for the mean difference between the two scores was  $-.11$  and  $.07$ . The standardized effect size index,  $d$ , was  $-.04$ , which indicated a small effect size. Figure 12 shows the distribution for grade level proficiency for the 2015-2016 school year for the study school district and the state.

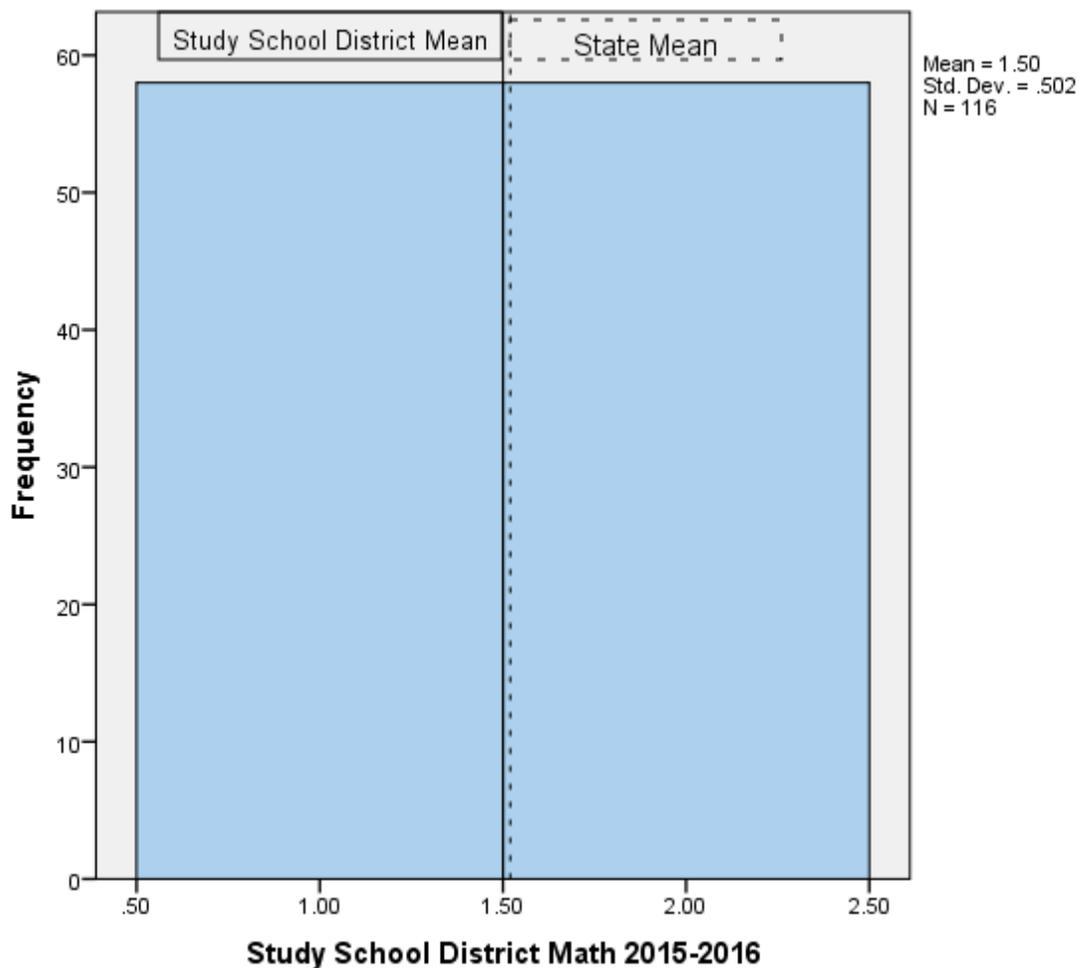


Figure 12. 2015-2016 Grade Level Proficiency in Math between the Study School District and the State.

## Chapter Summary

This ex post facto quantitative study was conducted to explore the possible relationship between the implementation of the 1:1 computing initiative in the study school district and the NC EOG Reading and Math scores of the 2012-2013 third grade sample through the sample's 2015-2016 sixth grade reading and math scores. State level test scores were also utilized to explore the relationship between the study school district's test scores in reading and math and those of the state.

Research Questions 1-4 investigated the study school district's NC EOG Reading Test scores. Specifically, the data collected concerned student grade level proficiency. Statistical analyses were conducted to determine if there was a significant difference either higher or lower in the mean of student grade level proficiency in relation to the implementation of the 1:1 computing program with the first full year of implementation in the 2012-2013 school year. The data indicated that there was a significant difference in the mean of grade level proficiency between the 2012-2013 and 2013-2014, 2014-2015 and 2015-2016, and the 2012-2013 and 2015-2016 school years. Overall, the results indicated a significantly higher mean between 2012-2013 and 2015-2016 with a medium effect size.

Research Questions 5 and 6 investigated the study school district's NC EOG Reading Test scores and the NC EOG Reading Test scores of the state. The collected data focused on student grade level proficiency. Statistical analyses were conducted to determine if there was a significant difference either higher or lower in the mean of student grade level proficiency in relation to the implementation of the 1:1 computing initiative with the first full year of implementation in 2012-2013. The data indicated that there was not a significant difference in

the mean of grade level proficiency between the study school district and the state in both the 2012-2013 school year and the 2015-2016 school year.

Research Questions 7 through 10 explored the study school district's NC EOG Math Test scores. The collected data focused on student grade level proficiency. Statistical analyses were conducted to determine if there was a significant difference either higher or lower in the mean of students' grade level proficient in relation to the implementation of the 1:1 computing initiative with the first full year of implementation in 2012-2013. The data indicated that there was a significant difference in the mean of grade level proficiency between each of the school years between 2012-2013 through 2015-2016. Overall, the results indicated a significantly higher mean between 2012-2013 and 2015-2016; however, the effect size was small.

Research Questions 11 and 12 investigated the study school district's NC EOG Math Test scores and the NC EOG Math Test scores of the state. The collected data focused on student grade level proficiency. Statistical analyses were conducted to determine if there was a significant difference either higher or lower in the mean of student grade level proficiency in relation to the implementation of the 1:1 computing initiative with the first full year of implementation in 2012-2013. The data indicated that there was not a significant difference in the mean of grade level proficiency between the study school district and the state in both the 2012-2013 school year and the 2015-2016 school year.

## CHAPTER 5

### DISCUSSIONS, CONCLUSIONS, AND IMPLICATIONS

With greater significance placed on teacher effectiveness and student achievement, it is vital to increase the quality and efficacy of instructional activities and materials in order to increase student engagement and content mastery. Many school districts throughout the country are turning to 1:1 computing initiatives to meet the new demands and challenges of more rigorous educational standards and expectations. This ex post facto quantitative study was conducted to explore the possible relationship between the implementation of the 1:1 computing initiative in the study school district and the NC EOG Reading and Math scores of the 2012-2013 third grade sample through the sample's 2015-2016 sixth grade reading and math scores. This study utilized student grade level proficiency data from the study school district for the NC EOG Reading and Math tests from the first full year of implementation of the 1:1 computing initiative (2012-2013) and state grade level proficiency data for the 2012-2013 and 2015-2016 NC EOG Reading and Math tests.

#### **Discussions and Conclusions**

The data revealed that the study school district was not significantly below grade level proficiency in reading and math prior to the implementation of the 1:1 computing initiative as well as after four years of implementation; however, the results of the study indicated that the study school district showed significant growth in both reading and math at the end of four years of implementation. During the 2012-2013 school year, the study school district's proficiency mean on the NC EOG Reading test was 1.37 and the state proficiency mean was 1.45. During

the 2015-2016 school year, the study school district's proficiency mean on the NC EOG Reading test was 1.57 and the state proficiency was 1.58. The same holds true for the NC EOG Math test. In 2012-2013, the study school district's proficiency mean was 1.41 while the state proficiency mean was 1.47. In 2015-2016, the study school district's mean was 1.50 with the state at 1.52. Although, the study school district did not reach or pass the state proficiency mean, the study school district exhibited significant growth in both subject areas.

Research Questions 1-4 explored the study school district's NC EOG Reading Test scores and the possible correlation between the implementation of the computing program. Research question 1 tested the means between the 2012-2013 school year and the 2013-2014 school year. The data indicated that there was a significant difference in the mean of grade level proficiency with the 2013-2014 school year showing growth. Research question 2 explored the means of the 2013-2014 school year and the 2014-2015 school year. The data indicated that there was not a significant difference in the mean of grade level proficiency. Research question 3 tested the means of the 2014-2015 school year and the 2015-2016 school year. The results indicated that there was a significant difference. The 2015-2016 school year experienced a significantly lower mean of grade level proficiency on the NC EOG Reading test; however, the results indicated a significantly higher mean between 2012-2013 and 2015-2016 with a medium effect size. The means and standard deviations for the four school years are presented in Table 1.

Table 1

*Means and Standard Deviations for NC EOG Reading PLG for the Study School District*

Year	<i>M</i>	<i>SD</i>
2012-2013	1.37	.49
2013-2014	1.59	.49
2014-2015	1.61	.49
2015-2016	1.57	.50

Research Questions 5 and 6 tested the study school district’s grade level proficiency mean on NC EOG Reading Test and the state’s grade level proficiency mean on the NC EOG Reading Test. The data indicated that there was not a significant difference in the mean of grade level proficiency between the study school district and the state in both the 2012-2013 school year and the 2015-2016 school year. The means and standard deviations for the two school years for the study school district and the state are presented in Table 2.

Table 2

*Means and Standard Deviations for NC EOG Reading PLG for the Study School District and the State*

Year	Group	<i>M</i>	<i>SD</i>
2012-2013	Study School District	1.37	.49
	State	1.45	.50
2015-2016	Study School District	1.57	.50
	State	1.58	.49

Research Questions 7-10 explored the study school district’s grade level proficiency the NC EOG Math Test. Research question 7 tested the means between the 2012-2013 school year and the 2013-2014 school year. The data indicated that there was a significant difference in the mean of grade level proficiency with the 2013-2014 school year showing growth. Research question 8 explored the means of the 2013-2014 school year and the 2014-2015 school year. The data indicated that there was a significant difference in the mean of grade level proficiency with the 2014-2015 school year showing significant growth. Research question 9 tested the means of the 2014-2015 school year and the 2015-2016 school year. The results indicated that there was a significant difference. The 2015-2016 school year experienced a significantly lower mean of grade level proficiency on the NC EOG Math test; however, the results indicated a significantly higher mean between 2012-2013 and 2015-2016 with a small effect size. The means and standard deviations for the four school years are presented in Table 3.

Table 3

*Means and Standard Deviations for NC EOG Math PLG for the Study School District*

Year	<i>M</i>	<i>SD</i>
2012-2013	1.41	.49
2013-2014	1.50	.50
2014-2015	1.62	.49
2015-2016	1.50	.50

Research Questions 11 and 12 investigated the study school district’s grade level proficiency on the NC EOG Math Test and the state grade level proficiency on the NC EOG Math Test. The results indicated that there was not a significant difference in the mean of grade level proficiency between the study school district and the state in both the 2012-2013 school year and the 2015-2016 school year. The means and standard deviations for the two school years for the study school district and the state are presented in Table 4.

Table 4

*Means and Standard Deviations for NC EOG Math PLG for the Study School District and the State*

Year	Group	<i>M</i>	<i>SD</i>
2012-2013	Study School District	1.41	.49
	State	1.47	.50
2015-2016	Study School District	1.50	.50
	State	1.52	.50

The school district showed significant growth during two of the four tested time periods in reading and three of the four test time periods in math. It is significant to note that the fourth year of implementation resulted in significant decreases in grade level proficiency in both reading and math. It is also noteworthy that the fourth year of implementation, 2015-2016, was the cohort's first year of middle school.

As indicated by earlier literature, Sung et al. (2016) reported that elementary students showed a high effect size. It is also important to note that students in the school district transition from an iPad in 5<sup>th</sup> grade to a MacBook in the 6<sup>th</sup> grade. The transition from elementary to middle school and the transition of devices could have resulted in the negative growth indicated by the data.

## **Implications for Practice**

Teachers are tasked in the North Carolina Professional Teaching Standards with increasing engagement, rigor, relevance, and 21st Century Skills in their classrooms. Specifically, Standard Four (Teachers Facilitate Learning for Their Students) states, “Teachers know when and how to use technology to maximize student learning. Teachers help students use technology to learn content, think critically, solve problems, discern reliability, use information, communicate, innovate, and collaborate” (North Carolina Department of Public Instruction, 2013, p. 6). Standard Four also encompasses the requirement for teachers to revolutionize assessments. “Teachers use 21st century assessment systems to inform instruction and demonstrate evidence of students’ 21st century knowledge, skills, performance, and dispositions” (North Carolina Department of Public Instruction, 2013, p. 7). The standards for 21st Century Learning include information, media, and technology skills; specifically, “Effective citizens and workers must be able to exhibit a range of functional and critical thinking skills, such as: information literacy, media literacy, and ICT (Information, Communications and Technology) Literacy” (Partnership for 21st Century Learning, 2016, p. 2). While this study was conducted using data from a small study school district, the results can be used by districts with similar demographics as a rationale for adopting a 1:1 computing program. The study results could be used to secure funding from local boards, private investors, and grants. Because the study school district’s 1:1 computing initiative showed significant growth from first year implementation through year four in both reading and math, the 1:1 computing initiative can be attributed some measure of success and can be utilized as a strategy to address new and more rigorous standards.

North Carolina is currently transitioning state testing to an online format. “The North Carolina Department of Public Instruction (NCDPI) encourages districts/schools to continue to move toward online assessments as much as their local technical infrastructure will allow” (North Carolina Department of Public Instruction, 2016, p. 1). Student access to technology in the form of a 1:1 computing initiative could impact student achievement on state assessments which will be administered online in the near future.

### **Implications for Future Research**

This study did not utilize observations and student survey responses to determine engagement, but that type of data could add depth to the exploration of the possible relationship between 1:1 computing and student achievement. An extension of this study could implement the Middle Grades Survey of Student Engagement (MGSSE) from the National Association of Independent Schools. The survey measures multiple dimensions of engagement including cognitive, academic, social, behavioral, and emotional (Indiana University Bloomington, 2017). These dimensions are congruent with the operational definition of student engagement used in this study. This study did not utilize teacher observations and teacher survey responses to determine teacher efficacy and attitude in implementing the 1:1 computing program. Future research could pair teacher technology competency or attitudes with student test scores. It would be valuable to know if a possible relationship exists between teacher technology skills/attitudes and student achievement in conjunction with a 1:1 computing program. The study school district utilizes a Learning Management System that tracks student use. It could be worthwhile to study the correlation between the time students spend logged into the LMS and the student’s grades in the particular class. In addition, future research could explore teacher perceptions of technology

implementation and students LMS utilization. Future research could continue to follow the identified cohort. It would be worthwhile to track data from elementary through high school. In addition to following the cohort, the researcher could disaggregate the data per school for the five elementary, two middle, and one high schools.

### **Chapter Summary**

This study analyzed data from the study school district beginning with the district's first year of implementation of the 1:1 initiative, 2012-2013, through the fourth year of implementation, 2015-2016, to explore the possible relationship with the implementation of the 1:1 initiative and student test scores on the NC EOG Reading and Math tests. The study school district's mean grade level proficiency on the NC EOG Reading and Math tests was not significantly lower or higher than the state's mean grade level proficiency on the NC EOG Reading and Math tests during the 2012-2013 and the 2015-2016 school years. While the study school district did not exhibit significantly lower means than the state, the study results indicated that the district did show significant growth from the first year of implementation through the fourth year of implementation. The data showed that the district exhibited two time periods of significantly positive growth in reading and three time periods of significantly positive growth in math.

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