The Effects of a One-to-One Laptop Initiative on Student Achievement

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Abstract

The purpose of this study was to determine to what extent the one-to-one initiative impacted student performance on the MAP ELA and mathematics assessments. The participants included those students from a suburban Kansas City, Missouri school district who were enrolled in fourth grade during the 2011-2012 school year and fifth grade during the 2012-2013 school year. There were no statistically significant differences in fifth grade student achievement on the MAP English Language Arts (ELA) and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative. The difference in the fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative was not affected by student race or socioeconomic status (SES). However, the difference in fifth grade achievement on the MAP mathematics assessment between students who participated in the one-to-one initiative and students who did not participate in the initiative was affected by student gender. Female students who participated tended to outperform female students who did not participate, while male students who participated tended to perform poorly when compared to males who did not participate.

A statistically significant difference in ELA growth, as measured by a difference between the fourth and fifth grade scale scores on the MAP ELA assessment, was found between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative. The differences were not affected by student gender and SES; however, although not statistically significant, White

students who participated in the one-to-one initiative tended to outperform White students who did not participate. No differences were found between fourth and fifth grade scale scores on the MAP mathematics assessment between fifth grade students who participated in the one-to-one initiative and those that did not participate in the initiative. The differences were not affected by student gender, race, and SES.

It was recommended that District X evaluate the effectiveness of this one-to-one initiative, consider expanding internet access to their students outside of the school day, and develop and implement strategies targeting the academic performance of lower-performing students. Future studies could be conducted that include additional quantitative measures of student achievement such as STAR, Acuity, and iReady and survey results from teachers, parents, and students. In addition, a measure could be included to evaluate the student acquisition of 21st century skills.

Dedication

I would like to dedicate this dissertation to my wife, Angela. Your intelligence, skill, thoughtfulness, and passion equip you to improve the lives of others far beyond my abilities. God knows that the only thing that impedes you is me, your selfless giving to our children, and the Common Variable Immune Deficiency that the Lord placed in your path. While you consistently refused to help me with this degree, you persistently believed that I could do it. You inspired me to continue when nothing else did; I am so blessed.

I regret the moments I missed with children Kamryn, Marin, and Lou, my parents Bert and Sandy Van Batavia, and the rest of my family and friends to complete this degree. I love you all.

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Chapter One

Introduction

During the first 15 years of the 21st century, public education witnessed the growth of technology in classroom instruction. This growth has come at a great monetary expense and with much debate. The implementation of technology is varied throughout school districts. Some districts have purchased laptops while others have purchased iPads or similar devices. Some, like Anchorage School District in Alaska (2014), have moved to a model of instruction that includes all secondary students using their own laptops, often called Bring Your Own Device (BYOD). Other districts have implemented a one-to-one technology model where each student uses a laptop provided by the school district. For example, the regional news outlet KMBC (2014) reported that the Shawnee Mission School District in Shawnee, Kansas decided to purchase electronic devices for all secondary students.

In 2001, the federal legislation, No Child Left Behind, generated a new era of high-stakes accountability for public education. Schools were tasked by states to demonstrate continuous improvement of their students' academic progress. In addition to classroom and student instruction, school districts have begun using technology to help meet the demands for improvement from state agencies and new rigorous Common Core Standards. For example, the Missouri Department of Elementary and Secondary Education (DESE) has promoted continuous improvement by measuring school districts through the fifth cycle of the Missouri School Improvement Process, which is referred to as the MSIP-5 (DESE, 2014).

Academic achievement and growth is a measured indicator by DESE during the MSIP 5 review process (DESE, 2014). Instructional technology methods could be used to address this indicator as well. In fact, introducing technology as an instructional tool was recognized as a productive teaching technique. The International Society for Technology in Education (ISTE) (2014) indicated:

> Technology, used effectively, can help all students meet and exceed the rigorous learning goals embedded in the Common Core State Standards by providing access to tools and resources that personalize instruction and creating rich, engaging, and relevant learning environments. With the advent of the 2014–2015 Common Core Online Assessments, it is imperative that students' learning takes place in a robust digital learning environment in order for them to be successful on these new higher-order thinking assessments. (para. 1-2)

As of 2014, forty-five states, including Missouri, had adopted the Common Core State Standards (CCSS) (Bidwell, 2014). Blackburn (2013) explained that while the CCSS established rigorous benchmarks, the impact on academic performance depends on how well the standards are implemented. Blackburn (2013) further stated, "Authentic rigor includes high expectations for students, increased support for students, and increased demonstration of learning by students" (para. 2).

Research concerning computer-based instruction has produced conflicting results regarding the impact on student achievement. Silvernail (2007) reported that "the evidence indicates that implementation of Maine's one-to-one ubiquitous laptop program has had a positive impact on middle school students' writing" (p. 9). The opposite has also been reported. Fried (2008) found a "significant, negative relationship between in-

class laptop use and course grade" (para. 11). These mixed findings have led administrators to question the expense of technology in classrooms. Investigations into one-to-one initiatives are often focused on student achievement to aid in the justification of the expense of such a program. Garner, Schweder, and Wissick (2004) reported that technology tools and instructional strategies could empower students with diverse learning needs to master content in mathematics, language arts, science, and social studies.

Background

The setting for this study was District X, a suburban school district established in 1951 in western Missouri. District X served the following Kansas City Northland metropolitan neighborhoods in the southern part of Platte County: "Parkville, Riverside, Houston Lake, Weatherby Lake, Platte Woods, and Lake Waukomis" (District X, 2014, p. 9). This public school district, with pre-kindergarten programs through grade 12, reported an enrollment of 10,504 students for the 2013-2014 school year (District X, 2014, p. 21). During the 2013-2014 school year, the school district included 10 elementary schools, three middle schools, two high schools, a day treatment school, and an early childhood center.

District X has experienced a noticeable change in the demographics of its students between 2004 and 2014. The number of students qualifying for free and reduced breakfast and lunch rates has increased from 18.4% in 2004-2005 to 29.2% in 2014-2015 (District X, 2015a, p. 37). District X students have also experienced a change in the diversity of their population during this same time. Combined minority populations increased from 17.1% in 2004-2005 to 30.1% of the student population in 2014-2015

(District X, 2015a, p. 34). These trends indicate that District X could potentially continue to have an increase in the diversity of its students and the needs of those students. Jackson and Davis (2000) reported that such evolutions leave teachers with the need to address student diversity in the regular classroom, rather than through other arrangements that have often replaced the teacher as needing to attend to the needs of students who diverge from the norm. Kao and Tienda (2005) reported that demographic shifts towards increased diversity and lower socioeconomic status often lead to decreased student achievement and is therefore considered a liability to school officials. Thus, District X may potentially plan to change how it meets the needs of its students.

The Missouri Assessment Program (MAP) test is administered to students each year and is designed by the state of Missouri to assess progress toward mastery of the Missouri Show-Me Standards (DESE, 2014). Scores are reported to the schools by the state. Students, based on their MAP scores, are placed into the following categories: below basic, basic, proficient, and advanced (DESE, 2014). District X has been recognized for its academic achievement. The district's overall high achievement has led to state honors of Accreditation with Distinction, the Distinction in Performance Award, and North Central Accreditation, as well as a Gold Medal ranking from Expansion Management Magazine (Kimbrel & Rizzo, 2013). An example of success is the high academic performance of the fifth and sixth grade students on the state MAP test in the areas of mathematics and English Language Arts (ELA). The 2008-2009 through 2013-2014 results of the District X fourth and fifth grade student performance on the MAP are shown in Table 1.

Table 1

Percentage of District X Fourth and Fifth Grade Students Achieving a Score of Proficient or Advanced on the MAP Mathematics and ELA

	Mathematics		ELA	
Year	Fourth Grade	Fifth Grade	Fourth Grade	Fifth Grade
2008-2009	51.3	63.7	61.1	65.3
2009-2010	63.8	68.6	67.1	69.6
2010-2011	64.0	72.3	64.9	66.2
2011-2012	60.6	69.6	65.2	66.1
2012-2013	57.3	70.6	67.5	71.5
2013-2014	52.0	69.1	59.5	67.8

Note: Adapted from *Missouri School Improvement Process*, by DESE (2015, April 4). Retrieved from: http://mcds.dese.mo.gov/guided inquiry /School%20Report%20Card/School%20Report%20Card.aspx

Since these scores are all above the state averages, they have provided evidence that District X has high achieving schools. DESE (2014) reported fourth grade averages of 42.9 for mathematics and 41.1 for ELA from 2008–2009 through 2013-2014. DESE (2014) reported fifth grade averages of 49.1 for mathematics and 50.6 for ELA from 2008-2014 However, with these scores, it is difficult for District X to achieve continuous improvement. Scull and Winkler (2011) explained that there is a widespread notion that students in suburban, high-performing schools experience the greatest educational growth. However, according to Betts and Koedel (2009), when studying proficiency based tests, there is a tendency for a student's growth decline if the current score is near the top of the distribution since the student has little room for improvement.

One of the ways that District X has decided to work towards continued academic improvement for its students has been through the implementation of the Future Learner Project (FLiP). The purpose of FLiP has been to create more student-centered classrooms and help "teachers act as facilitators and students take ownership of their learning" (District X, 2014). District X was working to achieve this goal by introducing students to computer-based instruction through a one -to-one environment using a flipped classroom teaching method.

In the fall of 2012, District X implemented the one-to-one initiative in three elementary schools. All fifth grade students who attended the pilot schools were issued laptops for the duration of the 2012-2013 school year. Students used the laptops in class and could take them home on a nightly basis. In the fall of 2013, all fifth grade students in the District X were issued laptops as an extension of this program.

For years, school districts have made strategic efforts to increase the technology skills of students. The one-to-one initiative was aligned with District X's strategic goal: "Increase the percentage of students proficient in 21st century skills" (District X, 2014, p. 4). Apple Computers (1990) reported that a one-to-one computer-based learning environment has been utilized in classrooms in various degrees since 1985. District X also implemented this program to address the academic needs of all students. Walsh (2012) highlighted this issue when he wrote, "Human beings don't naturally all learn the same material at the same pace and in the same way. One-to-one technology allows teachers to differentiate their content and their student assignments to meet the needs of all students" (para. 6). District X worked toward meeting student needs through the strategic implementation of the one-to-one initiative.

Statement of the Problem

A transition in the mode of instruction to a "flipped classroom" with a "one-to-one" (each student with a networked electronic device) initiative triggered interest in the effectiveness of these changes. Staff member's delivery of instruction has changed with student participation and collaboration playing a much greater role in the classroom. This change in instruction was piloted in fifth grade middle school classrooms. Incubator classrooms had a set of laptops dedicated for the students to use whenever they attended that class or were with that teacher (Kimbrel & Rizzo, 2013). The district began this process to improve student technology skills and academic achievement (Kimbrel & Rizzo, 2013). Providing these resources to students required a significant dedication of resources from the community. District X school board members proposed a levy increase to the taxpayers because of the additional cost associated with the electronic devices (District X, 2014, para. 11).

The research on one-to-one computer instruction has produced conflicting results. Spektor-Levy and Granot-Gilat (2012) found "seventh-grade students in a 1:1 environment demonstrated a significant statistical difference in regards to academic achievement over the students from their comparison group" (p. 91). Cottone (2013) reported that "fourth, fifth, and sixth graders demonstrated a significant statistical difference between a pre-1:1 laptop group and the post-1:1 laptop with positive results in math but not for reading" (p. 19). District X did not know if the one-to-one initiative would ultimately have a positive influence on student achievement on the MAP mathematics and ELA assessments or if it would have unique effects on the subpopulations of gender, race, or SES. Along with other institutions, District X was

attempting to measure the success of this program through educational outcomes. However, as reported by Maninger and Holden (2009), "these educational outcomes are difficult to quantify and even more challenging to relate directly to specific instructional initiatives" (p. 9). It is important to know if placing students in District X's one-to-one initiative has had any impact on mathematics and ELA scores as assessed on the MAP.

Purpose of the Study

The first purpose of this study was to determine if there were differences in fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year. The second purpose was to determine whether the differences in fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative during the 2012-2013 school year and students who did not participate in the initiative were affected by one of the following variables: student gender, race, or SES. The third purpose is to determine if there were a differences in ELA and mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA and mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year. The final purpose was to determine if there were a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA and mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the

initiative during the 2012-2013 school year during the 2012-2013 school year were affected by one of the following variables: student gender, race, or SES.

Significance of the Study

The results of this study could contribute to the body of research regarding computer-based instruction and one-to-one instructional environments. "The main purpose of integrating many digital technologies into the learning environment is increasing the quality and success of education" (Ozerbas & Erdogan, 2016, p. 1). District X has begun the implementation of a one-to-one program in grades 5-12 and is considering expanding it in grades K-4 (Kimbrel & Rizzo, 2013). The results of this study might provide useful information regarding the relationship of a one-to-one environment and student achievement in the District X. For example, the District X might explore the expansion of the one-to-one initiative to additional grade levels or the expansion of electronic devices used for instruction in the future. District X needs to have data that illustrates the effect of the use of laptops as an instructional tool; the results of this study could provide information regarding this issue. Additionally, the results of this study might help other districts make decisions on how to best use their resources to improve student achievement.

Delimitations

Per Lunenburg and Irby (2008), "delimitations are self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). This study included the following delimitations:

1. The setting for this study was a suburban school district near Kansas City, Missouri.

2. The sample included fourth graders during the 2011-2012 school year and fifth graders during the 2012-2013 school year.
3. Student achievement was measured by using student scores on the MAP ELA and mathematics assessments.

Assumptions

According to Lunenburg and Irby (2008), "assumptions are postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). This study included the following assumptions:

1. All teachers were highly qualified as determined by the Missouri Department of Elementary and Secondary Education.
2. All teachers received the same professional development on instructional practices as prescribed by District X.
3. All teachers designated as FLiP instructors delivered instruction in a one-to-one environment.
4. Teachers administered the MAP assessments in a standardized manner.
5. State personnel scored the MAP assessments in a standardized manner.
6. Handling of the materials for the MAP assessments was performed in an ethical and legal manner, following state guidelines.
7. Students put forth their best effort on all assessments.

Research Questions

Lunenburg and Irby (2008) called the research questions the "directional beam for the study" (p. 126). The focus of the study was the relationship between MAP scores and

the one-to-one laptop initiative in District X. The following research questions (RQ) were addressed in this study:

RQ1. To what extent is there a difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year?

RQ2. To what extent is the difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one of the following variables: student gender, race, or SES?

RQ3. To what extent is there a difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one initiative and students who did not participate in the initiative during the 2012-2013 school year?

RQ4. To what extent is the difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one of the following variables: student gender, race, or SES?

RQ5. To what extent is there a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one

laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

RQ6. To what extent is the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by one of the following variables: student gender, race, or SES?

RQ7. To what extent is there a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

RQ8. To what extent is the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by one of the following variables: student gender, race, or SES?

Definition of Terms

Per Lunenburg and Irby (2008), key terms should be defined that are central to the study and used throughout the dissertation. The following definitions are used in this study:

English Language Arts (ELA) Missouri Assessment Program (MAP). The MAP ELA assessments test students' "progress toward mastery of the Missouri Show-Me Standards regarding language arts" (DESE, 2014, p. 7).

Flipped instruction. Flipped instruction has multiple meanings; however, for the purposes of this study it describes the students receiving their instruction at home, normally with technology, and doing their work at school in some form. Enfield (2013) explained that a flipped classroom "involves providing instructional resources for students to use outside of class so that class time is freed up for other instructional activities" (p. 14).

Mathematics Missouri Assessment Program (MAP). The MAP mathematics assessment test students' "progress toward mastery of the Missouri Show-Me Standards regarding mathematics" (DESE, 2014, p. 7).

One-to-one initiative. One-to-one has multiple meanings; however, for the purposes of this study, it describes a situation where each student in a specific environment possesses an electronic device provided by the school for instruction. Jackson (2004) described one-to-one as "putting a computer – a PC, laptop, handheld, or tablet PC – into the hands of every student" (para.1).

Organization of the Study

This study is arranged in five chapters. Chapter one included the introduction, background of the study, statement of the problem, the purpose of the study, the significance of the study, delimitations, assumptions, research questions, definitions of terms, and the organization of the study. Chapter two contains a review of the literature, which includes a historical review of the utilization of digital devices in classrooms, the

evolution of one-to-one classroom initiatives, preparation of students for the future through one-to-one, and the relationship between technology use and student achievement. In chapter three the research design methodology used in this study, the selection of participants, the measurement, data collection, data analysis and hypothesis testing, and the limitations are described. Chapter four includes the results of the data analysis. Presented in chapter five are a summary of the study, discussion of the findings related to the literature, and the conclusions.

Chapter Two

Review of the Literature

The research on one-to-one computer instruction has produced conflicting results. In 1960, Toffler (1970) purported "information overload was a psychological disorder in which a person has difficulty understanding an issue and making decisions because they have too much information" (p. 8). Toffler (1970) wrote, "When the individual is plunged into a fast and irregularly changing situation, or a novelty-loaded context … his predictive accuracy plummets. He can no longer make the reasonably correct assessments on which rational behavior is dependent" (p. 25). The American Psychological Association (2010) proposed that the vast number of visual images now available, coupled with an increase of informational texts has even caused an increase in the average I.Q. The Internet and the growth of the consumption of information have created less utilitarian minds; people have become interested in hypotheticals, classifying things together, and have "donned scientific spectacles" (Winerman, 2013, p. 28).

The increase in information and change in our general way of thinking has also affected the educational system; in the past one hundred years, the school day and school year have increased. Cuban and Tyack (1995) explained that in 1900, "the average American school year consisted of 99 days, but only half of the school-age population was enrolled" (p. 21). In 2000, enrollment in grades 9-12 was 94% of eligible students (United States Department of Education, 2005). In addition to the increased length of the school day, teachers have changed their method of lesson delivery, and learning for students has become more collaborative. Barron and Darling-Hammond (2008) conducted research on learning and found that new academic approaches, "including

implementing inquiry-based learning and technology help prepare students for life in the 21st century" (p. 22). In addition to these forms of technology implementation, some districts have begun to promote teachers "flipping" their instruction. Enfield (2013) described flipped instruction as a mode of instruction where students work on their standards in class and receive direct instruction through a digital device outside of class. One example of a resource for flipped instruction is an electronic device such as a laptop.

Chapter two includes a review of the literature. This review includes a historical review of the utilization of digital devices in classrooms, the evolution of one-to-one classroom initiatives, preparation of students for the future through one-to-one, and the relationship between technology use and student achievement. These topics are reviewed as they relate to the purpose of the study and the research questions stated in chapter one.

History of Digital Devices in the Classroom

Looking back into the history of digital devices in the classroom, Dunn (2011) purported the "magic lantern" was probably the first regularly used device in the classroom" (para. 6). The "magic lantern" projected images that were printed on glass plates; educators then showed these images to students. "By the end of World War I, these devices were common throughout urban school districts; the Chicago Public School District had almost 8,000 "magic lanterns" in use" (Dunn, 2011, para. 6). Today, when digital devices in the classroom are mentioned, many different devices may be included. With the implementation of several statewide "and district-wide large-scale one-to-one computing projects in the first few years of the 21st century and the rapid expansion in the following years, there has been a considerable increase in the number of one-to-one" computing evaluation and research studies (Lei, Conway, & Zhao, 2007). However,

research in this field has not been able to keep up with its rapid development and expansion (Penuel, 2006).

The Apple I was the first computer used in a school setting. Hill (2014) reported that it was built by Steve Wozniak, as a gift to computer club sponsor Liz Loop in 1976 (para. 11). The next major milestone for digital devices in education occurred in the 1980s and 1990s when desktop computers began to appear in classrooms throughout the country. During this time, national teacher technology support groups were developed. According to Thompson (2013), "this group collaboration and teamwork among teachers led to the regular use of digital devices in classrooms" (p. 109). The United States Federal Government supported the continued growth of this educational technology use with published reports, beginning in 1995, which highlighted the "importance of a solid technology-based educational foundation" (Thompson, 2013, p. 109). An extension of this was shown by Attewell and Battle (1999) who reported that the growth of computer use in the classrooms "raised concerns that students who did not have computers or computer access at home may become disadvantaged" (p. 1). Concerns about computer access were addressed and debated, but they did not prevent the spread of digital device use in classrooms.

When they had the room and money "to buy a large number of computers, many schools throughout the 1980s and early 1990s placed them in centrally" located places in their buildings and repurposed the space (Means, Olson, & Ruskus, 1995). "Computer use in labs has been found to be effective at least over the short term" (Kulik, 1994, p. 6), but researchers have long lobbied and argued that for technology to make a powerful difference in student learning, "students must be able to use computers more than once or

twice a week in a lab at school" (Kozma, 1991 p. 3). Limited access has been cited as a "reason why teachers make limited use of technology with students" (Adelman & Taylor, 2002, p. 240). Teachers reported that when computers are in labs, "they use technology less often for instruction because of the difficulty of scheduling time in the lab and transporting students there" (Penuel, 2006 p. 7).

In 2000, Maine used unexpected funds to launch a statewide one-to-one program, which started with over 17,000 seventh grade students in 243 schools around the state. Silvernail and Lane (2004) reported on the early impact of the first 14 months of the program. They did not include student achievement in this report; however, they did indicate that the growing use of the laptops did have favorable outcomes such as:

> Teachers and students alike report improvements in the quality of students' work, the students learn more, and that students increase their understanding of what they are learning. Students of all types are more motivated to learn, and more engaged in the learning process. And interaction about learning and content between teachers and students, and students with other students has increased substantially. (Silvernail & Lane, 2004, p. 31)

These types of outcomes helped promote the use of technology, one-to-one programs, and other changes in education.

During the computer era, education has been re-conceptualized around the "construction of knowledge through information processing, modeling, and interaction" (Sharples, Taylor, & Vavoula, 2005, p. 87). Bergmann and Sams (2012) wrote that the one-to-one initiative has not only changed the delivery of the material, "it has changed the aesthetic look and feel of the classroom. One-to-one tablet implementation has called

for teachers to become facilitators, instead of lecturing in front of rows of students" (p. 11). Increased student collaboration with technology, in turn, has "led to physical rearrangement of the classroom" (Bergmann & Sams, 2012, p. 12). Niemeyer (2013) wrote that interviews at MIT revealed that faculty and students had a strong interest in warmer, more intimate, and more attractive classroom spaces that promote healthy student exchanges.

An unexpected outcome of the one-to-one initiative was the support that has been provided to special education students. In the past, education was dominated by reading directly from a textbook, which proved difficult for students with language deficiencies, students with dyslexia, or students with hyperactivity disorders. However, assistive technology (AT) made continually available with the one-to-one initiative, has provided support in new ways. In Florida public schools, McKay (2005) found that students with more subtle disabilities under IDEA or Section 504 of the Rehabilitation Act "could be significantly helped through the use of AT solutions" (p. 22). In recent studies, students with dyslexia were able to "analyze blurry images and read faster on hand-held devices" (Johnson, 2014, p. 12).

Response to Intervention (RTI), is a way to provide all students with the highest level of instruction as a means of improving achievement. Rose and Meyer (2002) found that implementing daily technology, "which supports multiple means of knowledge representation, engagement, and expression of understanding, could help achieve RTI goals" (p. 3). The RTI Movement, which was conceptualized in the Individuals with Disabilities Education Act of 2004 (IDEA), "provides more intensive and structured interventions to ensure that students attain success both academically and behaviorally,

and the framework moves away from allowing students to continually fail before intervention is implemented" (Basham, Israel, Graden, Poth, & Winston, 2010, p. 243).

Peterson and Wilson (2006) stated, "Students need opportunities to learn in multiple ways, and teachers need to have a pedagogical repertoire that draws from myriad learning theories" (p. 4). Also, researchers reported that in sixth grade classrooms with one-to-one experience a "decrease in negative student behaviors and a decrease in behavior" referrals (Harless & Harthun-Reed, 2005, p. 6). Researchers in five different middle schools across Massachusetts found that when the one-to-one initiative is implemented, "positive student benefits have been noted regardless of, which devices are used" (Bebell & Kay, 2010, p. 13). They went on further to state that "students have experienced increases in lesson engagement and overall achievement" (Bebell & Kay, 2010, p. 2).

One of the variables that contributes to one-to-one programs producing varying results is the effectiveness of computer use at home. Community members are concerned that many students go home with their computers, but they do not have internet access at home to help support their learning putting them at a disadvantage to those students who have internet access at home (Kerawalla & Crook, 2002). Schools struggle with providing wireless service at home for students who are provided computers but do not have network access. Children spend most of their time playing games that are not typically found in classrooms (Kerawalla & Crook, 2002). Most students who do have internet access at home use their computers for unsupervised recreational purposes and need a parent or guardian to ensure a positive educational impact (Lauman, 2000).

Evolution of One-to-One Computers in Schools

Uninterrupted internet access is the precursor to one-to-one, and in recent years, most school districts have made internet access as common as traditional classroom supplies. Walderman (2014) stated, "the Internet has become ubiquitous in classrooms across the nation; almost 100 percent of public schools had access in 2005, up from a mere 35 percent in 1994" (para. 5). Teacher input and training are also vital aspects of the one-to-one initiative. Costley (2014) reported in a study conducted in an Arizona school district "Findings showed that students were engaged during the math lessons using technology and students were able to discuss what they learned the following day" (p. 5). DeNisco (2013), who has conducted research in school districts across the United States reported that teachers have anxiety about technology because it is "something different and in some cases, the implementation of technology means giving up control to kids" (p. 1).

Russell, Bebell, and Higgins (2004) conducted a study comparing one-to-one classrooms to classrooms where the devices were shared among students from a cart of laptops. This study was conducted in Andover, Massachusetts from 2000 to 2003 in fourth and fifth grade classrooms. Included in the study were 209 students in nine different classrooms. There was no research conducted on the effect of the technology on student achievement; however, they did report differences in the classrooms based on the ratio of students to laptop computers. For example, they reported that:

> The analyses provide evidence that when full versus shared access to laptops is provided, technology use for a variety of academic purposes increases significantly. In addition, student engagement increases, the amount of time

> students spend writing increases, and classroom interactions between students and teachers change. (Russell et al., 2004, p. 14)

The researchers included information on the differences in instructional practices from the different classrooms. They reported that "teaching and learning activities differed substantially in classrooms that are permanently equipped with technology at a 1:1 ratio" (Russell et al., 2004, p. 14). Dunleavy and Heinecke (2007) supported this when they reported that "laptop students experienced an increase in individualized learning, as the laptops allowed teachers to differentiate instruction, individualize pacing, and provide timely feedback" (p. 17).

The one-to-one initiative is another recent academic approach that has seen implementation in schools across many industrial countries. Guss (2015) reported that a teacher in Australia "implemented an early one-to-one initiative with secondary students in 1989" (p. 1). Guss (2015) reported that in the class trial, computers were given to all students for one school year; twenty-five years later, the school is a true one-to-one example, with every student being issued a computer. "In United States classrooms several one-to-one initiatives were launched in the late 1990s, led by Illinois, Connecticut, Texas, New Mexico, and California" (Lambert, 2014, p. 4). The first statewide one-to-one initiative was launched in Maine in 2001 and cost approximately $120 million. Silvernail (2007) found that after six years into a statewide one-to-one program, "the Maine Education Policy Research Institute found that more than 80% of teachers thought that (one-to-one) laptops helped them diversify and individualize curriculum and instruction" (p. 3).

Of all the steps in the 1:1 implementation process, parent and community resistance can be tough to overcome. Loader reported "pushback from parents in those early years was remembered" (as cited in Guss, 2015, p. 3). Although parent pushback has become less of a problem for this initiative as years have passed, community pushback has become another roadblock in its implementation. The failure of levies and bonds that increase technology funding through the increased local tax payments has impeded the development of one-to-one in districts throughout the United States. In New Albany-Plain School District in Ohio in 2014, "voters defeated a levy that would have brought wireless technology upgrades" (Bush & Zachariah, 2014, para. 2). In 2014, District X voters defeated a levy that would have "funded a one-to-one initiative for district secondary students "(District X, 2014, para. 8). Along with parent and community pushback to the increased technology education, Heller (2014) argued that there could well be an eternal juxtaposition between educational reformers and current educators—this often stops research-based initiatives or changes that focus on technology.

Public organizations such as public schools move slow, there are many people involved, and it normally ends with a public vote. (Heller, 2014). Keough's (2006) research focused on the "proven educational methods that must accompany technology integration for true success" (p. 2). The struggle in this process is to make decisions and implementations with prudence while keeping up with technology and best practices (Keough, 2005). Heller (2014) reinforced this reality in stating that "this is the hell of regulatory blockades and referenda and open meetings to which crazy people come to read bizarre complaints off crumpled notebook paper" (para. 11).

Since the early 2000s, educational testing has played an ever-increasing role, as school districts and their individual schools have been evaluated on student performance on standardized tests. According to Fullan and Levin (2009), "the majority of school leaders throughout the United States contended that the one-to-one initiative enhances student learning" (p. 56). O'Malley, Lewis, and Donehower (2013) conducted a meta-analysis of iPads used as math learning tools with students on the autism spectrum. In this study, the researchers reported that new technology that makes one-to-one access possible "has enormous educational implications because it makes learning portable, mobile, and accessible" (O'Malley et al., 2013, p. 3). School districts have adopted the unlimited use of laptops expecting that acquiring full-time access to technology would improve academic performance and raise standardized test scores (Lambert, 2014).

According to Tomlinson (2005), "differentiated instruction is based on the premise that instruction should be adapted to the students' different learning styles, interests, and ability levels" (p. 4). Tomlinson (2005) went on to summarize that "teachers who use differentiated instruction are expected to show flexibility in the ways they teach their students and organize their curriculum" (p. 4). Tomlinson (2005) later found that "in a classroom where differentiated instruction is the foundation of instructional decisions, teachers adapt their instructional activities and selection of materials to each student's linguistic and cultural background, academic ability, interests, and learning style" (p. 5).

Increased student interaction is a goal that many educators strive for through technology; this is not the only way to personalize instruction. This technology can be easily implemented in a one-to-one program. Garner et al., (2004) reported in a study

involving K-12 special education students that "technology tools such as speech recognition, verbal feedback, and word prediction could make learning accessible, allowing students and teachers more opportunities to communicate, conduct investigations, and develop products" (p. 4).

For example, Bentley (2008) reported from a study sampling middle school science students that "learning technology such as probes, modeling tools, and visualization software can extend students learning" (p. 4). In an Ohio district, "teachers used differentiated instruction in the classroom by prescribing technology-supported cooperation, which enhanced student achievement" (Cobb, 2010, p. 5). In a study with 8th graders in Cleveland public schools, Cobb (2010) stated that "most important, significant increases occurred in student achievement for students in the treatment group who used Internet-based software that differentiated instruction based on student needs and targeted learning outcomes" (p. 9).

Argueta, Huff, Tingen, and Corn (2011) reported on a meta-analysis from research conducted in six states that included over 300 school districts and students enrolled in kindergarten through twelfth grade. Their findings included suggestions for successful one-to-one program implementations. They reported, "Effective leadership is fundamental for the successful implementation and sustainability of the initiative, as are thorough planning, initial and ongoing targeted professional development, buy-in from all stakeholders, and a robust infrastructure" (Argueta et al., 2011, p. 15). These findings suggest a dedication of resources from district funds that are in high demand.

The learning curve for school districts that implement the one-to-one initiative is steep, as it is accompanied by many logistical issues that school officials must learn to

manage. Tusch (2012) wrote that a building principal indicated, "The biggest surprise came when the insurance provider informed us that we had exceeded their allowable threshold for repair costs, and our coverage was being dropped" (p. 42).

Some schools that have implemented one-to-one initiatives have taken learning with technology a step further by "flipping" their classrooms. Smith (2012) stated that since 2012, "30% more K-12 classrooms have adopted the flipped teaching approach, although middle school and high school teachers are the most likely to use the flipped classroom technique" (p. 2). Flipping instruction swaps homework time with direct instruction, meaning students first watch instruction about a topic outside of school before continuing learning in class (Smith, 2012). Flipping a classroom has been found to help some schools reduce their failure rates and give teachers more time with students (Schencker, 2014). Bergmann and Sams (2012) found that in biology classrooms "because flipping the classroom results in a time shift of direct instruction, students experience higher levels of achievements and are more engaged than in traditional classroom settings" (p. 15). The flipped learning model is gaining the attention of educators who recognize the need to improving student achievement and teacher effectiveness by leveraging to promote creative learning (Meyer, 2013).

Bruner (1996) theorized that "student learning in technology-centered classrooms was more likely the result of the constructivist approach to education that these classroom teachers likely use" (p. 31). Meyer (2013) supported this in a collaborative report between Project Tomorrow and The Flipped Learning Network, which included data from 403,000 public schools. Meyer (2013) argued that "the one-to-one initiative, along with accompanied flipped instruction, does not produce higher learning outcomes; rather,

active student engagement is the key to increased student achievement and learning" (p.1).

The one-to-one initiative has been implemented in various ways. O'Malley et al. (2013) reported on a one-to-one program in math "where students were only given iPads with pre-loaded math apps" (p. 8). In general, the one-to-one initiative is executed in one of two ways: the laptop model or the tablet model, such as a Chromebook or iPad. "In 2013, the Los Angeles Unified School District issued iPads to 2,100 students, but recalled them the next year and gave schools the choice from among six different devices to support their one-to-one initiative" (Murphy, 2013, para. 7). Guss (2015) reported that "the youngest students were provided iPads, older elementary students were provided notebook computers that were used at school only, and secondary students were provided with laptops that could be used at school or home" (p. 2).

School districts have many options when considering how to implement a one-to-one initiative. In addition to laptop and tablet options, desktop computers can be converted to tablets with a digitizer pen where students can jot notes, draw diagrams, and flip and erase using a pencil with "palm-rejection technology that prevents hands from interfering with writing" (Camilleri, Malige, Fujimoto, & Rempel, 2013, p. 1858). Some of these devices have an enhanced finger-touch sensitivity on multi-touch screens that allows students to complete applications and forms quickly. One of the reasons it is difficult to isolate specific success of an implementation plan is that the available technology is consistently changing. Furthermore, "as educational technology continues to evolve, our notion of concepts like 1:1 computing will undoubtedly also evolve"

(Bebell & O'Dwyer, 2010, p. 13). Researchers are interested in why some studies have positive results from a one-to-one initiative and some studies do not (Sutton, 2015).

Professional development of the staff is often referenced and studied in literature as an important aspect of a one-to-one initiative in schools. Bebell and O'Dwyer (2010) in a meta-analysis of studies related to one-to-one initiatives in secondary public schools found that "professional development is not only essential but that it should not also just focus on new instructional skills; instead, it should address teacher beliefs about instruction itself" (p. 12).

> Professional development is a key in one-to-one rollouts. Almost 93% of teachers in a statewide Maine study believe that technology has a positive effect on students' engagement, but 46% say they lack the training needed to use technology effectively with students. (DeNisco, 2013, p. 1)

Supporting this finding, Sutton (2015) found that professional development, and more importantly, how it is approached when implementing one-to-one, had the largest impact on student learning.

Preparing Students for the Future through One-to-One

Preparing and educating students for future jobs is a daunting task that today's educators face. Along with this task, many educators disagree on exactly how students should be taught. One-to-one initiatives have encouraged discussions related to how to facilitate deep learning instead of encouraging memorization (Towler, 2014).

With this available technology in the classroom, it is easier for teachers to understand that a sense of meaning is what separates memorization from learning. Rockman (2007) found that students were more engaged and had better attendance when

attending a school with one-to-one laptops. Researchers reported that in addition to gaining technology skills, one-to-one initiatives improve a student's ability to effectively research and share their learning (Harris 2010). Orlin (2013) stated, "When you memorize a fact, it's arbitrary, interchangeable – it makes no difference to you whether sine of $\pi/2$ is one, zero, or a million, but when you learn a fact, it could be no other way" (p. 3).

Along with changes in teaching practices, the growth in technology has changed the skills students need to be successful in the workforce. Sharples et al. (2005) found while conducting research on adult learning that when successfully implemented and executed, the one-to-one initiative could support these needed changes and skills. In classrooms where mobile learning is readily accessible, "the control and management of learning is distributed across learners, guides, teachers, technologies, and resources in the world" (Sharples et al., 2005, p. 4). Researchers found that 21st-century skills have changed the expectations for a school district to provide every student an education that gets them ready for college and careers (Barron & Darling-Hammond, 2008). The benefit of a one-to-one laptop environment is reinforced by researchers who report that "standardized tests are not an ideal metric for evaluating student learning, as these tests fail to assess the skills and competencies students learn during participation in one-to-one student laptop programs" (Grimes & Warschauer, 2008, p. 14). Successful educators find themselves teaching students for unknown careers in the future. For example, "the top 10 "in demand" jobs projected for 2010 did not exist in 2004" (United States Department of Labor, 2010, p.11).

To be college and career ready, students must be proficient in mobile technologies and be adept at using these technologies to do critical thinking, problem solving, collaboration, and multimedia research and sharing. Researchers reported that Northern Virginia seventh graders who were not involved in one-to-one initiatives or did not have internet access at home might lack the skills they needed to be employable (Attewell & Battle, 1999). Penuel (2006) found in a meta-analysis of the effects of one-to-one computing iniatives that

> To ensure students are ready for a post-secondary career or college classes, which includes equitable access to quality learning tools and technologies that enable students to learn in relevant, real world contexts, many schools are turning to one-to-one computing initiatives as a solution. (p. 8)

Vockley (2007) reported that employers have begun to expect their applicants will come to them with the technology skills they need in the workplace. With the one-to-one initiative, students have access to unlimited technological resources and information throughout the school day; educators must direct the usage of this technology so that students will benefit and truly become college and career ready.

Once one-to-one has become a reality in the classroom, neither curriculum nor pedagogy need to be completely revamped. According to Nagel (2013), "implementing subtle, technology-based changes to homework resulted in improvements in student performance on tests" (p. 1). Independent of the technology that is used in a one-to-one classroom, teachers need to focus on giving quick responsive feedback on assignment and students opportunities to practice researching and applying knowledge (Nagel, 2013)

Implementing technology into a classroom does not mean that technology becomes a teacher. Battle (1999) found that "students gain less from home computers since very little educational computing is going on inside the home" (p. 6). The lack of effective support at home helps demonstrate the importance of effectively implementing deeper thinking lessons incorporating technology into the classroom. Nagel (2013) also reported that "because one-to-one initiatives often required teachers to use experimental teaching approaches into their students' daily activities" (p. 2), daily lessons may take on a different approach and feel. Although this shift may make some teachers feel uncomfortable, "these new approaches are generally more student-centered, and the approaches allow students to take control of how they engage with a subject and implement solutions" (Nagel, 2013, p. 2). Mastering the skills of engaging with a subject and implementing solutions is an imperative skill for students, especially those who are educationally disadvantaged or those from a low socio-economic background.

A handful of large-scale studies support the effects of technology implementation in schools, specifically the implementation of the one-to-one initiative. For example, The One-to-One Institute (2010), "a research initiative linked closely with the one-to-one institute, which supports one-to-one laptop initiatives in K-12 schools, released a study about successful implementation models of education technology in October 2010" (para. 2). The One-to-One Institute (2010) reported, "most of the schools that have integrated laptops and other digital tools into learning are not maximizing those devices in ways that best make use of their potential" (para. 4). The report goes on to outline the critical steps needed to capitalize on that potential.

However, many researchers do agree that learning through digital devices is a key component in a student's success and productivity as an adult. In a paper presented to the MLearn organization in the United Kingdom, Sharples et al. (2005) reported that there was a strong need to rethink the future of one-to-one learning because as adults our students will need to interact and learn from digital devices in their careers and personal lives. The culture of the learning environment was revealed as technical in nature. Harris (2010) reported in a study on student outcomes with laptops in California that "outside of core curriculum learning, students also developed skills in technology usage, data processing and representation, and higher order thinking" (p. 56).

However, not all researchers found evidence that one-to-one initiatives promoted the development of college and career readiness. Staib (2011) conducted a study on student outcomes with laptops in an elementary and middle school in New York. Staib (2011) found that sixth grade students were not expected to learn in an environment that was relevant to the real world. Staib (2011) also found that "students were not engaged in the type of inquiry, collaboration, and public sharing that would be indicative of a Web 2.0 mode of instruction and student centered work" (p. 99).

Argueta et al. (2011) conducted a study analyzing major one-to-one initiatives in in over 300 school districts in six different states including, Florida, North Carolina, Michigan, Pennsylvania, Texas, and Virginia. The results of this study indicated findings related to student outcomes including an increase in attendance, motivation, engagement, and an overall decrease in discipline (Argueta et al., 2011). The results also supported the use of technology in classrooms to help students prepare for the future. "Researchers also report that laptops have facilitated the development of 21st-century skills, digital

literacy, creativity and innovation skills, critical thinking and problem-solving skills, communication and collaboration, and self- directed learning) among students" (Argueta et al., 2011, p. 15).

The findings of Argueta et al. (2011) have been supported by other researchers. Staib (2011) reported that "sixth grade students in a one-to-one initiative were engaged in activities that reflected 21st "century learning using laptops; however, they did not use the laptops in a modern manner" (p. 100). The current Common Core State Standards encourage college and career readiness through rigorous academic expectations for all students (O'Malley et al., 2013). One of the barriers to the benefits of a one-to-one initiative was reported by Bolkan (2014) who polled 620 K-12 U.S. educators was that "53% of educators said enough of their students lack internet access at home that they do not use technology as much as they'd like in the classroom" (p. 2). Accessibility to network services is an obstacle to a student's ability to access their curriculum through digital devices.

Student Achievement in a One-to-One Setting

Since the early 2000s, educational testing has played an increased role measuring learning in classrooms as school districts and their individual schools have been evaluated on student performance on standardized tests. According to Fullan and Levin (2009), most school leaders throughout the United States contended that the one-to-one initiative enhanced student learning. However, a wealth of discussion regarding the value and impact of one-to-one initiatives on student academic achievement exists. There is much more to the success of a one-to-one initiative than simply providing the infrastructure and a device to each student. (Lemke, Coughlin, & Reifsneider, 2009).

Included in this section is a discussion of student achievement in a one-to-one setting; it is divided into two parts. The first part focuses on evidence that does not support student achievement in a one-to-one setting. The second part focuses on evidence that does support student achievement in a one to one setting.

Evidence that does not support student achievement in a one-to-one setting. Academic achievement with technology has been researched for many years. Jacklin and Maccoby (1974) concluded in a study of California public schools through Stanford University that "there were gender differences in math ability that favored males" as measured by teacher created tests (p. 13). Researchers have found a wide range of results regarding mathematics achievement, ELA achievement, SES, race, gender, and one-to-one initiatives. Some of the research has reported improved student achievement; however, results are mixed and inconsistent.

Attewell and Battle (1999) collected data from the National Educational Longitudinal Study (NELS) to determine whether eighth grade students with computer use in the classrooms and at home improved their academic achievement on mathematics and reading local assessments compared to students without computer access regardless of gender, SES, or race. The researchers reported that the less financially stable a student home environment was, the less impact a one-to-one initiative had on their academic success (Attewell & Battle, 1999). Educators have raised concerns about the potential for a one-to-one initiative to widen the achievement gap between social classes. Attewell and Battle (1999) indicated in their study conducted with 18,000 eighth grade students from Pennsylvania, "The concern is that students who live in conditions without the

means to pay for internet access will fall farther behind those students that can afford internet access" (p. 1).

Similar student achievement results have been reported in other studies. Lewis (2004) reported that sixth grade Florida students in a one-to-one initiative "did not make significant academic achievement in reading or math on district level assessments when compared to students that were not in a one-to-one initiative" (p. 2). In another study, Dunleavy and Heinecke (2007) found that mid-Atlantic state middle school students in a one-to-one initiative "demonstrated no significant program effects for math achievement" on state standardized tests when compared to students that were not a part of the one-to-one initiative (p. 1). Dunleavy and Heinecke (2007) reported in their study of 972 at-risk middle school science and math students, that "there was a clear gender effect in science between girls and boys in a one-to-one initiative with boys significantly outperforming girls in academic achievement in science as measured by the state standardized test" (p. 9).

Some of the results of the one-to-one studies have shown mixed or minimal results in academic improvement. In a comprehensive study of the effects of a one-to-one initiative, researchers found that there was no significant impact on any student test score from the implementation of a one-to-one program (O'Dwyer, Russell, Bebell, and Seeley, 2008). This finding was based on student achievement in mathematics on the Massachusetts Comprehensive Assessment System. They studied 986 students from 55 fourth grade classrooms in 25 schools across nine school districts in the state Massachusetts. In California, Grimes and Warschauer (2008) found similar results when they reported that "high school students in a one-to-one laptop environment experienced

minimal increase in math scores and decreased English/Language Arts scores on California state assessments" (p. 308).

The research regarding effects of student gender on academic achievement has been conflicting. Chiu, Chow & McBride-Chang (2007) found that sixth grade girls outscored sixth grade males in reading achievement. A study focused on reading achievement reaped different results. Wade (2010) found that California suburban high schools' students demonstrated no statically significant difference between girls and boys in a one-to-one initiative when compared to the grade point average of students that were not in a one-to-one initiative (p. 26). These two studies were, however, measuring students at different grade levels and using different measurements for academic success.

Researchers have reported supporting results on the lack of student achievement in ELA in a one-to-one environment. In a study that included more than 1,000 Virginian elementary students, Bryan (2011) reported that no significant gains were made in reading fluency by students in a one-to-one environment as measured by the Reading Curriculum-Based Measurement. Walters (2012) reported that fourth and fifth grade students "produced little to no difference in language arts achievement on the California Standards Reading Test between students in a one-to-one laptop environment and students not in a one-to-one laptop environment" (p. 140). Also, Walters (2012) found that there was little to moderate effect on Hispanic ELL students from Southern California on California Standards Reading Test in response to a one-to-one initiative.

Research has been conducted on the effect of one-to-one on student achievement related to gender. Dennis (2014) reported in a meta-analysis including over 19,000 North Carolina high schools that "students in one-to-one high schools did not benefit from one-

to-one laptop initiatives in Algebra I and English I courses" (p. 75). Dennis (2014) found that the co-variables in this study of SES, gender, and ethnicity were not predictors of the effect on these students being in a one-to-one initiative (p. 75).

Kulow (2014) found that "elementary students in a one-to-one initiative using Chromebooks made gains on teacher created unit assessments that were equal to or not significantly different from elementary students that were not in a one-to-one initiative" (p. 108). Later, Clark (2015) reported that there was "no significant difference in mathematical performance on teacher created unit tests" (p. 62) in 42 Texas Algebra high school students before and after the implementation of a one-to-one program. These findings could be used as evidence against implementing or expanding one-to-one programs.

Evidence that does support student achievement in a one-to-one setting. Many schools have implemented successful one-to-one programs. These examples are strong statements related to the potential of digital devices in the classroom in the face of mixed results. Many researchers have reported positive results on student achievement. Attewell and Battle (1999) conducted research in elementary classrooms in New York City that produced positive results on student achievement in schools with 94% or more of the students qualifying for free or reduced lunch. This study on educational equity and the impact of digital devices provided more information on the impact of one-to-one and low SES students. The researchers found that "the higher a student's SES the larger the educational payoff was present from having been a part of a one-to-one initiative" (Attewell & Battle, 1999, p. 6). Additionally, Owston and Wideman (2001), in a study that was conducted with middle school students in California school districts, "found that

students in a one-to-one laptop environment scored higher and showed a greater amount of improvement on the writing subtest of the California Test of Basic Skills than did non-laptop students" (p. 439).

As mathematics teachers have been working to improve student learning, incorporating powerful handheld 1:1 technologies with game-based learning applications like the iPad might be used to "guide students to exploration, discovery, practice, appreciation, and wonder," which may lead to increased achievement (Goddard, 2002, p. 26). The use of laptops as a one-to-one device has been found to improve student learning as measured by standardized tests in mathematics and writing and increase student motivation as well as student collaboration (Mouza, 2008). Some of the research conducted on the use of one-to-one as a learning environment has reported positive student attitudes towards their learning. Russell et al., (2004) reported, "Students in the 1:1 classrooms viewed laptop computers as their primary writing tool" (p. 322). The researchers also reported that students experienced "nearly universal use of technology for writing" (p. 313).

Similar studies reported positive results specifically related to student achievement. Gulek and Demirtas (2005) conducted a study in Harvest Park Middle School in California. They compared 259 sixth, seventh, and eighth grade students in a one-to-one environment to 834 students not in a one-to-one environment. Their results "indicate that laptop enrollment has a significant effect on mathematics and language scores (Gulek and Demirtas, 2005, p. 21). These results were based on student grade point averages and performance on California standardized state assessments. "Numerous academic studies have shown the significant positive correlation between

technology, student learning, and mathematics achievement" (Berk, 2010, p. 2). In a Texas school district, high school students use of laptops for learning was the strongest indicator of academic improvement on reading and mathematics test scores (Bebell & O'Dwyer, 2010). Additional studies were conducted that reinforced these results.

Researchers have reported positive findings with low SES students. Harris (2010) reported that "for the most part, the literature has failed to take into account the influence of the material conditions of low SES students and the presence or lack of entry skills and behaviors" (p. 64). Harris's study, conducted in Chavez high school in Southern California, was conducted to compare low SES students to high SES students in a one-to-one laptop environment. Harris (2010) concluded that "laptops affected low SES students in the areas of academic and non-academic learning to a higher degree than their non-low SES peers" (p. 165). This study focused on the potential of one-to-one to minimize the achievement gap between students divided by social class.

Some specific content areas appear to researchers as being more difficult for teachers to implement technology than are other areas. Bebell and O'Dwyer (2010) found in a study of one-to-one Texas classrooms that "technology was used somewhat less frequently for math and science than for English language arts and social studies" (p. 8). Other content areas with strong web-based curricular ties, such as journalism or Project Lead the Way (PLTW), promote the use of computers in the classrooms. However, researchers have reported favorable results when this technology is pushed into a classroom. Mills (2010) found in rural Minnesota high schools that "there was an increase of student achievement by students participating in one-to-one laptop programs"

(p. 104). These findings were based on "high school student performance on state comprehensive exams and cumulative grade point averages" (Mills, 2010, p. 102).

One-to-one initiatives have reported favorable results on standardized assessments. Sixth through eighth grade students in 21 different schools participating in the second year of a one-to-one program produced statistically significant gains on ELA state assessment scores compared to those students that were not in one-to-one the previous year on the same test (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010). Argueta et al. (2011) conducted research spanning over six states and more than 300 school districts. They found "that using laptops in the writing process had a long-term positive effect on students' writing skills, helping them become better writers in general, and not just helping them write better when they used the laptops" (Argueta et al., 2011, p. 8). These researchers continued that "teachers and students in some implementing states believe that the use of laptops positively impacts student achievement, but only some analyses of test scores support this belief" (p. 8). This research related to student ELA academic achievement was supported by research conducted in Taiwan. Huang, Liang, & Chiu, (2013) found the 23 sixth grade Taiwanese students in their study who used electronic devices in a one-to-one environment for reading "made a significant improvement in their reading comprehension" as measured by standardized assessments (p. 105).

Similar results were reported in studies conducted with students of varying grade levels. Brummel, Greer, Jackson, and Pollet (2013) conducted a study in 53 New York elementary schools measuring the effect of Computer Supported Collaborative Learning (CSCL).) Statistically significant academic gains were found in these elementary

students using CSCL in mathematics as measured by CSCL assessments (Brummel et al., 2013). The researcher reported that "girls outperformed boys in a one-to-one initiative for mathematics" (Brummel et al., p. 101). Gender differences were also demonstrated in Cottone's (2013) study where fourth, fifth, and sixth grade girls "outperformed boy's academic achievement in math and reading in a one-to-one initiative" (p. 2). In addition, the researcher found that lower SES students in fourth, fifth, and sixth, grade classes in a one-to-one initiate produced academic gains in math and reading when compared to high SES students in the same one-to-one initiative" (Cottone, 2013, p. 2). These findings are encouraging for educators looking for ways to help students in low SES situations. Cottone (2013) found that in general, these Mooresville North Carolina fourth, fifth, and sixth grade students in the one-to-one study made significant gains in math but not in reading academic achievement when measured by state assessments. Additionally, Cottone (2013) reported that Black fourth, fifth, and sixth grade students in a one-to-one initiative made significant academic gains in math and reading.

Some researchers have reported on the benefit of increased web access through student achievement in one-to-one programs. O'Malley et al. (2013) reported new technology makes one-to-one access possible and "has enormous educational implications because it makes learning portable, mobile, and accessible" (p. 3). Furthermore, Lebo (2014) found in a student survey of 330 Iowa high schools, that "the implementation of a one-to-one laptop initiative had a positive impact on high school student's commitment to learning" (p. 70). According to Casey (2014), the effect of computer usage in classrooms on the academic achievement of non-White students has had a narrow margin of difference. With the implementation of one-to-one iPads, the

Charleston County School District reported gains in reading among fifth and eighth grade Hispanic students and those who speak English as a second language. The researcher also found significant math gains among Black, Hispanic, and English Language Learners (ELL). These results are encouraging to school districts with large populations of minority and ELL students.

Lambert (2014) conducted a statewide study on middle school mathematics students' results in South Carolina. To improve student success on standardized test scores, school districts have adopted the unlimited access to laptops for students (Lambert, 2014). Later, in 2015, a meta-analysis was conducted that included 40 studies worldwide investigating the effects of a computer-based environment on students' learning outcomes. The results showed that there was a positive effect on student achievement in mathematics, while there was not a significant effect on other areas such as social science, language, and science (Van der Kleij, Feskens, & Eggen, 2015).

One-to-one programs with iPads are reporting similar results to those with laptop computers. In a study with fourth grade students, Zhang, Trussell, Gallegos, and Asam (2015) reported results that showed statistically significant improvement for students in a one-to-one environment that used math applications on their iPads as measured by classroom teacher pre- and post-tests. Moreover, these researchers reported that "of the 800 students, 90% were Hispanic, students in a one-to-one environment achieved significant academic gains" on teacher-generated assessments (p. 2).

Some international studies produce the same favorable results. Warschauer and Zheng (2016) conducted a meta-analysis of 96 studies worldwide. Warschauer and Zheng (2016) found students' test scores in science, writing, mathematics, and English

language arts improved significantly. Ozerbas and Erdogan (2016) reported from a study conducted with 58 seventh grade students in Ankara, Turkey "the academic success level of the students in the experimental group, who learn mathematics in a digital classroom, is higher than the academic success of students in the control group, who learn in the classroom without any digital technologies" (p. 208). The researchers continued, "it can be interpreted that using digital classrooms is a significant factor in increasing students' academic success" (Erdogan & Ozerbas p. 208). These results are favorable for schools hoping to expand one-to-one programs for their students.

Summary

This review of the literature included the history of digital devices in the classrooms, the evolution of one-to-one computer classroom environments, preparing students for the future through one-to-one computers, and student achievement with one-to-one initiatives. The results of the research were mixed. As schools and communities evaluate their inclusion of digital devices in the classroom, it will be important for educators to monitor closely the effect these devices have on the academic achievement of the students. Chapter three includes the research design, selection of the participants, data collection procedures, data analysis and hypothesis testing, and the limitations of the study.

Chapter Three

Methods

The purpose of this study was to determine whether District X students who participated in a one-to-one laptop initiative during the 2011- 2013 school years achieved at higher levels on the MAP ELA and mathematics assessment than did students who did not participate in the one-to-one initiative and whether student gender, race, or SES affected those differences. An additional purpose was to determine whether there was a difference in MAP ELA and mathematics growth from fourth grade to fifth grade between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in this initiative and whether those differences were affected by student gender, race, or SES. Included in this chapter are the research design and the procedures used to address the research questions. The selection of participants, measurement, data collection procedures, data analyses and hypothesis testing, and limitations of this study are presented as well.

Research Design

This quantitative study utilized a quasi-experimental design. This design was chosen because, in this study, the researcher investigated the effectiveness of a one-to-one initiative when comparing groups with and without the one-to-one learning environment using archival data. The dependent variables were the MAP ELA and mathematics assessment scores for fourth grade students during the 2011-2012 school year and fifth grade students during the 2012-2013 school year. The independent variables were participation in the one-to-one program, student gender, student SES, and student race.

Selection of Participants

The population under examination was fourth and fifth grade students attending District X. The sample included those students who were enrolled in fourth grade during the 2011-2012 school year and fifth grade during the 2012-2013 school year. The sample included students who enrolled in regular education classes in mathematics and ELA for the established grades and had demographic information available for the study.

This study used a non-random purposive sampling procedure, which is defined by Lunenburg and Irby (2008) as a sample selection process utilized by the researcher based on "knowledge of the experience of the group to be sampled" (p. 175). The students must have registered a fifth grade MAP score in District X during the 2012-2013 school year to be included in the sample data that was used to address RQ1-RQ8. The students must also have registered a fourth grade MAP score in District X during the 2011-2012 school year to be included in the sample data that was used to address RQ5-RQ8.

Measurement

The instruments used in this study were the MAP ELA and mathematics assessments. Per DESE (2014), both the ELA and mathematics assessments consist of 52 questions (p. 4). The MAP assessment provides useful information regarding academic achievement and progress. The District X aligns its curriculum with the state standards, and the MAP assesses these standards.

As described in the *Spring 2009 Guide to Interpreting Results*, published by DESE (2009b), the ELA portion of the MAP is administered to all students in third through tenth grades during the spring of each school year. Three types of questions appear on the test: selected-response, constructed-response, and performance events

(DESE, 2009b). Selected-response items provide three to five possible responses for student selection. Constructed-response items require students to compose their own response to an open-ended question. Within the English language arts portion of the test, a writing performance event, or essay, is also administered (DESE, 2009b). All students must respond to a process-oriented writing prompt to demonstrate proficiency in writing (DESE, 2009b).

As indicated in the 2009 MAP technical report, the English language arts assessment includes three styles of questions: selected-response, constructed-response, and performance event. Selected-response items, also known as multiple choice, each included a question along with three to five response options. Constructed-response items require the students to provide an appropriate response with work to support the solution. DESE (2007) reported that performance events require students to use higher level thinking to solve problems that are more difficult and often allow more than one approach to solving the problem.

The use of the MAP offers a non-intrusive benefit to students and staff as it is administered annually and is an ingrained part of the assessment process in the District X. District officials already use MAP data as the basis for measuring staff and administrative effectiveness. Academic services make instructional decisions based on MAP scores and MAP performance indicators such as Acuity scores (DESE, 2007).

The state of Missouri provides clear descriptions of the student MAP scores. Per the *Guide to Interpreting Results* (Missouri DESE, 2009b), the resulting achievement indicator, a single scale score, represents the number of correct responses earned by a student. These scale scores are placed in a continuum from third to tenth grade, which

provides a longitudinal perspective regarding a student's academic growth during this period. Because of this, scale scores within an academic discipline may be compared from one grade to the next and analyzed. Student performance on the MAP test is reported as one of the following achievement levels: below basic, basic, proficient, or advanced. The "levels describe a pathway to proficiency. Each achievement level represents standards of performance for each assessed content area" (DESE, 2007 p. 4). In addition to the achievement level, a student's achievement is also reported as a scale score indicating a student's total performance in the specific content area.

DESE released a report of what is covered on each test in partnership with McGraw-Hill. The mathematics exams are described as "students in Missouri public schools will acquire a solid foundation that includes knowledge of number and operations, algebraic relationships, geometric and spatial relationships, measurement, and data and probability" (DESE, 2009b, p. 2). The ELA exams are described as "students in Missouri public schools will acquire a solid foundation that includes knowledge of and proficiency in" speaking and writing Standard English, reading comprehension, formal and informal writing, evaluation and interpretation, and a broad understanding of language and culture (DESE, 2009b p. 2).

Seven variables are identified in the research questions: fifth grade MAP mathematics scores (RQ1, RQ2), fifth grade MAP ELA scores (RQ3, RQ4), fourth and fifth grade MAP mathematics scores (RQ5, RQ6), fourth and fifth grade MAP ELA scores (RQ7, RQ8), gender (RQ2, RQ4, RQ6, RQ8), race (RQ2, RQ4, RQ6, RQ8), and SES (RQ2, RQ4, RQ6, RQ8). The following paragraphs address the measurement of each variable.

"The MAP is designed to measure how well students acquire the skills and knowledge described in Missouri's Grade-Level Expectations (GLEs)" (DESE, 2009b, p. 5). The assessments yield information on academic achievement at the student, class, school, district, and state levels. This information is often reported by schools as scaled scores. The scaled score converted from the student's raw scores on a test to a common scale that allows for the numerical comparison between students. This comparison can then be analyzed to provide information about the students and the test. The Department of Elementary and Secondary Education (DESE) designate the scale for these scores. The scale ranges are found in Table 2.

Table 2

Scaled Scores for Fourth and Fifth Grade MAP mathematics and ELA as Designated by DESE from 2009 to 2013

	Mathematics		ELA	
Scale	Fourth Grade	Fifth Grade	Fourth Grade	Fifth Grade
Below Basic	465-595	480-604	470-611	485-624
Basic	596-650	605-687	612-661	625-674
Proficient	651-687	688-705	662-690	675-701
Advanced	688-805	706-830	691-820	702-840

Note. Adapted from Missouri Assessment Program grade level assessments: Technical report. DESE, 2009. Retrieved from https://dese.mo.gov/sites/default/files/2009-MAP-Technical-Report.pdf

This information is used to "analyze individual student performance related to the instruction of the GLEs and to gauge the overall quality of education throughout Missouri" (DESE, 2009, p. 5). For RQ1 and RQ2, the fifth grade ELA range is from 485 to 840. For RQ3 and RQ4, the fifth grade mathematics range is from 480 to 830. For

RQ5 and RQ6 the possible growth in ELA was from 465 to 830. For RQ7 and RQ8, the possible growth in mathematics is between 470 and 840. Thus, it is an appropriate and effective measurement for the purpose outlined in this study.

Validity and reliability are important components of a good assessment instrument. Roberts (2010) defined validity as "the degree to which the instrument truly measures what it purports to measure" and reliability as "the degree to which the instrument consistently measures something from one time to another" (p. 151). Roberts (2010) further defined reliability as "the degree to which the instrument consistently measures something from one time to another" (p. 151). In 2009, DESE published a technical report regarding the validity and reliability of MAP test scores. Regarding validity, DESE reported, "validity is an overarching component of the MAP testing program" (DESE, 2009a, p. 4). The purpose of an assessment is crucial to understand whether a test score is being utilized properly. DESE conducts internal evaluations of their assessments to improve the quality of the assessments. No test provides a perfect assessment of a student's ability; thus, all tests have a known standard error of measurement (SEM), which "reports the amount of variability that can be expected in a student's test score due to the inherent imprecision of the test" (DESE, 2009b). The process of validating assessment results is ongoing. DESE continues to conduct validity studies on MAP assessments and confirm meaning into results by adhering to industry standards during test-development stages (DESE 2009b).

Reliability of the MAP scores was evaluated using Cronbach's alpha coefficients by DESE. "The closer the coefficient is to 1, the more consistent are the scores" (DESE, 2009a, p. 136). In 2009, DESE and CTB/McGraw-Hill published a technical report

providing evidence of the reliability of the MAP and its content areas (see Table 3). The scale scores were categorized by the designation of cut points for each category. DESE then evaluated the accuracy of the designated cut points as an internal evaluation of the accuracy and consistency of their scale scores.

Table 3

Accuracy and Consistency of Proficient and Advanced Scores for Fourth and Fifth Grade MAP Mathematics and ELA as Designated by DESE from 2009 to 2013

	Mathematics		ELA	
Measurement	Fourth Grade	Fifth Grade	Fourth Grade	Fifth Grade
Cut Points	.94	.96	.92	.90

Note. Adapted from Missouri Assessment Program grade level assessments: Technical report DESE, 2009. Retrieved from https://dese.mo.gov/sites/default/files/2009-MAP-Technical-Report.pdf

The coefficients at .90 or above .90 for mathematics and ELA respectively, are evidence of internal consistency. The MAP mathematics and ELA consistently measure the knowledge of fourth and fifth grade students.

Four remaining variables were specifically identified for this study. Participation was defined as those who participate in the one-to-one initiative during the fifth grade. Gender references either a male or a female student. Race references either "White" or "non-white." Students self-indicated their classification for race. For this study, ethnic categories were collapsed into "White" and "non-White" (which included Asian, Black, Hispanic, Native American, and Alaskan Native). Socioeconomic status (SES) refers to students who receive financial assistance for breakfast and lunch from the school district, as free and reduced lunch status and students who do not receive financial assistance as full pay.

Data Collection Procedures

Before the data was collected, the designated forms to request permission to conduct research in District X were completed. This request was granted by the Director of Research, Evaluation, and Assessment (REA) on April 15, 2014 (see Appendix A). Once approved on July 1, 2015, clear guidelines regarding data sets and coding process were discussed with the district's Director of REA. A similar request was submitted to the Baker University Institutional Review Board seeking approval from the university to conduct this study (see Appendix B). A renewal request was made to the Baker University Institutional Review Board was submitted and approved on October 27, 2016 (see Appendix C). The Director of REA harvested historical data sets from 2011-2012 and 2012-2013. The researcher then contacted each fourth and fifth grade school principal in District X to make them aware of this study via email, and an offer to share the results of the study with building principals was made. Then, the researcher offered to share the findings of the study with principals of District X. Random student numbers were generated and attached to data by a computer technologist. All data were merged into a Microsoft Excel workbook by a district computer technologist. This information included student gender, race, SES, MAP ELA scale scores, and MAP mathematics scores from each of the assessments from 2011-2012 and 2012-2013. Once the data were merged, it was imported into IBM SPSS® Statistics Faculty Pack 24 for Windows for analysis.

Data Analysis and Hypothesis Testing

Eight research questions were posed. These questions were selected to determine to what extent there was a difference between student achievement on the MAP and one-

to-one computer implementation. The research questions provide the basis for the data analysis. The hypotheses, listed after each relevant research question, were tested for statistically significant differences.

RQ1. To what extent is there a difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year?

H1. There is a statistically significant difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year.

The first two-factor analysis of variance (ANOVA) was conducted to test H1 and H2. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student gender). The main effect for student participation in the one-to-one laptop initiative was used to test H1. The level of significance was set at .05.

RQ2. To what extent is the difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop

initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H2. The difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the first ANOVA was used to test H2. The level of significance was set at .05.

H3. The difference in fifth grade student achievement on the MAP ELA assessment between students who did participate in the one-to-one laptop initiative during the 2012-2013 school year and students who did not participate in the initiative is affected by student race.

A second two-factor ANOVA was conducted to test H3. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H3. The level of significance was set at .05.

H4. The difference in fifth grade student achievement on the MAP ELA assessment between students who did participate in the one-to-one laptop initiative and

students who did not participate in the initiative is affected by student SES during the 2012-2013 school year.

A third two-factor ANOVA was conducted to test H4. The two categorical variables used to group the dependent variable name variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test H4. The level of significance was set at .05.

RQ3. To what extent is there a difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one initiative and students who did not participate in the initiative during the 2012-2013 school year?

H5. There is a statistically significant difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year.

A fourth two-factor ANOVA was conducted to test H5 and H6. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The

two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student gender). The main effect for student participation in the one-to-one laptop initiative was used to test H5. The level of significance was set at .05.

RQ4. To what extent is the difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H6. The difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative during the 2012-2013 school year and students who did not participate in the initiative is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the fourth ANOVA was used to test H6. The level of significance was set at .05.

H7. The difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative during the 2012-2013 school year and students who did not participate in the initiative is affected by student race.

A fifth two-factor ANOVA was conducted to test H7. The two categorical variables used to group the dependent variable, fifth grade student achievement on the

MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H7. The level of significance was set at .05.

H8. The statistically significant difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A sixth two-factor ANOVA was conducted to test H8. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test H8. The level of significance was set at .05.

RQ5. To what extent is there a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

H9. There is a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year.

A seventh two-factor ANOVA was conducted to test H9 and H10. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student gender). The main effect for student participation in the one-to-one laptop initiative was used to test H9. The level of significance was set at .05.

RQ6. To what extent is the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H10. *T*he difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment,

between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the seventh ANOVA was used to test H10. The level of significance was set at .05.

H11. The difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

An eighth two-factor ANOVA was conducted to test H11. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H11. The level of significance was set at .05.

H12. The difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth

grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A ninth two-factor ANOVA was conducted to test H12. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test H12. The level of significance was set at .05.

RQ7. To what extent is there a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

H13. There is a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP Mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year.

A tenth two-factor ANOVA was conducted to test H13 and H14. The two categorical variables used to group the dependent variable, mathematics growth, as

measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender status, and a two-way interaction effect student (participation in the one-to-one laptop initiative x student gender). The main effect for student participation in the one-to-one laptop initiative was used to test H13. The level of significance was set at .05.

RQ8. To what extent is the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by of the following variables: student gender, race, or SES?

H14. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the tenth ANOVA was used to test H14. The level of significance was set at .05.

H15. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

An eleventh two-factor ANOVA was conducted to test H15. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) from the eleventh ANOVA was used to test H15. The level of significance was set at .05.

H16. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A twelfth two-factor ANOVA) was conducted to test H16. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the

MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect student participation in the one-to-one laptop initiative x student SES. The interaction effect (student participation in the one-to-one laptop initiative x student SES) from the twelfth ANOVA was used to test H16. The level of significance was set at .05.

Limitations

Limitations are "particular features of [the] study that [the researcher] know may negatively affect the results or [the researcher's] ability to generalize" (Roberts, 2010, p. 162). This researcher identified the following limitations to the current study:

1. Technology is changing rapidly. To generalize the effect of technology far beyond the time examined in this study is speculative.
2. Student and teacher exposure to technology as a learning tool is changing quickly. As technology usage in classrooms becomes more common over time, it is assumed that the use of technology would become more effective and less disruptive. As technology use becomes an expectation instead of a change, the pedagogical practices of teachers may have a different influence on student learning.
3. The deployment of a one-to-one initiative may look different in another school district. The device, infrastructure, professional development, teacher ability, and the district leadership might influence the effectiveness of a device

of this nature. Other communities with nearly similar demographics and resources might have different outcomes if this study were to be replicated.

Summary

The methodology used in this study was described in this chapter. This study was a quantitative, quasi-experimental study that used archival data from a student achievement on the MAP in one school district to determine the extent to which a one-to-one initiative influenced MAP ELA and mathematics scores. Provided in chapter four are the results of the statistical analysis, which determines if there is a significant difference in the variables identified and student academic achievement. Chapter four includes the descriptive statistics and the result of the hypothesis testing.

Chapter Four

Results

The first purpose of this study was to determine if there were differences in fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year. The second purpose was to determine whether the differences in fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative were affected by one of the following variables: student gender, race, or SES during the 2012-2013 school year. The third purpose was to determine if there were differences in MAP ELA and mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA and mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year. The final purpose was to determine if there were differences in MAP EL and mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA and mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year were affected by one of the following variables: student gender, race, or SES. The eight research questions that guided the current study are addressed through the results of the data analysis provided in

this chapter. Chapter four begins with descriptive statistics, followed by the results of the hypotheses testing.

Descriptive Statistics

The descriptive statistics in this section provide details of the variables in the research questions from this study. Participants by elementary school, participant gender, participant ethnicity, participant SES, and fifth grade one-to-one participants are found in Tables 4-8. Table 4 includes the number of students in each elementary school and the percent of the total participation each school represents. These students are the cohort that became the fifth graders in this study. School G has a low number of participants because it is an alternative school.

Table 4

Participants by Elementary School

School	*N*	%
School A	69	9.8
School B	82	11.7
School C	63	9.0
School D	62	8.8
School E	103	14.7
School F	80	11.4
School G	5	0.7
School H	65	9.3
School I	84	12.0
School J	89	12.7
Total	702	100.0

The statistics related to the gender of the participants in the study appear in Table 5. Approximately half of the participants were male, and half of the participants were female. The data is the expected representation of gender in a public school.

Table 5

Participant Gender

Gender	*N*	%
Female	346	49.3
Male	356	50.7
Total	702	100.0

The statistics related to the ethnicity of the participants in the study appear it Table 6. Participants in the study were referred to as being White or non-White. Collectively, 27.4 percent of the participants were non-White. White participants comprised 72.9% of the sample.

Table 6

Participant Ethnicity

Ethnicity	*N*	%
Native American	2	0.3
Asian	22	3.1
Pacific Islander	6	0.9
African American	73	10.4
Hispanic	60	8.5
White	510	72.6
Multi-Racial	29	4.1
Total	702	100.0

The statistics related to the SES of the participants in the study appear in Table 7. Over 75% of the participants paid full price for their lunches. The remaining 24.4% of the participants received either free or reduced-priced lunches at school.

Table 7

Participant SES

SES	*N*	%
Full Pay	531	75.6
Free/Reduced Lunch	171	24.4
Total	702	100.0

The statistics related to the participation in the one-to-one laptop initiative in fifth grade are in Table 8. Of the 702 participants, 66.2% did not participate in the one-to-one laptop initiative in the fifth grade, and 33.8% did participate in the initiative.

Table 8

Fifth Grade One-to-One Participants

Participation	*N*	%
Non-participant	465	66.2
Participant	237	33.8
Total	702	100.0

Hypothesis Testing

Eight research questions were posed. The research questions provide the basis for the data analysis. The hypotheses, listed after each relevant research question, were tested for statistically significant differences. The analysis and the results of the hypothesis tests are listed after each hypothesis.

RQ1. To what extent is there a difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year?

H1. There is a statistically significant difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year.

The first two-factor ANOVA was conducted to test H1 and H2. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student gender). The main effect for student participation in the one-to-one laptop initiative was used to test H1. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between the two means, $F = .782$, $df = 1, 698$, $p = .377$. See Table 9 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis of a statistically significant difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year was not supported.

Table 9

Descriptive Statistics for the Results of the Test for H1

Variable	*M*	*SD*	*N*
Did not Participate	691.41	34.23	465
Participated	688.89	34.63	237

RQ2. To what extent is the difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop

initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H2. The difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the first ANOVA was used to test H2. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = 2.302$, $df = 1, 698$, $p = .130$. See Table 10 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in fifth grade student achievement on the MAP ELA assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year was affected by student gender was not supported.

Table 10

Descriptive Statistics for the Results of the Test for H2

Variable		*M*	*SD*	*N*
Did not participate	Female	693.92	33.31	230
	Male	688.95	35.00	235
Participated	Female	695.65	33.23	116
	Male	682.40	34.84	121

H3. The difference in fifth grade student achievement on the MAP ELA assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

A second two-factor ANOVA was conducted to test H3. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H3. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .550$, $df = 1, 696$, $p = .455$. See Table 11 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in fifth grade student achievement on the MAP ELA assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student race was not supported.

Table 11

Descriptive Statistics for the Results of the Test for H3

Variable		*M*	*SD*	*N*
Did not participate	Non-White	680.66	37.32	99
	White	694.50	32.66	365
Participated	Non-White	677.66	33.36	91
	White	695.88	33.77	145

H4. The difference in fifth grade student achievement on the MAP ELA assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A third two-factor ANOVA was conducted to test H4. The two categorical variables used to group the dependent variable name variable, fifth grade student achievement on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test H4. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = 1.023$, $df = 1, 698$, $p = .312$. See Table 12 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in fifth grade student achievement on the

MAP ELA assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student SES was not supported.

Table 12

Descriptive Statistics for the Results of the Test for H4

Variable		*M*	*SD*	*N*
Did not participate	Full Pay	696.10	30.94	374
	Free/Reduced	672.14	40.05	91
Participated	Full Pay	694.93	32.14	157
	Free/Reduced	677.03	36.44	80

RQ3. To what extent is there a difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one initiative and students who did not participate in the initiative during the 2012-2013 school year?

H5. There is a statistically significant difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year.

A fourth two-factor ANOVA was conducted to test H5 and H6. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for

students' participation in the one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect. The main effect for student participation in the one-to-one laptop initiative was used to test H5. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between the two means, $F = .040$, $df = 1, 698$, $p = .841$. See Table 13 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that there is a statistically significant difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year was not supported.

Table 13

Descriptive Statistics for the Results of the Test for H5

Variable	*M*	*SD*	*N*
Did not participate	692.10	46.36	465
Participated	691.27	44.01	237

RQ4. To what extent is the difference in fifth grade student achievement on the MAP mathematics assessment between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H6. The difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative is affected by student gender during the 2012-2013 school year.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the fourth ANOVA was used to test H6. The level of significance was set at .05. The results of the analysis indicated a marginally significant difference between at least two of the means, $F = 3.137$, $df = 1, 698$, $p = .077$. See Table 14 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. Although the finding was not statistically significant, the hypothesis that the difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student gender was supported. Female students who participated tended to outperform female students who did not participate, while male students who participated tended to perform poorly when compared to males who did not participate.

Table 14

Descriptive Statistics for the Results of the Test for H6

Variable		*M*	*SD*	*N*
Did not participate	Female	688.55	46.08	230
	Male	695.58	46.47	235
Participated	Female	694.26	39.73	694.26
	Male	688.41	47.74	688.41

H7. The difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

A fifth two-factor ANOVA was conducted to test H7. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H7. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .000$, $df = 1, 696$, $p = .987$. See Table 15 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student race was not supported.

Table 15

Descriptive Statistics for the Results of the Test for H7

Variable		*M*	*SD*	*N*
Did not participate	Non-White	674.51	48.28	99
	White	697.20	44.30	365
Participated	Non-White	677.33	43.93	91
	White	699.90	42.04	145

H8. The statistically significant difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A sixth two-factor ANOVA was conducted to test H8. The two categorical variables used to group the dependent variable, fifth grade student achievement on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and (a two-way interaction effect. student participation in the one-to-one laptop initiative x student SES). The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test H8. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .418$, $df = 1, 698$, $p = .518$. See Table 16 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in fifth grade student achievement on the MAP mathematics assessment between students who did participate the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year is affected by student SES was not supported.

Table 16

Descriptive Statistics for the Results of the Test for H8

Variable		*M*	*SD*	*N*
Did not participate	Full Pay	698.18	45.63	374
	Free/Reduced	667.13	40.83	91
Participated	Full Pay	700.03	40.33	157
	Free/Reduced	674.10	46.08	80

RQ5. To what extent is there a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

H9. There is a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year.

A seventh two-factor ANOVA was conducted to test H9 and H10. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the

one-to-one laptop initiative, a main effect for student gender, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student gender).

The main effect for student participation in the one-to-one laptop initiative was used to test H9. The level of significance was set at .05. The results of the analysis indicated a statistically significant difference between the two means, $F = .4.162$, $df = 1, 698$, $p = .042$. See Table 17 for the means and standard deviations for this analysis. The mean growth for students who participated ($M = 19.24$) was significantly higher than the mean for students who did not participate (15.20). The hypothesis of a statistically significant difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year was supported.

Table 17

Descriptive Statistics for the Results of the Test for H9

Variable	*M*	*SD*	*N*
Did not Participate	15.20	24.74	465
Participated	19.24	24.44	237

RQ6. To what extent is the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by one if the following variables: student gender, race, or SES?

H10. *T*he difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the ELA MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the seventh ANOVA was used to test H10. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .296$, $df = 1, 699$, $p = .586$. See Table 18 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender was not supported.

Table 18

Descriptive Statistics for the Results of the Test for H10

Variable		*M*	*SD*	*N*
Did not participate	Female	14.62	24.54	230
	Male	15.77	24.96	235
Participated	Female	17.56	25.71	116
	Male	20.85	23.15	121

H11. The difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

An eighth two-factor ANOVA was conducted to test H11. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student race). The interaction effect (student participation in the one-to-one laptop initiative x student race) was used to test H11. The level of significance was set at .05. The results of the analysis indicated a marginally significant difference between at least two of the means, $F = 2.643$, $df = 1$, 696, $p = .104$. See Table 19 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. Although the finding is not statistically significant, the hypothesis that the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-

2013 school year is affected by student race was supported. White students who participated tended to outperform White students who did not participate.

Table 19

Descriptive Statistics for the Results of the Test for H11

Variable		*M*	*SD*	*N*
Did not participate	Non-White	18.57	23.77	99
	White	14.26	24.97	365
Participated	Non-White	17.63	21.28	91
	White	20.34	26.30	145

H12. The difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A ninth two-factor ANOVA was conducted to test H2. The two categorical variables used to group the dependent variable, ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect (student participation in the one-to-one laptop initiative x student SES). The interaction effect (student participation in the one-to-one laptop initiative x student SES) was used to test

H12. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between the two means, $F = .026$, $df = 1, 698$, $p = .871$. See Table 20 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES was not supported.

Table 20

Descriptive Statistics for the Results of the Test for H12

Variable		*M*	*SD*	*N*
Did not participate	Full Pay	15.39	24.42	374
	Free/Reduced	14.42	26.13	91
Participated	Full Pay	19.32	24.00	157
	Free/Reduced	19.08	25.44	80

RQ7. To what extent is there a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year?

H13. There is a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one

laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year.

A tenth two-factor ANOVA was conducted to test H13 and H14. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. A tenth two-factor ANOVA was conducted to test H13 and H14. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student gender. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student gender status, and a two-way interaction effect student (participation in the one-to-one laptop initiative x student gender status). The main effect for student participation in the one-to-one laptop initiative was used to test H13. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between the means, F = 2.509, df = 1, 698, p = .114. See Table 21 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that there is a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students

who did not participate in the initiative during the 2012-2013 school year was not supported.

Table 21

Descriptive Statistics for the Results of the Test for H13

Variable	*M*	*SD*	*N*
Did not participate	33.94	28.99	465
Participated	30.27	30.36	237

RQ8. To what extent is the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year affected by one of the following variables: student gender, race, or SES?

H14. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender.

The interaction effect (student participation in the one-to-one laptop initiative x student gender) from the tenth ANOVA was used to test H14. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .272$, $df = 1, 698$, $p = .602$. See Table 22 for the means and standard deviations for this analysis. No follow-up post

hoc was warranted. The hypothesis that the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student gender was not supported.

Table 22

Descriptive Statistics for the Results of the Test for H14

Variable		*M*	*SD*	*N*
Did not participate	Female	32.33	27.08	230
	Male	35.53	30.73	235
Participated	Female	27.38	29.57	116
	Male	33.03	30.96	121

H15. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the mathematics MAP assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student race.

An eleventh two-factor ANOVA was conducted to test H15. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student race. The two-factor ANOVA

can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student race, and a two-way interaction effect. The interaction effect (student participation in the one-to-one laptop initiative x student race) from the eleventh ANOVA was used to test H15. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = 1.311$, $df = 1, 696$, $p = .253$. See Table 23 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the mathematics MAP assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student race was not supported.

Table 23

Descriptive Statistics for the Results of the Test for H15

Variable		*M*	*SD*	*N*
Did not participate	Non-White	29.55	26.45	99
	White	35.38	29.23	365
Participated	Non-White	23.10	28.55	91
	White	34.77	30.79	145

H16. The difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop

initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES.

A twelfth two-factor ANOVA was conducted to test H16. The two categorical variables used to group the dependent variable, mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, were students' participation in the one-to-one laptop initiative during the 2012-2013 school year and student SES. The two-factor ANOVA can be used to test three hypotheses including a main effect for students' participation in the one-to-one laptop initiative, a main effect for student SES, and a two-way interaction effect student participation in the one-to-one laptop initiative x student SES. The interaction effect (student participation in the one-to-one laptop initiative x student SES) from the twelfth ANOVA was used to test H16. The level of significance was set at .05. The level of significance was set at .05. The results of the analysis indicated there was not a statistically significant difference between at least two of the means, $F = .498$, $df = 1, 698$, $p = .480$. See Table 24 for the means and standard deviations for this analysis. No follow-up post hoc was warranted. The hypothesis that the difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year is affected by student SES was not supported.

Table 24

Descriptive Statistics for the Results of the Test for H16

Variable		*M*	*SD*	*N*
Did not participate	Full Pay	35.76	30.06	374
	Free/Reduced	26.46	22.78	91
Participated	Full Pay	32.15	32.30	157
	Free/Reduced	26.58	25.92	80

Summary

Chapter four included the descriptive statistics and a summary of the statistical testing and analysis results. The chapter addressed the eight research questions and the statistical testing of the sixteen hypotheses from this study. Chapter five includes a summary of the study, an overview of the problem and purpose statement, review of methodology, major findings, findings related to literature, conclusions, implications for action, and recommendations for future research.

Chapter Five

Interpretation and Recommendations

Chapter five concludes this study by including the overview of the problem, the purpose of statement and research questions, the methodology, the major findings of this research, and a summary of the study. A discussion of the findings related to the literature follows. Chapter five also contains implications for action and recommendations for future research, which will lead to suggestions for extensions of the study. This chapter ends with the concluding remarks.

Study Summary

Many school districts have expanded the use of technology in classrooms across the United States. Accountability through standardized testing became a trend in 2001 when No Child Left Behind (NCLB) was passed into law. The topic of this study was the effect of one-to-one initiatives on fifth grade student performance on standardized assessments. In this section, the overview of the problem, the purpose statement, and researched questions, a review of the methodology, and the major findings are included.

Overview of the problem. Many school districts are attempting to measure the success of one-to-one initiatives by analyzing the results of student achievement on state assessments. Schools want to know if placing students in a one-to-one initiative supports the efforts to improve scores on standardized tests such as the MAP. District X did not know whether the one-to-one initiative would influence student performance on the MAP ELA and mathematics assessments. Additionally, District X did not know whether student gender, race, and SES affected any differences in student performance.

Purpose statement and research questions. The first purpose of this study was to determine if there were differences in fifth grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year and whether those differences were affected by one of the following variables: student gender, race, or SES. The other purpose was to determine if there was a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELA and mathematics assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year and whether those differences were affected by one of the following variables: student gender, race, or SES. To address these purposes, eight research questions were posed.

Review of the methodology. This quantitative study utilized a quasi-experimental design. The dependent variables were the MAP ELA and mathematics assessment scores for fourth grade students during the 2011-2012 school year and fifth grade students during the 2012-2013 school year. The independent variables were the participation in the one-to-one program, student gender, race, and SES. There were 702 participants in the study. Twelve two-factor ANOVAs were conducted to examine the statistical significance of the 16 hypotheses concerning the effect the one-to-one initiative had on the ELA and mathematics MAP the scores and growth.

Major findings. The results of the data analysis were derived from analyses that addressed eight research questions. The results from RQ1, RQ2, and RQ3 yielded no statistically significant findings. There was minimal difference in the student

achievement between fifth graders who participated in the one-to-one initiative and those who did not participate in the one-to-one initiative on the MAP ELA assessment. The results from RQ4 indicated that, although the finding was not statistically significant, fifth grade student achievement on the MAP mathematic assessment between students who did participate in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school year was affected by student gender. Female students who participated in the one-to-one initiative tended to outperform female students who did not participate in the initiative on the MAP mathematics assessment. However, the MAP mathematics assessment showed that male students who participated in the one-to-one initiative did not perform as well as males who did not participate in the one-to-one initiative.

The results related to RQ5 indicated significant differences in student performance on the MAP ELA. There was a difference in ELA growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the MAP ELAassessment, between fifth grade students who participated in the one-to-one laptop initiative, and fifth grade students who did not participate in the initiative during the 2012-2013 school year. Fifth grade students who did not partcipate in one-to-one were outperformed by fifth grade students who did participate.

Although the finding related to RQ6 was not statistically significant, the difference between the fourth (2011-2012) and fifth grade (2012-2013) scale scores on the MAP ELA assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year was affected by student race. White students who

participated tended to outperform White students who did not participate. The results related to RQ7 and RQ8 yielded no statistically significant difference in student growth on the MAP mathematics assessment between students who participated in the one-to-one initiative and those who did not.

Findings Related to the Literature

The researcher conducted a review of literature related to the impact of one-to-one initiatives on student academic performance. In addition, the researcher conducted a review of the literature on the impact one-to-one initiatives has had on student performance based on gender, the differences based on SES, and the differences based on race. This study found that there were some areas which demonstrated academic success in the one-to-one initiative and some areas that did not. The results of this study support and are in contrast to the literature.

The research related to academic achievement and student SES conflict with the findings of this study. Attewell & Battle (1999) found that the poorer a student was, the greater the potential being a part of a one-to-one initiative had to improve their academic success. In a later study, Harris (2010) reported that learning with laptops had a greater education impact on students with low SES than students who were not low SES. The results of this study indicated that there was not a significant difference in academic performance between those students with low SES in the one-to-one initiative and those students with low SES that were not in the one-to-one initiative.

Conflicting research can be found regarding the impact of a one-to-one initiative on student academic performance and race. Walters (2012) reported that there was little to moderate effect on Hispanic students on a state reading test in response to being in a

one-to-one initiative. In contrast to this report, Casey (2014) reported that Hispanic students in a one-to-one initiative had gains in reading compared to non-Hispanic students. In the current study, White students who participated in the one-to-one initiative tended to outperform White students who did not participate. However, non-White students who participated in the one-to-one initiative did not outperform non-White students who did not participate.

The research related to the gender differences in a one-to-one initiative showed conflicting results. Chiu et al. (2007) found that sixth grade girls outperformed sixth grade boys in ELA scores. Conversely, Brummel et al., (2013) reported that girls outperformed boys in mathematics when placed in a one-to-one initiative. Similar studies have not had the same results. Dennis (2014) reported that student academic achievement in mathematics did not benefit from being in a one-to-one initiative, and the co-variable of gender was not an indicator of academic performance of any significance. However, Brummel et al. (2013) studied sixth grade students, and Dennis' study was conducted with high school students. In the current study, female fifth grade students who participated in the one-to-one initiative tended to outperform female students who did not participate, while male students who participated tended to perform poorly when compared to males who did not participate as measured by their mathematics scores on the MAP. Results may suggest that the device may not be the determining factor on achievement as it relates to gender.

Owston and Wideman (2001) reported that students in a one-to-one laptop environment outscored and showed more growth than students without a laptop when measuring ELA. Mouza (2008) reported that laptops improved student learning as

measured by standardized tests in mathematics and ELA. In addition to this finding, Shapley et al. (2010) found that middle school students in a one-to-one initiative produced higher scores on an ELA state exam than students not in the one-to-one initiative. Chiu et al. (2013) found that students who used electronic devices in a one-to-one program made significant growth in their reading comprehension. In this current study, students who were in the one-to-one initiative experienced more growth on the MAP ELA than those students who did not participate in the one-to-one initiative. This finding is in contrast to Bryan (2011) and Walters (2012) whose studies indicated there was little to no difference in academic achievement in ELA for students participating in a one-to-one initiative.

Researchers have reported conflicting results on student achievement in mathematics in one-to-one initiatives. Van der Kleij et al. (2015) reported that there was a positive effect on student achievement in mathematics in their study of students in a one-to-one learning environment. Likewise, Ozerbas and Erdogan (2016) reported that students in a digital learning environment have more academic success in mathematics than those students without the devices. However, the current study found that there was not a difference in mathematics growth, as measured by a difference between the fourth (2011-2012) and fifth grade (2012-2013) scale score on the Mathematics MAP assessment, between fifth grade students who participated in the one-to-one laptop initiative and fifth grade students who did not participate in the initiative during the 2012-2013 school year. This finding supports Dunleavy and Heinecke (2007) who found that students in a one-to-one initiative demonstrated no significant improvement in student

mathematic achievement when comparing students that were and were not a part of the one-to-one initiative.

This study found conflicting results, as students who participated in the initiative did demonstrate an overall improvement in ELA but not in mathematics. This study found that there was not a significant impact on the differences between the groups with and without the device. However, there was a significant impact on the growth demonstrated by students with the device in ELA and not a significant impact on the growth demonstrated by students in mathematics. Researchers have reported that student performance in ELA and mathematics mirrored each other rather than contrasting with each other. Lewis (2004) reported that students in a one-to-one initiative did not make significant academic achievement in mathematics or ELA when compared to students that were not in a one-to-one initiative. Supporting this finding, O'Dwyer et al. (2008), found that there was no significant impact on any academic performance when one-to-one programs were initiated. Additionally, Kulow (2014) found that student academic performance in a one-to-one initiative was not significantly different from students that were not in a one-to-one initiative. In contrast to this study, some have reported a positive effect on student academic performance in both ELA and mathematics. Gulek and Demirtas (2005), Bebell and O'Dwyer (2010), Mills (2010), and Warschauer and Zheng (2016) all reported in their respective studies that students in a one-to-one initiative demonstrated academic success in both ELA and mathematics.

Conclusions

This section provides conclusions drawn from the current study on the impact of a one-to-one initiative on student performance on the MAP ELA and mathematics and the

effect of gender, race, and SES on the differences. Data from the current study is significant to school leaders, as the findings could be used to improve or create support in a one-to-one initiative. This section includes implications for action, recommendations for future research, and concluding remarks to complete the study.

Implications for action. In this era of high-stakes testing in public schools, it is important to evaluate how school districts are using their resources and the results the resources have on student test scores. The results of this study indicated that fifth grade students who participated in one-to-one initiative demonstrated more growth than fifth grade students who did not participate in one-to-one on the ELA portion of the MAP assessment, but the same was not true for mathematics. A specific area of action may be to evaluate how mathematics instruction is supported and what resources are used to deliver the content. Also, District X may want to break down the individual results by teacher and study to determine if individual pedagogical teacher practices may have influenced student achievement. District X may also want to review how other school districts have achieved improvement in student mathematics performance in a one-to-one setting and incorporate some of their processes and practices.

The results of the study indicated that White students who participated tended to outperform White students who did not participate, but the same was not true for non-White students. Another area for action may include investigations into the performance of White students in comparison to non-White students. The formation of focus groups consisting of non-White students and their families may be beneficial. These focus groups could discuss academic data and form a plan for supporting the success of non-White students. District X may want to provide professional development to their staff

that targets best practices in improving the academic performance of subgroups such as non-White students.

Another result of this study was that there was not a significant difference in academic performance between those students with low SES in the one-to-one initiative and those students with low SES that were not in the one-to-one initiative. District X may want to share the results of this study with their staff and evaluate why this one-to-one initiative did not produce better academic gains for these students. District leaders may want to devise a strategy that ensures the implementation of effective instructional practices in one-to-one classrooms, specifically strategies that target low SES students. District X may also want to analyze their students access to technology at home, particularly with students with low SES. The flipped instruction mode of content delivery includes the expectation that students will access their devices away from school. District X may want to be creative with expanded student access to the web outside of school by incorporating web access on their school buses, as other school districts have done (Reeves, 2003). District X may want to focus on informing families of effective learning practices that can be implemented at home with their student's devices. District X may also reach out to other public and private institutions to support digital learning for students beyond school hours.

Recommendations for future research. The purpose of this study was to determine to what extent the one-to-initiative impacted student performance on the MAP ELA and mathematics. This study was limited to one sample of students in one school district. Changing variables such as demographics or sampling size could strengthen a study's findings.

The first recommendation would be to add a qualitative research component to the replication of the current study. By gathering feedback and insight from teachers, students, and parents, a better understanding of improving the effectiveness of the one-to-one initiative could be obtained. In addition, Grimes & Warschauer, (2008) reported that only looking at student achievement data may not be the best way to evaluate the success of a one-to-one initiative because it does not measure the acquisition of skills that students acquire while learning with the device. District X may want to begin monitoring the 21st Century skills of the students in the one-to-one initiative. Qualitative measures could also ensure the validity of the quantitative results.

A second recommendation would be to add additional quantitative measures regarding student academic achievement to a replication of this study. The results of another standardized assessment could be analyzed, such as Acuity or STAR. Additional assessments could provide more insight into the academic progress of the students and add to the validity of the existing quantitative results.

A third recommendation would be to study the teacher training received during a one-to-one initiative. The professional development of the teachers may have an impact on the results of the student performance. Studying how the students were instructed to use the devices and the engagement of the students while they were using the devices may reveal an opportunity to increase the effectiveness of the device as a learning tool.

A fourth recommendation would be to extend the study throughout the students' career in a one-to-one initiative. The effectiveness of a one-to-one program may change throughout the development of the students' career within a school district. A study of

this nature could also include quantitative data such as ACT scores, graduation rate, and college and career readiness.

A fifth recommendation would be to replicate the study in an urban or rural setting. The current suburban setting may have an influence on the results of the study. A different setting would add to the knowledge of the topic and provide insight into the results.

A sixth recommendation would be to compare the results of the study to the results from other school's districts with different or similar demographics. It would be valuable to study what demographics may serve as indicators of success or failure. A study comparing District X to other districts within the state of Missouri may also be useful.

Concluding remarks. This study is a part of the body of work researching how instructional technology impacts student learning. The results of this study are consistent with some of the results of similar studies devoted to examining the impact of a one-to-one initiative on the academic success of students. Most of the research questions did not yield a statistically significant relationship between the one-to-one initiative and student scores on a standardized assessment such as the MAP. As children are prepared for their futures in public schools, many are being provided with and using technology with the expectation that the devices they use will enhance their learning. Public education may be experiencing a situation where the advances in technology are surpassing our ability to effectively implement it, train our teachers to be effective with it, and prepare our students to use it as members of the workforce. The Bureau of Labor Statistics reported that by 2020 there would be a million more job openings than trained workers to fill the

positions (Sims, 2014). More studies such as this one should be conducted to add to our knowledge and ability to create informed strategies to narrow the gap between achievement levels of subgroups. A one-to-one initiative can have a positive impact on student learning (Silvernail, 2007). Students deserve a relevant, updated education that helps them learn 21st Century skills so that education catches up to the expectations of being career ready (Sims, 2014).

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Appendices

Appendix A: District X Proposal for Research Permission Form

[redacted] School District

April 15, 2014

Dear Mr. Van Batavia:

Per [redacted] School District Board Policy, external agencies or individuals desiring to conduct research studies involving either students or staff members during the school day must submit a written prospectus to the Superintendent, or designee, for approval prior to initiation of the study. To be approved, all such research proposals must demonstrate that the projected findings will have value to either the District as a whole or to a unit within the District, and not be unduly disruptive or time consuming to the normal educational process.

The [redacted] School District recognizes the importance of research as a means of improving the instructional program for the District's students and also recognizes the need to monitor and control the amount of time and energy expended by both staff and students on research projects.

I have had the opportunity to review the prospectus for the research project entitled **The Effect of Flipped Classroom Instruction on Student Achievement** as well as speak to the principal at the school regarding the project. It is my pleasure to approve the project **The Effect of Flipped Classroom Instruction on Student Achievement** and the use of relevant [redacted] School District data, classrooms and students within the project. I find the project to have value to the district, support the goals of the district, and not be unduly disruptive or time consuming to the educational process.

Please contact me if you have any questions.

Cordially,

[redacted]
Director of Research, Evaluation, & Assessment
[redacted] School District

Appendix B: Baker University IRB Proposal for Research Permission Form

BAKER UNIVERSITY

SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

Date:
IRB PROTOCOL NUMBER _____
(IRB USE ONLY)

IRB REQUEST
Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name	Signature	
1. Dr. Susan Rogers	Susan Rogers	Major Advisor
2. Margaret Waterman	Margaret Waterman	Research Analyst
3. Jim Foil		University Committee Member
4. Becky Kiefer		External Committee Member

Principal Investigator: Brian Van Batavia
Phone: 816-301-3190
Email: vanbataviab@[redacted]2.mo.us
Mailing address: 8126 NW Tipton Ave
Kansas City, MO 64152

Faculty sponsor: Dr. Susan Rogers
Phone: 913-344-1226 – office/ 785 230-2801--cell
Email:

Expected Category of Review: __X_Exempt ___ Expedited _ _Full

II: Protocol: (Type the title of your study)

The Effects of a One-to-One Laptop Initiative on Student Achievement

Summary

In a sentence or two, please describe the background and purpose of the research.

The setting for this study was District X, a suburban school district serving the following Kansas City Northland metropolitan neighborhoods in the southern part of Platte County: Parkville, Riverside, Houston Lake, Weatherby Lake, Platte Woods, and Lake Waukomis. This public school district, with pre-kindergarten programs through grade 12, reported an enrollment of 10,504 students for the 2013-2014 school year.

The first purpose of this study is to determine if there are differences in 5th grade student achievement on the MAP English Language Arts (ELA) and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative during the 2012-2013 school years. The second purpose is to determine whether the differences in 5th grade student achievement on the MAP ELA and mathematics assessments between students who participated in the one-to-one laptop initiative and students who did not participate in the initiative are affected by one if the following variables: student gender, race, or SES during the 2012-2013 school year. The third purpose is to determine if there are differences in 6th grade student achievement on the MAP ELA and mathematics assessments among students who participated in the one-to-one laptop initiative during 2012-2013 and 2013-2014, students who participated in the one-to-one laptop initiative during 2012-2013 and who did not participate in the initiative during 2013-2014, students who did not participate in the one-to-one laptop initiative during 2012-2013 and did participated in the one-to-one laptop initiative during 2013-2014, and students who did not participate in the one-to-one laptop initiative during 2012-2013 and 2013-2014. The final purpose of the study is to determine whether the differences in 6th grade student achievement on the MAP ELA and mathematics assessments among students who participated in the one-to-one laptop initiative during 2012-2013 and 2013-2014, students who participated in the one-to-one laptop initiative during 2012-2013 and who did not participate in the initiative during 2013-2014, students who did not participate in the one-to-one laptop initiative during 2012-2013 and did participated in the one-to-one laptop initiative during 2013-2014, and students who did not participate in the one-to-one laptop initiative during 2012-2013 and 2013-2014 are affected by one if the following variables: student gender, race, or SES.

Briefly describe each condition or manipulation to be included within the study.

Some students have participated in the 1-1 initiative and some students have not participated in the 1-1 initiative.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.
Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.

No, subjects will not encounter psychological, social, physical, or legal risk. All data used in this study will be archival data.

Will any stress to subjects be involved? If so, please describe.

There will be no stress to the subjects involved, as the data is archival.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.

No, the subjects will not be deceived or misled in any way.

Will there be a request for information which subjects might consider to be personal or sensitive? If so, please include a description.

There will be no request for information which subjects consider personal or sensitive.

Will the subjects be presented with materials which might be considered to be offensive, threatening, or degrading? If so, please describe.

Subjects will not be presented with materials which might be considered to offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?

The subjects will not be asked to complete any extra time because the MAP is a part of Districts X's assessment program and the data is archival.

Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.

The population under examination is 5th and 6th grade students attending District X. The sample includes those students who were enrolled in 5th grade during the 2012-2013 school year and 6th grade during the 2013-2014 school year. The sample includes students who were enrolled in either the regular education classes of mathematics and ELA for the established grades and has demographic information available for the study. However, all data is archival and no one will be solicited.

What steps will be taken to insure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?

There is no need to solicit participation. Only archival data will be used for this study.

How will you insure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.

No consent is required because only archival data will be used for this study.

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.

No data will be made part of any permanent record than can be identified with the subject.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.

The fact that a subject did or did not participate in the study will not be made part of any permanent record available to a supervisor, teacher, or employer.

What steps will be taken to insure the confidentiality of the data? Where will it be stored? How long will it be stored? What will be done with it after the study is completed?

All data will be provided by the District X and no identifiable information will be requested. The information will be stored in password protected technology. The information will be kept only until the researcher completes the degree process. The data will be destroyed at the completion of the candidate's doctoral degree.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?

There are no risks involved in this study.

Will any data from files or archival data be used? If so, please describe.

Archival data will be collected for scale scores during the 2012 – 2015 school years for 5^{th} and 6^{th} grade students on the ELA MAP and on the math MAP in the District X. This archival data will include the student gender, student SES, and student race.

Appendix C: IRB Renewal

Baker University Institutional Review Board

October 27, 2016

Dear Brian Van Batavia and Dr. Rogers:

The Baker University IRB has reviewed your research project renewal application and approved this project under Expedited Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at EMorris@BakerU.edu or 785.594.7881.

Sincerely,

Erin R. Morris

Erin Morris PhD
Chair, Baker University IRB

Baker University IRB Committee
Joe Watson, PhD
Nate Poell MA
Susan Rogers PhD
Scott Crenshaw