

**ANALYZING THE IMPACT OF A 1:1 INITIATIVE ON STUDENT LEARNING  
OUTCOMES: A FOCUS ON LOW SOCIOECONOMIC STUDENTS IN THE HIGH  
SCHOOL SETTING**

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled:

**ANALYZING THE IMPACT OF A 1:1 INITIATIVE ON STUDENT LEARNING  
OUTCOMES: A FOCUS ON LOW SOCIOECONOMIC STUDENTS IN THE HIGH  
SCHOOL SETTING**

presented by Matthew R. Lacy,

a candidate for the degree Doctor of Education

and hereby certify that, in their opinion, it is worthy of acceptance.

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## **Dedication**

To my wife Chris, for her unwavering support and encouragement. This life-changing opportunity would not have been possible without you. To my daughters Anna and Olivia, thank you for understanding when Dad couldn't be at your ballgame. I can't wait to see what you do in the future, and I don't want to miss a moment, memory, ballgame or dance recital from this point forward.

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Analyzing the Impact of a 1:1 Initiative on Student Learning Outcomes: A Focus on Low Socioeconomic Students in the High School Setting

Matthew R. Lacy

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Abstract

The purpose of this quantitative study was to analyze the impact of a 1:1 initiative on English Language Arts (ELA) student learning outcomes for low socioeconomic students. The case study specifically analyzed achievement scores for 10<sup>th</sup> grade students at two different sites. Student learning outcomes included scale scores measured by the state summative end of course (EOC) exam, and student end of course grade point average (GPA). Student outcomes were also filtered by gender to better understand the impact of 1:1 on male and female ELA achievement.

Study results found a statistically significant negative relationship between technology implementation and student achievement when analyzing all EOC scale scores at each site. A statistically significant negative relationship was also found when student end of course GPA was examined for low SES students. Improvements in the mean of EOC scale scores was noted for low socioeconomic students, and for females in a 1:1 setting. However, these improvements were not found to be statistically significant.

SECTION ONE:  
INTRODUCTION TO DISSERTATION

## **Background**

Students in today's world are immersed in a technology rich culture (Valentine & Bernhisel, 2008). Many students use technology on a daily basis to play games, listen to music, and communicate with each other through text messaging and social media (Harris, Straker, & Pollock, 2013). To accommodate today's learners, many schools are implementing a 1:1 initiative to allow students to learn with the assistance of technology (Penuel, 2006). 1:1 refers to providing technology, such as computers or laptops, for every student in a school.

In the past 20 years, educational communities around the globe have seen an expansion of 1:1 initiatives (Dunleavy, Dextert, & Heinecket, 2007). In 2000, approximately 1000 American schools used a 1:1 initiative totaling over 150,000 laptops (Johnstone, 2003). Since 2000, school districts continue to invest heavily in student devices. According to The National Center for Education Statistics (NCES); student to device ratios have improved dramatically from the ratio of 6.6 devices per student in 2000. In 2008, the student to device ratio dwindled to 3.1 devices per student (NCES, 2012). A simple Google search on educational technology will confirm what the statistics from the NCES seem to support. 1:1 initiatives continue to grow in popularity amongst P-12 educators. While districts continue to invest in 1:1 initiatives, studies that measure the effectiveness of 1:1 have yielded mixed findings.

Some research studies have shown positive student learning outcomes associated with 1:1 initiatives (Bebell & Kay, 2010; Gulek & Demirtas, 2005; O'Dwyer, Russell, Bedell, Tucker-Seeley, 2005), while others have concluded that despite the heavy financial investment, 1:1 programs do not lead to increased student achievement scores (Hill, 2004). Some educational experts such as Mike Schmoker (2011) contend that technology initiatives, such as 1:1 programs, siphon time and energy away from the essential tasks of designing curriculum and implementing

well-crafted and purposeful lessons. Critics feel that 1:1 depletes already limited budgets and serves as a distraction that actually has a negative impact on student learning (Cuban, 2001).

School districts considering 1:1 implementation may do so without the promise of increased student achievement. A key reason some school districts are implementing 1:1 is to provide equitable access to technology for low income families (Penuel, 2006). There is a growing concern that low-income students lack access to technology outside of the school setting (Purcell, Heaps, Buchanan, & Friedrich, 2013; Thomas, 2008). The increasing use of technology in the educational setting could actually exacerbate inequalities for low income students. The increased use of technology at school can lead to activities requiring technology outside of the school day, ultimately leading to increased inequities in digital access (Hargittai, 2007; Warschauer, 2000). This is especially concerning given the amount of research documenting the effects of poverty on student achievement (Abbott and Joireman , 2001; Bolon, 2001; Milne & Plourde, 2006; O'Dwyer et al., 2005, 2008; Sirin, 2006; Stull, 2013).

Missouri schools are focused on ensuring that all students are college and career ready. Missouri's Department of Elementary and Secondary Education states "college and career ready means that students have the education they need for their futures" ("College and Career Ready", 2014, "para." 1). Providing needed access to technology is essential in preparing students to be college and career ready (Larson & Miller, 2011). The incorporation of a 1:1 initiative has the potential to impact college and career readiness, which is a chief goal of Missouri's Department of Education ("College and Career Ready", 2014).

School districts in Southeast Missouri reflect the nationwide interest in educational technology. Several districts in Southeast Missouri have invested heavily in 1:1 technology initiatives, while other districts are in the process of researching the impact 1:1 initiatives have

on student learning. This study seeks to further examine the impact that 1:1 technology initiatives have on student learning outcomes.

### **Statement of the Problem**

School districts across the nation are examining the role of technology in education. While 1:1 initiatives are gaining in popularity, they carry a steep price tag. The estimated cost to implement a 1:1 initiative can range from \$100-\$400 per student, per year (Rhor, 2014). It is natural for district leaders to question the impact investments in technology will have on student learning outcomes such as student achievement, and grade point average (G.P.A.).

### **Problem of Practice**

Educators across Missouri are concerned with student achievement scores, which are measured by state summative exams. Missouri is a state that has signed an ESEA Flexibility Waiver, commonly referred to as a NCLB waiver. In exchange for signing the waiver, states had to adopt college and career readiness standards (such as the Common Core), develop a plan to identify and improve the bottom 15% of schools; and create teacher and principal evaluation systems based on multiple valid measures, including student progress over time (McGuinn, 2011). Student achievement data in the State of Missouri is measured by the fifth version of the Missouri School Improvement Program (MSIP5). According to the MSIP 5 manual, MSIP 5 is the “state’s accountability system for reviewing and accrediting public school districts” (“MSIP5”, 2014, p. 2). Student achievement data comprises 40.4% of the State’s accreditation criteria (“MSIP5”, 2014). Driven by the requirements of the NCLB waiver and MSIP5, student achievement data is a considerable focus for Missouri educators. It is logical for school administrators to analyze the impact of a 1:1 initiative on student achievement.

## **Existing Gap in the Literature**

Current research examining the relationship between 1:1 initiatives and student learning outcomes yields mixed results. Most research related to 1:1 implementation and student outcomes is concentrated at the middle school level, while research related to 1:1 technology initiatives at the high school level (grades 9-12) is less robust. Additional research is needed to better understand the relationship between 1:1 initiatives and student achievement in the high school setting.

## **Purpose of the Study**

The purpose of this study is to determine how a 1:1 technology initiative will impact ELA learning outcomes for low socioeconomic (SES) 10<sup>th</sup> grade students. Low socioeconomic students will be defined in this study as students who qualify for the National School Lunch Program (“United State Department of Agriculture”, 2016). Student learning outcomes will be defined as standardized English Language Arts (ELA) scores, and ELA II course G.P.A. ELA scores are a focus of this study because ELA proficiency is important to all other subject areas. The ability to read and utilize effective written communication skills is vital to every academic subject currently assessed. While many factors impact student achievement, statistical analysis will control for gender and SES.

A focus of the study is to examine learning outcomes for students who are classified as low socioeconomic status (SES). If a linkage between positive student scores on state achievement tests and 1:1 is found, equity issues will exist between students that have access to technology, and students who are lacking access. The findings of this study will help district leaders analyze the impact of a 1:1 technology initiative, and how it could affect learning outcomes for students.

## **Research Questions**

The research questions guiding this study are:

- How do student English Language Arts (ELA) II end of course exam (EOC) scores in a high school fully implementing 1:1 technology compare to a high school not fully implementing 1:1 technology?
- How do lower SES student ELA II EOC scores in a high school fully implementing 1:1 technology compare to low SES students in a high school not fully implementing 1:1 technology?
- How does ELA II G.P.A for lower SES students in a high school fully implementing 1:1 technology compare to low SES students in a high school not fully implementing 1:1 technology?
- How do male and female student ELA II EOC scores in a high school fully implementing 1:1 technology compare to male and female students in a high school not fully implementing 1:1 technology.

## **Null Hypotheses**

- There is no statistical difference when comparing ELA II EOC scores in a high school fully implementing 1:1 technology and a high school not fully implementing 1:1 technology.
- There is no statistical difference when comparing lower SES ELA II EOC scores in a school fully implementing 1:1 technology and a school not fully implementing 1:1 technology.
- There is no statistical difference when comparing lower SES ELA II student G.P.A. in a school fully implementing 1:1 technology and a school not fully implementing 1:1 technology.
- The null hypothesis would find that there is no statistical difference when comparing male

and female student ELA II EOC scores in a high school fully implementing 1:1 technology and a high school not fully implementing 1:1 technology.

### **Conceptual/Theoretical Frameworks**

The Elementary and Secondary Education Act (ESEA) of 1965 was enacted to offer equitable educational opportunities to underprivileged children living in the United States (Thomas & Brady, 2005). Nicholas Kristof of the New York Times might have best encapsulated the vision of ESEA by stating, “the best escalator to opportunity in America is education” (2014, “para.” 1). The vision of ESEA was to provide an equitable education by ensuring “that all children have a fair, equal, and significant opportunity to obtain a high quality education” (No Child Left Behind [NCLB], 2002). While this is true in terms of the law, research finds that this is not the reality for impoverished Americans.

The Civil Rights ACT of 1964 was a precursor to ESEA. A requirement of the Civil Rights Act was to investigate inequalities of the American public school system (Hanushek, 1989). The investigation culminated in the release of a report by the U.S. Office of Education entitled *Equality of Educational Opportunity*, commonly referred to as the Coleman Report (Hanushek, 1989). While a chief goal of ESEA was to help provide an equitable education for impoverished students, the Coleman Report concluded schools have a minimal impact in determining student achievement. Family background factors were determined to have a greater impact on student performance than measurable school factors (Huang & Sebastian, 2015; Hanushek, 1989).

Poverty expert, Donna M. Beegle (2007), states a common myth in the United States is that higher education is an opportunity afforded to everyone. Those living in poverty have the most to gain from a college education, but are the least likely to become educated (Beegle,

2007). Those living in poverty not only struggle to access higher education, but are more likely to struggle in the P-12 setting as well (Beegle, 2007).

A meta-analysis by Sirin (2006) measured the relationship between student achievement and socioeconomic status (SES). Sirin found a strong relationship between achievement and SES at the school level. Many low SES students live in poor and unsafe neighborhoods that are inadequately funded by a local tax levy. Consequently, achievement suffers among low SES students (Sirin, 2006).

The relationship between student achievement and low SES students is similar at the district level. The Council of Great Schools (2001) found lower student achievement scores in districts with increased poverty. The amount of per-pupil spending on instruction and administration of a school district has been associated with higher student achievement. Wenglinsky (1997) states district spending allows for smaller class sizes, which raises student achievement scores. Bolon (2001) found a strong correlation between community income levels and student achievement. Community income can account for as much of 80% of the variance in average test scores (Bolon, 2001). Regardless of a student's individual SES, there is evidence that all students benefit from learning in an environment in which the SES of the group is high (Perry & McConney, 2010).

Stull (2013) found not only a linkage between SES and student achievement, there is also a linkage between parental expectations and student achievement. According to Stull (2013), expectations regarding academic achievement increases with family SES. In a study examining the relationship between student achievement, socioeconomic status, and ethnicity, socioeconomic status was found to be a much greater predictor of student achievement (Abbott and Joireman, 2001). Research (Abbott and Joireman, 2001; Bolon, 2001; Milne & Plourde,

2006; O'Dwyer et al., 2005, 2008; Sirin, 2006; Stull, 2013; Wenglinsky, 1997, 2005) documents the negative relationship between SES and academic achievement.

The relationship between SES and student achievement is so significant, efforts by schools to close the achievement gap for disadvantaged students might not be effective. The Coleman Report (Coleman et al., 1966) was the first to report that family factors were more impactful to student achievement than school factors. Hanushek (1989) studied the impact of per pupil expenditure on student achievement and determined school expenditures are not related to student achievement. This directly contradicts the efforts of ESEA to provide additional funding to low SES schools in hopes of providing equitable educational opportunities. An international study by Huang and Sebastian (2015) examined the impact of schools to close the achievement gaps perpetuated by socioeconomic status. Huang and Sebastian (2015) concluded that there is “isn't much support for concluding that schools in many countries are able to significantly bridge SES-based achievement gaps” (p. 520). A 25 country international study by Chudgar and Luschei (2009) also determined that schools are less influential than family influences in determining student achievement. However, Chudgar and Luschei (2009) found no evidence that schools are not an important influence. This observation seems to be solidified in the research of Reardon (2013), who noted the income achievement gap has grown significantly in the last 30 years, but clarified that this achievement gap already existed for low SES students when they entered kindergarten. Based on the findings of Reardon (2013) and Chudgar and Luschei (2009) there is evidence that schools might not be more impactful than family influences, but at a minimum, they help to not exacerbate the achievement gap for low-SES students.

While research examining the relationship between school interventions for low SES students and achievement is mixed, the expectations from the State of Missouri are clear. Public schools in Missouri are expected to help low SES students demonstrate proficiency as measured by state summative assessments. Public schools in Missouri are awarded accreditation points for low SES students who demonstrate academic proficiency (“MSIP 5”, 2015).

Low SES students living in impoverished school districts lack access to needed resources (Sirin, 2006). Limited access to needed resources includes restricted access to technology. Thomas (2008) found that students in low socioeconomic areas lack the same access to technology as higher SES students. Thomas’ study of low SES students in the Mississippi Delta determined a technology gap did exist for low SES students, particularly in the home setting. “Students in rural areas indicated they had less computer access, usage, and technology skills than peers living in middle or higher socioeconomic areas” (Thomas, 2008, p. 13). One reason for the disparity of access is the cost associated with high-speed Internet connectivity. While the cost of computer hardware has diminished, the cost of high-speed Internet can restrict access for lower income families (Farrell, 2005). Access to technology increases most rapidly at the highest family income levels, and most slowly for students in the lowest income levels (Martin & Robinson, 2007). A Pew research study (Purcell et al., 2013) found that teachers of the lowest SES students believe their students lack sufficient access to essential digital tools, both in school and at home. As a result, lower socioeconomic students have diminished technology skills in comparison to higher socioeconomic students.

Students that have access to a computer at home, before the age of 10, display superior technology skills than students that lack access (Ching, Basham, & Jang, 2005). DiMaggio and Hargittai (2001) state that even if additional technological resources are provided to low SES

students, resources may not be equitable. Students living in poverty may not have updated computers to run contemporary programs or web browsers, or may only have internet access at school or the public library. DiMaggio and Hargittai (2001) state a shift in focus from closing the “digital divide”, seeking to provide access to technology, to closing the gap in “digital inequalities” is needed. This shift includes understanding how technology should be utilized for instruction. Schools that contain high SES students utilize technology more frequently than lower SES schools to conduct research and analysis (Warschauer, Knobel, & Stone, 2004). Hargittai (2007) contends the differential spread in internet access could lead to increasing inequalities, benefiting those who have access and denying access to the underprivileged. There is a concern the increased use of technology in the educational setting can actually enhance inequities for impoverished students (Warschauer, 2000).

Research by Ching et al. (2005) found that gender also plays a role in the use of technology. It was determined gender, in addition to income level and race, are a predictor in technology use. Females, low SES students, and students of color are the most unprepared for the collegiate digital environment (Farell, 2005; Margolis & Fisher, 2001). Males who had home computer access before the age of 10 displayed higher levels of technology use than other demographics (Ching et al., 2005). Girls are more likely to learn computer skills at school, while boys are more likely to learn technology skills in the home setting (Shashaani, 1994). Two international studies supported these findings concluding males used computers outside of the school setting more frequently than females (Harris, Straker, & Pollock, 2013; Vekiri & Chronaki, 2008). Gender appears to be a predictor of technology use, with males using technology more frequently than females (Ching, et al., 2005; Harris, et al., 2013; Shashaani, 1994; Vekiri & Chronaki, 2008).

Studies (DiMaggio and Hargittai, 2001; Hargittai, 2007; Warschauer, 2000) state that simply providing access is not ensuring equity. Providing access to physical devices does little to address the challenges faced by low SES students (Warschauer, Knobel, & Stone, 2004). In addition to providing access; training on how to effectively utilize technological devices is needed. Penuel (2006) found that a 1:1 initiative can provide both access and training to ensure digital equity. Penuel's meta-analysis found that providing equitable access to digital resources was a goal of many 1:1 initiatives, and these initiatives ultimately led to improved technology literacy skills for students.

Providing equitable access to technology has the potential to improve technology skills for students across various demographics, including low income and female students. School districts across the nation are examining this critical issue to determine the benefits of providing a device to each student within a school or school district.

## **Design of the Study**

### **Setting**

A case study approach was utilized to examine two Missouri high schools, each located in the same county. It should be noted that the principal investigator is currently employed by a district examined in this case study. Smith High School (SHS) is in the third year of 1:1 implementation and has a student population of 1,102 students. SHS has a free and reduced lunch rate of 64.4% and is racially diverse. SHS's student body is comprised of 29.9% African American students while 58.8% are identified as Caucasian ("District Report Card", 2014). Clark High School (CHS) has a student body of 1053 students. The free-reduced lunch rate is 36.9% and the student body offers little racial diversity as 91.7% of CHS students are identified as Caucasian ("District Report Card", 2014). CHS currently does not promote a 1:1 technology

initiative, nor does CHS utilize a Bring Your Own Device (BYOD) initiative. A BYOD initiative utilizes the personal devices of students.

While the sites are not comparable demographically, SHS is the only school in the region currently utilizing a 1:1 initiative with comparable student enrollment numbers. Differences in demographics will be controlled by analyzing achievement outcomes of low SES students at each site.

### **Participants**

Participant sampling was determined by what Fink (2013) describes as stratified random sampling. The student body of SHS and CHS was divided into a subset of students that met the criteria for free and reduced lunch status. This subset of free and reduced lunch students was divided by male and female students. A minimum of 35 male and 35 female free and reduced lunch students were selected at random at both sites. Student learning outcomes were collected for each subset that measured: (a) student achievement data; and (b) student ELA II G.P.A.

### **Data Collection Tools**

Student outcome data was collected from both school sites. The data included student achievement data in the form of the ELA II EOC exams, and student ELA II G.P.A. The ELA II EOC state exam is administered to sophomores in the state of Missouri, and all students in the State are required to take the ELA II EOC (“LEA Guide”, 2014). Data was disaggregated by creating a sub group of students who qualify for free and reduced lunch status, but did not receive special education services. Student achievement data for low-income students is important to analyze as the State holds school districts accountable for ensuring low SES students show academic improvement to ultimately meet the required state standards (“MSIP5”,

2014). Student names were not used, but students in the free and reduced lunch status subgroup were assigned a numerical value in IBM SPSS to denote both the student's attendance center and gender.

### **Data Analysis**

Student outcome data was examined through quantitative analysis using IBM SPSS software. Using Field's *Discovering Statistics Using IBM SPSS Statistics* (2013) as a guide, an analysis of variance (ANOVA) was utilized to better understand the relationship between categorical predictors. Statistical analysis was utilized to determine the relationship between 1:1 technology implementation and ELA II student learning outcomes for low SES students in the high school setting.

Student learning outcome data was derived from a subset of students categorized at a lower socioeconomic status; determined by free and reduced lunch criteria. Data was also analyzed in SPSS to determine if gender had an impact on student outcome data, while controlling for 1:1 technology implementation.

A second phase of data collection was utilized to answer the first research question. To gain further insight into the impact of a one student one device initiative, ELA II EOC scale scores were reviewed for all 10<sup>th</sup> grade students at SHS and CHS. These scores were examined by conducting an analysis of variance (ANOVA) in SPSS. A review of ELA II EOC scores from 2012-2014 revealed that CHS has outperformed SHS. The three-year average for CHS ELA II EOC scores is 75.6% as compared to a 59.2% average for SHS ("Achievement Level Report", 2015). While there is currently an achievement gap in SHS ELA performance, analysis of achievement scores seeks to understand if the student achievement gap can be closed as a result of 1:1 implementation.

## **Limitations, Assumptions, and Design Controls**

To ensure validity of statistical analysis, a proper sampling size was included in the data collection. Data was collected for 70 free and reduced lunch students at each site, divided evenly by gender. Statistical significance was set at the .05 level. It should be noted this study analyzed data to determine the relationship between 1:1 technology implementation and ELA II student learning outcomes. Many factors impact student achievement including, but not limited to, the quality of instruction, curriculum design, and the fidelity of 1:1 technology implementation. While the study could not control for all of these variables, comparable data was collected by controlling for SES, special education status, and gender. Data analysis was also used to compare all ELA II scores at CHS and SHS.

## **Definitions of Key Terms**

### **1:1 Initiative**

*1:1 Initiative:* 1:1 technology initiatives have three distinct characteristics. 1:1 initiatives provide students with a portable device or computer, they enable access to the Internet through wireless networking, and they are focused on using devices to complete academic tasks (Penuel, 2006).

### **21st Century Skills**

*21st Century Skills:* The Partnership for 21st Century Skills is a framework of defined skills utilized by classroom instructors. The Framework of 21st Century Learning includes

- Life and career skills;
- learning and innovation skills;
- information, media, and technology skills;
- Core content and 21st century themes;

- and a support system for technology implementation that includes standards, assessments, curriculum, instruction, professional development, and 21st century learning environments (“Partnership for 21st Century Skills”, 2009).

### **Blended Learning**

*Blended Learning:* Blended learning couples online learning and classroom instruction. Blended learning allows students to have control of the time, setting, and pace of instruction (Tucker, 2013). Blended learning utilizes the benefits of an online environment with the support of traditional classroom instruction.

### **Bring Your Own Device Initiative (BYOD)**

*Bring Your Own Device Initiative:* Bring Your Own Device (BYOD) allows students to use a personal device to connect to the school’s wireless network (Ackerman & Krupp, 2012). Schools that lack sufficient funds to support a 1:1 initiative can supplement existing technology by allowing students to utilize their own device(s).

### **Digital Divide**

*Digital Divide:* A distinction between those that have access to the Internet and those that lack access. Specific attention and concern is given to those that lack access in urban and rural areas. (DiMaggio & Hargittai, 2001).

### **Low Socioeconomic Students**

*Ubiquitous Learning Environment:* Students that qualify for the National School Lunch Program are classified as low socioeconomic students (“United States Department of Agriculture”, 2016).

## **Ubiquitous Learning Environment**

*Ubiquitous Learning Environment:* A ubiquitous learning environment augments instruction with technology to provide access and information when and where desired (Aboud & Mynatt, 2000). 1:1 technology initiatives provide a ubiquitous learning environment by immersing students with access to technology.

## **Significance of the Study**

### **Practice**

The relationship between student achievement outcomes and 1:1 technology implementation will help serve as a guide to districts considering a 1:1 initiative, or to districts considering the extension of an existing 1:1 program. As the NCES (2012) statistics show, school districts are investing heavily in providing access to technology for students. 1:1 technology initiatives are expensive in nature, and costs exist outside of purchasing devices (Rhor, 2014). 1:1 initiatives require investments in technology infrastructure and additional staffing to provide technical support.

Technology initiatives are popular across the nation, and districts nation-wide are examining this critical issue. The Clark School District is no exception. The traditional belief in the Clark School District is many variables impact student achievement, and technology is one that will have minimal impact if not implemented properly. Consequently, the district is further behind in technology implementation than many surrounding schools. Examining the relationship between 1:1 implementation and student outcomes will help serve as a guide for the Clark School District to plan for technology implementation in the future.

## **Scholarship**

While there is an abundance of information regarding 1:1 implementation and student learning outcomes at the middle school level, a gap in research exists at the high school level. Research at the upper elementary and middle school level has documented a positive relationship with math and writing achievement. However, existing research is less conclusive regarding the relationship between 1:1 programs and overall ELA achievement. Additional research is also needed to better understand how technology programs can close the achievement gap for low SES students (Grimes & Warschauer, 2008). This study will examine the relationship between ELA II student learning outcomes and 1:1 implementation.

## **Summary**

It is essential that schools adequately prepare students to live and work in an ever changing and technology rich world (Larson & Miller, 2013). To provide students with 21st century skills, many school districts across the nation are implementing 1:1 technology initiatives (Penuel, 2006). 1:1 initiatives are gaining in popularity throughout the nation, and school districts across Southeast Missouri reflect this trend. Districts that have yet to adopt a 1:1 initiative are analyzing the effectiveness of these initiatives. The importance of understanding the connection between student achievement and 1:1 initiatives is significant, given that districts across Missouri operate under federal legislation that places emphasis on student achievement scores (House, 2013; McGuinn, 2011).

Districts should also seek to understand the relationship between low SES students and technology initiatives, such as 1:1. There is concern the expansion of technology in the educational setting can actually increase inequities for impoverished students (Hargittai, 2007; Warschauer, 2000). Low SES students lack the same access to technology as high SES students,

and as a result display diminished technology skills in comparison to higher socioeconomic students (Ching et al, 2005; Purcell et al., 2013; Thomas, 2008). This is concerning given that research (Abbott and Joireman, 2001; Sirin, 2005; Bolon, 2001; Stull, 2013) documents the negative impact poverty can have on student achievement.

SECTION TWO:  
PRACTITIONER SETTING FOR THE STUDY

School districts considering the adoption of a 1:1 initiative must do so with thorough analysis and planning. Change initiatives in a school setting need key resources if they are to be implemented with fidelity. Gansle and Noell (2009) concluded in a study of sustainable school change programs that three common components appear to contribute to implementation of new practices in the workplace: (a) effective programs reduce barriers by providing support to their staff by providing training, time, and other needed resources; (b) buy in is obtained from staff; and (c) effective programs provide environmental support by assessing implementation performance and providing feedback.

Technology initiatives, such as 1:1, need professional development and training for successful adoption and sustained use. Schools implementing 1:1 programs cannot simply distribute student devices and expect gains in student achievement (Holcomb, 2009). Devices need to be coupled with professional development, training, and support to effectively use technology for learning (Holcomb, 2009). According to a 2007 study by Dunleavy et al., high quality professional development is essential to ensure effective teaching practices in a 1:1 initiative. Professional development can not only help teachers build the requisite technological skills for a 1:1 initiative, but can help educators develop a philosophical belief that educational technology is beneficial (Donovan, Green, & Hansen, 2009).

Leadership at the building and district level is critical in ensuring necessary resources and support is provided. A review of both sites will yield a better understanding of the structure and leadership of each organization.

## **History of Organizations**

Two Missouri High Schools, Smith High School (SHS) and Clark High School (CHS) will be the focus of this study. CHS and SHS, like all schools in the State of Missouri, are evaluated by the Missouri School Improvement Program (MSIP 5). MSIP 5 is the “state’s accountability system for reviewing and accrediting public school districts (“MSIP 5”, 2014, p. 2). The Missouri Department of Elementary and Secondary Education (DESE) annually reviews schools throughout the State and computes an Annual Performance Report (APR) score for each school and school district based on five distinct criteria. The five criteria used by MSIP 5 are (a) academic achievement, (b) subgroup achievement (subgroups of students who perform below the state average), (c) college and career readiness, (d) attendance, and (e) graduation (“MSIP” 5, 2015).

The process of annually evaluating Missouri schools, and school districts, has placed an emphasis on the five criteria used by MSIP 5. Consequently, Missouri school districts use APR scores to help guide school improvement. Technology has the potential to impact three of these criteria (a) academic achievement, (b) subgroup achievement, and (c) college and career readiness. Each site in the study will explore 1:1 as a strategy to improve APR scores, specifically in the area of student achievement and college and career readiness.

### **Academic Achievement**

While additional research is needed to better understand student achievement outcomes associated with 1:1 implementation (Penuel, 2006), existing research finds a positive correlation between 1:1 implementation and student achievement (Bedell & Kay, 2010; Gulek & Demirtas, 2005; Kposowa & Valdez, 2013; O’Dwyer et al., 2005). 1:1 technology initiatives have also increased active learning and student engagement (Lowther et al., 2003). Improved student

writing skills have also been associated with 1:1 implementation (Goldberg, Russell, & Cook, 2003; Lowther, Ross, & Morrison, 2003; O'Dwyer, et al, 2005; Silvernail & Gritter, 2007).

While schools are examining strategies to improve student achievement scores, students classified into underperforming subgroups require additional attention. MSIP 5 monitors students who fall into subgroups that historically underperform on the state assessment, and awards specific points for subgroup achievement in APR calculation ("MSIP 5", 2015). Consequently, schools and school districts develop strategies to bolster academic performance for subgroup students. A review of APR scores for CSD and SSD reveals growth opportunities for subgroup achievement. In 2014, CSD obtained an APR score of 78.6% for subgroup achievement. CHS obtained a healthy score of 92.9%, but failed to gain all APR points in the standard of subgroup achievement ("APR: School Summary Report", 2014). Subgroup scores for SSD have more room for improvement as the district obtained only 67.9% of possible APR points, while SHS obtained 82.1% of possible APR points for subgroup achievement ("APR: School Summary Report", 2014).

1:1 initiatives have demonstrated improved academic success for low SES students (Grimes & Warschauer, 2008), and have helped at-risk learners by facilitating personalized learning opportunities and bolstering student engagement (Beyth-Marom, Saporta, & Caspi, 2005; Cardon, 2000; Edmonds & Li, 2005). Driven by the need to demonstrate continual improvement with MSIP 5, Missouri school districts are examining 1:1 implementation to determine if a technology initiative can have a positive impact on student achievement scores.

## **College and Career Readiness**

College and career readiness is a key focus of MSIP 5, and consequently, an important goal of any school district in Missouri. DESE states “college and career ready means that students have the education they need for their futures” (“College and Career Ready”, 2014, “para.” 1). Some Missouri school districts are exploring 1:1 implementation to impact college and career readiness; a chief goal of DESE (“College and Career Ready, 2014). Providing access to technology is essential in preparing students to be college and career ready (Larson & Miller, 2011).

The term 21st century skills is frequently used in education, and the Partnership for 21st Century Skills has created a framework of defined skills. These skills work in conjunction with classroom instruction and academic content standards (Partnership for 21st Century Skills, 2009). There is a need to ensure students receive instruction and guidance in developing 21st century skills as education is the least technology focused industry in the United States (Vockley, 2008).

Current research does find a correlation between 1:1 implementation and increased technology skills. 1:1 initiatives have improved student technology proficiency (Lei & Zhao, 2008; Shapley et al., 2001; Warschauer, et al., 2014), increased student confidence in research and software skills (Lowther, et al., 2003) and enhanced access and research opportunities for students (Bebell & Kay, 2010). As Missouri school districts review APR scores and discuss improvement strategies focused on college and career readiness; instruction and accessibility to technology is critical to college and workforce readiness (Larson & Miller, 2011). Both sites are driven to better understand how 1:1 will impact APR scores. 1:1 has the potential to impact three key areas as measured by MSIP 5. Organizational structure, as well as district and school

leadership, will play a critical role in providing the necessary resources for a sustained 1:1 program.

## **Organizational Analysis**

### **Clark High School**

Clark High School (CHS) is located in Missouri and has a student body population of 1053 students. The student body has little diversity as 91.7% of CHS students are identified as Caucasian and the population has a relatively low free-reduced lunch rate of 36.9% (“District Report Card”, 2014).

Stability has been a trademark of the Clark School District (CSD) and CHS. All CHS building administrators have at least 5 years’ experience in their current role. The current building principal has held this position for the past 8 years, and previously served as an assistant principal at CHS. Similarly, all central office administrators are veterans of the district with a minimum of 8 years administrative experience in the district. Longevity in district leadership positions has resulted in fiscal stability, allowing the district to invest in facilities and infrastructure. The opening of a new elementary school in 2015 and the renovation and expansion of the senior high campus in 2010 best exemplify the growth of the school district. While the district facilities plan has recently been upgraded, technology access is currently limited at CHS as the school does not utilize a 1:1 technology initiative or a Bring Your Own Device (BYOD) initiative.

### **Smith High School**

Smith High School (SHS) is a Missouri high school that is in many ways the antithesis of CHS. SHS has a free and reduced rate of 64.4% and is racially diverse. SHS’s student body is 29.9% African-American, while 58.8% are identified as Caucasian. SHS has a student

population of 1,102 students and is in the third year of 1:1 implementation (“District Report Card”, 2014).

While CSD maintained the same superintendent for 16 years, SSD had 4 different superintendents during this time. However, there has recently been a consistent presence in the district’s top leadership spot. SSD’s current superintendent has held this spot for the past 8 years. With stability at the top leadership position, the district has focused on the structural framework (Bolman & Deal, 2008). This has taken many forms, but included strategic facilities planning, and a focus on K-12 curriculum and instruction. A large instructional focus of SSD has been the 1:1 technology initiative at SHS. The district has invested in additional staff to provide professional development and training. Additional investments have been made to technology infrastructure, and providing devices to each student at SHS. Investments in technology infrastructure and providing professional development were key reasons SHS was selected as a case site for this study. Providing training and professional development is essential for successful 1:1 implementation (Dunleavy et al., 2007; Holcomb, 2009). Previous visits and observations at SHS noted the impact of professional development and the implementation of instructional strategies utilizing technology, particularly in ELA classrooms.

### **Leadership Analysis at CHS**

There has been a recent change in district leadership at CSD. The superintendent of 16 years retired at the end of the 2014-2015 school year. The district focus until the 2015-2016 school year centered on facilities upgrades and curriculum and instruction. Technology was not ignored, as facility upgrades and new construction were built to include a modern technology infrastructure. However, technology was not a district priority as the Superintendent was reluctant of 1:1 technology initiatives and the associated costs.

Because of the reluctance to adopt 1:1 technology, or incorporate BYOD, CHS is a unique case site. Stable leadership within CSD also make it unique, as many administrators within the district have more than 5 years' experience. The current principal at CHS has been in this position for 9 years, and worked at the school prior to accepting the building principal position. While there is currently a new superintendent at CSD, the district contains many top-level leaders with the experience necessary to consider and support a 1:1 initiative. Gansle and Noell (2009) state that providing a system of support is crucial for a successful change initiative, and CSD's stable leadership has the experience and capacity to provide the requisite support.

### **SHS Leadership**

The SSD superintendent has served in this role for the past 8 years, and is the fourth superintendent at SSD over the past 16 years. The principal at SHS served in this role for the past 14 years and retired at the end of the 2014-2015 school year. Both leaders had a wealth of experience and knowledge of the school district, which was critical in providing a support system needed for successful 1:1 implementation.

SSD leaders worked to implement 1:1 at SHS by forming a technology committee that involved community members, parents, faculty members, and school and district administrators. The committee worked together to decide on the timeline for implementation, the selection of a student devices, and discussed necessary support components. Ultimately, support components included the hiring of additional staff. These additions included the hiring of an instructional technology facilitator to provide professional development, and the hiring of additional technology support staff to help make repairs to student devices. Professional development was provided over the summer months and extended into the fall semester. This allowed the staff at SHS to become acquainted with the software and hardware utilized for the 1:1 initiative.

## **Implications for Research in the Practitioner Setting**

School districts across the nation are currently implementing 1:1 initiatives (Penuel, 2006). These initiatives can be costly (Rhor, 2014), and examining the relationship between 1:1 and student achievement scores is important. Missouri school districts are held accountable for student achievement and student subgroup achievement as measured by MSIP 5. A better understanding of the relationship between 1:1 implementation and student achievement is needed (Grimes & Warschauer, 2008; Penuel, 2006).

The lack of access to technology for low SES students is a growing concern for educators (Purcell, Heaps, Buchannan, & Friedrich, 2013; Thomas, 2008). The increased use of technology in the classroom has the potential to actually exacerbate inequalities for low SES students (Hargittai, 2007; Warschauer, 2000). Gender is also a predictor of technology use as females are more likely to learn technology skills at school (Shashaani, 1994) and males are more likely to use computers outside the school setting (Harris, Straker, & Pollock, 2013; Vekiri & Chronaki, 2008). 1:1 initiatives have the potential to provide digital access to low SES and female students. Additional information related to the impact of increased technology access for subgroup populations is a key consideration for district leaders considering 1:1 implementation.

Understanding the relationship between 1:1 implementation and student learning outcomes will help district leaders prepare and plan for 1:1 adoption. The findings of this study, coupled with multi-frame thinking (Bolman & Deal, 2008) can help district leaders ultimately build support for 1:1 adoption. The structural frame can assist districts through a systematic approach of preparation. Key considerations could include: (a) funding; (b) analyzing staffing needs; (c) reviewing the district's infrastructure; and (d) selecting the correct device. Political considerations help to ensure support from key stakeholders, such as the school board and the

business community. The human resources frame allows district administrators to hire new staff members who fit the innovative culture of a district seeking to implement 1:1. New and current staff members will also need sustained professional development. Finally, investing in technology and facilitating an innovative culture can help serve as a motivator to teachers. Allowing teachers the freedom to be innovative through the use of technology can excite and motivate teachers.

### **Summary**

School and district leaders must be prepared to meet the unique and significant challenges of 1:1 implementation. 1:1 adoption requires school leaders to be organized and proactive in planning. This requires leaders to provide their staff with needed resources, a sound digital infrastructure, and sustained professional development. Creating a culture that embeds technology into daily instruction is a significant challenge of schools adopting 1:1.

School change is a complex topic, and although a 1:1 initiative might have many benefits, it can often encounter resistance. A primary reasons schools encounter resistance to change is these initiatives involve behavior change (Gansle & Noelle, 2009). People are comfortable with the existing culture, and the existing culture helps provide an environment in which staff and students feel they can function and be productive. School and district leadership can combat resistance to 1:1 implementation by providing resources, training, and by creating a collaborative culture based on open communication. Teams that establish trust, and feel comfortable stating opinions, will communicate honestly about frustration; ultimately leading to problem-solving conversations (Levi, 2014).

1:1 implementation has the potential to impact student learning outcomes in a positive manner. However, this positive impact is dependent on school and district leaders to provide

needed resources in a collaborative school setting. Both school districts have unique challenges. CSD is exploring a possible 1:1 adoption, while SSD is focused on maintaining and improving a 1:1 initiative. Administrators in each district understand the need to build a positive school culture that will support 1:1 implementation.

SECTION THREE:  
SCHOLARLY REVIEW FOR THE STUDY

## Introduction

Technology initiatives have advanced rapidly since the mid- 1990's (Gulek & Demirtas, 2005). These initiatives include 1:1 programs that provide each student in a school setting with a device, such as a laptop or tablet. The earliest 1:1 initiatives took place in the mid-1990's with Microsoft's *Anytime Anywhere Learning Project* being the most visible of it's time. The *Anytime Anywhere Learning Project* had 52 participating schools in 1997. The program expanded to 800 schools and 125,000 students and teachers by 2000 (Gulek & Demirtas, 2005; Penuel, 2006). Eventually, individual school districts, such as the Beaufort County School District (South Carolina), implemented 1:1 programs. Beginning in 1997, the Beaufort School District provided 300 sixth grade students with their own laptop computer. The use of computers in the classroom increased for both students and instructors (Stevenson, 1999).

In the fall of 2002 the State of Maine implemented a 1:1 initiative by providing all 7th & 8th grade students and instructors with laptop computers. 100,000 students and teachers participated in the 1:1 initiative by 2007 (Silvernail & Gritter, 2007). In 2003, The State of Texas embarked on a similar initiative by establishing the Technology Immersion Pilot. This initiative spent more than \$20 million to immerse high-need middle school students in a technology rich environment (Shapley, Sheehan, Maloney, & Carnikas-Walker, 2011). Michigan initiated a similar program called the Freedom to Learn One-to-One initiative. The chief goals of the Freedom to Learn initiative was to gain 21st century knowledge and skills while increasing academic achievement (Lowther, Inan, Ross, & Strahl, 2012). Large scale 1:1 programs are also being implemented across the nation in South Dakota, Pennsylvania, New Hampshire, Georgia, Louisiana, California, Virginia, Florida, Kansas, and Massachusetts (Bedell & Kay, 2010).

School districts across the United States continue to invest heavily in technology. According to The National Center for Education Statistics (NCES); student to device ratios have improved dramatically from the ratio of 6.6 devices per student in 2000, to a ratio of 3.1 devices per student in 2008 (NCES, 2012). Shrinking student to device ratios and the adoption of large scale 1:1 programs point to a growing interest in utilizing technology for classroom learning. School districts have initiated 1:1 initiatives to bolster academic achievement, afford equitable access to digital resources, and to transform the quality of classroom instruction. Other initiatives, such as Maine's 1:1 initiative hope to bolster regional economies by better preparing students for a workplace rich in technology skills (Penuel, 2006).

Growing interest nationally in 1:1 initiatives have come at a cost, and these costs are substantial. More than 10 billion dollars have been spent by local and state agencies on technology integration in the classroom, with the federal government spending an additional three billion on educational technology (O'Dwyer, Russell, Bebell, & Tucker-Seeley, 2005). With heavy investment in time and financial resources, policymakers are looking to determine the impact that 1:1 initiatives have on student learning. Research related to the impact of 1:1 initiatives on student achievement, technology skills, and equitable access to technology will be discussed and reviewed in this scholarly review of literature.

### **Student Achievement**

Due to the large financial investment needed to support a 1:1 technology initiative, many institutions are examining how these programs impact student learning outcomes. (Penuel, 2006). 1:1 initiatives have been found to have a positive impact on student achievement scores. Gulek and Demirtas (2005) found an increase in student achievement including cumulative grade point averages (GPAs), end of course grades, writing scores, and state mandated standardized

test scores. Bebell and Kay (2010) found that students participating in a 1:1 initiative were more engaged, demonstrated improved research skills and made gains in standardized ELA test scores. The school district of Mooresville, N.C. implemented a 1:1 initiative in 2007. The Mooresville initiative included students in grades 3-12. Since implementing 1:1, Mooresville has noted a 20% increase in the core subjects of English, Math, and Science as measured by state summative assessments. It should be noted that this increase in student achievement occurred at the same time the district's free and reduced lunch rate increased by 9% (Quillen, 2011). Case studies by Kposowa and Valdez (2010) and Light, McDermott, and Honey (2002) noted a positive relationship between ubiquitous access to laptop computers and improvements in standardized ELA and math scores.

A prominent research study examining the impact of technology in K-12 education was Project RED (revolutionizing Education). Project RED surveyed nearly 1,000 schools to better understand the impact of technology initiatives on student learning outcomes. The outcomes included factors such as dropout rates, discipline reports, and student achievement scores ("Project RED", 2015). The results of Project Red "indicate that schools properly implementing 1-to-1 programs achieve more educational success than schools with higher student-to computer ratios" (Devaney, 2010, p. 10). The key findings of Project RED include

- Positive outcomes are dependent on technology implementation;
- properly implemented technology saves money;
- schools employing key implementation factors outperform all other schools and all 1:1 schools;
- principal leadership is critical;
- the use of technology to provide targeted interventions improves learning;

- online collaboration increases productivity and student engagement; and
- technology must be used daily (“Project RED”, 2015, Findings).

The findings from Project RED are exciting for institutions looking to justify a shift to 1:1.

However, it should be noted that RED was sponsored by several prominent technology companies including Intel, Hewlett-Packard, and SMART technologies. (“Project RED”, 2015).

The validity of findings for Project RED have also been questioned as the conclusions are based on data yielded from a self-reported survey, and the accuracy of the data was not verified (Sells et al., 2012).

Writing proficiency has been shown to increase through the implementation of a 1:1 initiative (Goldberg, Russell, & Cook, 2003; Jeroski, 2008; Lowther, Ross, & Morrison, 2003, O’Dwyer, et al., 2005; Silvernail & Gritter, 2007). A meta-analysis of research studies from 1992-2002 by Goldberg, Russell, and Cook (2003) concluded that students, who used computers to write, produced higher quality written work in both length and quality. In a later research synthesis of 1:1 studies, Penuel (2006) reported evidence of improved writing skills associated with 1:1 initiatives. A review of Maine’s Middle School Laptop Program concluded that while there was no overall increase in state test scores, students did display improved writing skills when comparing the state’s written test scores from 2000 and 2005 (Silvernail & Gritter, 2007). Peace River North School District’s 1:1 initiative in British Columbia also noted improved student writing proficiency that was statistically significant (Jeroski, 2008). A case study of three laptop programs by Warschauer, Zheng, Niiya, Cotten and Farkas (2014) found that, “70% of students reported that they wrote more with their laptops, and 64% of students agreed that laptop use improved the quality of their writing” (p. 52).

Studies have found a link between how technology is utilized for classroom instruction and achievement. Improved student writing scores were noted when technology was utilized to compose and edit papers. Lower ELA outcomes were found when students primarily used technology to prepare presentations (O'Dwyer et al, 2005). This is somewhat contradicted by Grimes and Warschauer (2008), who found 1:1 initiatives to facilitate more student centered activities and writing opportunities, but did not find a significant change in ELA achievement. Ironically, math scores increased, although most instruction focused on ELA and writing activities (Grimes & Warschauer, 2008). A study by Shapley et al. (2011) found no statistically significant differences in academic achievement for 1:1 students, but did find positive learning outcomes in the areas of student engagement and increased technology skills. Increased engagement has led to more student interest in technology, and in turn, higher levels of student motivation (Madrazo, 2011).

While 1:1 proponents tout improved student achievement, writing and technical skills, critics view these claims as unsubstantiated (Weston & Bain, 2010). 1:1 critics point to early technology programs that yielded inconsistent or statistically insignificant results measuring academic achievement. One such study, an evaluation report of Georgia's Athens Academy, concluded that there was little to no quantitative evidence of improved academic performance and achievement. This evaluation was a four year study of a laptop adoption program in grades 7-10 (Hill & Reeves, 2004). At least one study (Vigdor & Ladd, 2010) noted a statistically significant negative impact on ELA and Math achievement scores when additional access to home computer technology and high-speed internet service was provided. Vigdor and Ladd (2010) focused on the disparities of home computer access for low socioeconomic students. The

study concluded that improved access to technology would have a negative impact on student achievement by serving as a distraction that crowded out study time at home.

Simply providing a computer to all students will not necessarily improve student learning. Penuel (2006) found that many 1:1 initiatives focused on transforming instruction to be more student centered. Dextert, Dunleavy, & Heineket (2007) determined that a 1:1 initiative has the potential to provide a value added education by promoting formative assessment, individualized instruction, self-paced instruction, and the capacity for students to interact and collaborate online. Lowther, Ross, and Morrison (2003) noted improvements in student engagement and attentiveness in comparison to control students learning without the aid of a personal technology device. A three year study of the New Mexico Laptop Learning Initiative found that students were more engaged in classwork because creative and collaborative lessons were utilized by teachers when equipped with laptops in the classroom (Rutledge, Duran, & Carroll-Miranda, 2007)

The use of technology in the classroom can improve motivation and interest levels for students who have an interest in technology. However, this will not necessarily lead to increased academic achievement (Granito & Chernobilsky, 2012). While technology has the potential to better engage and motivate students who have an interest in technology, students with no interest will still benefit from traditional instructional methods (Granito & Chernobilsky, 2012). 1:1 initiatives have demonstrated a decrease in classroom discipline problems, which in turn may promote increased student engagement (Shapley et al., 2011). Laptop initiatives have been associated with facilitating a student-centered learning environment that develops high order thinking skills in a low SES school (Kemker, Barron, & Harnes, 2007). The use of technology in the classroom can provide student-centered and value added learning opportunities that improve

student engagement and motivation. (Bedell & Kay, 2010; Dextert, Dunleavy, & Heinecket, 2007; Gecer & Funda, 2012; Granito & Chernobilsky, 2012; Grimes & Warschauer, 2008; Lowther, 2003; Penuel, 2006; Rutledge, Duran, & Carroll-Miranda, 2007; Shapley, et al., 2011).

It should be noted that while 1:1 initiatives can promote a value added learning environment, program implementation plays a prominent role in adding value to classroom instruction. The quality of computer work appears to exceed the quantity of computer work. (Wenglinsky, 2005). Dextert et al. (2007) found that the addition of technology did not automatically add value to classroom instruction, and noted the importance of professional development to ensure effective teaching practices. Hill and Reeves (2004) found the adoption of learner centered pedagogical practices to be a challenge of laptop initiatives. Professional development is a key component for any school undergoing a technology initiative , and teachers will need time to explore how new technological resources can complement traditional instructional practices and pedagogy (Corn, Tagsold, & Patel, 2011; Drayton, Falk, Stroud, Hobbs & Hammerman, 2010). In addition to teacher training, the selection of devices and attention to technology infrastructure are important considerations for districts implementing 1:1 initiatives (Warschauer,et al., 2014).

### **Technology Skills**

While technology skills are not directly related to student achievement, student proficiency in the area of technology is essential to college and workforce readiness (Larson & Miller, 2011). Schools looking to implement a 1:1 initiative may do so to adequately prepare students for life in a technology rich culture (Penuel, 2006). Research does find a correlation between 1:1 implementation and increased technological skills in comparison to students who are not in a 1:1 environment (Bedell & Kay, 2010; Corn, Tagsold, & Patel, 2011; Kereluik, Mishra, Fahnoe, &

Terry, 2013; Lei & Zhao, 2008; Lowther, 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011)

Larson and Miller (2011) reviewed The Partnership for 21st Century Skills, an advocacy group promoting technology skills in education. The term 21st century skills is used often in education, and The Partnership for 21st Century Skills is a framework of defined skills utilized by classroom instructors. The use of technology to access information is a needed skill for 21st century students (Kereluik, Mishra, Fahnoe, & Terry, 2013). The Framework of 21st Century Learning includes

- Life and career skills;
- learning and innovation skills;
- information, media, and technology skills;
- Core content and 21st century themes;
- and a support system for technology implementation that includes standards, assessments, curriculum, instruction, professional development, and 21st century learning environments (“Partnership for 21st Century Skills”, 2009).

There is a need to ensure that today’s students develop 21st century skills as “education is the least technology-intensive enterprise in a ranking of technology use among 55 US industry sectors” (Vockley, 2008, p. 2). The Partnership for 21st Skills, the International Society for Technology in Education (ISTE), and the State Educational Technology Directors Association (SETDA) collaborated to address the issue of preparing students for a digital world (Vockley, 2008). This collaborative effort implores educational leaders to use technology comprehensively to develop 21st century skills, support teaching and learning, and to create robust education support systems (Vockley, 2008).

In a study of 1:1 initiatives in western Massachusetts, Bedell and Kay (2010) found that students frequently used the internet to access information in the school setting. Ultimately, enhanced access to technology provided students additional research opportunities. 1:1 programs have helped students develop increased levels of confidence in the areas of research and software application skills (Lowther, et al., 2003). Students immersed in a 1:1 initiative have demonstrated growth in technology proficiency (Lei & Zhao, 2008; Shapley et al, 2001). A study by Silvernail, Small, Walker, Wilson, and Wintle (2008) demonstrated that student use of technology does improve 21st century skills. However the study by Silvernail et al. (2008) concluded that students must receive instruction related to 21st century skills to show improved proficiency in these skills. This study provided an intervention related to evaluating digital content to experimental groups of students, and evaluated a control group of students who did not receive the intervention. The experimental group of students outperformed the control group at a statistically significant level. This is noteworthy considering some control group students were participating in a statewide 1:1 initiative (Silvernail et al., 2008). In addition to demonstrating improved technology skills, 1:1 initiatives provide students with opportunities to learn and demonstrate “digital citizenship”. 1:1 students are “learning how to behave appropriately in a digital world” (Corn, Tagsold, & Patel, 2011, p. 17). Warschauer, et al. (2014) found that the percentage of students who described themselves as very proficient with technology increased as a result of participation in a 1:1 program. 1:1 programs have not only demonstrated increased technology skills for students, but have also impacted 21st century skills for instructors as well. Teachers in a 1:1 environment have displayed greater technological confidence, allowing them to model 21st century skills in the classroom (Lowther et al., 2012).

## **Equity**

Providing equitable access to digital resources is a goal of many 1:1 programs (Penuel, 2006). This is important as many students identified as at-risk are most vulnerable to the digital divide (Madrazo, 2011). There is evidence that a 1:1 initiative can indeed close the proficiency gap in technology skills for economically disadvantaged students (Shapley, et al., 2011). Early evaluations of laptop programs emphasized a need for equality. Results from these early evaluations suggested that home access to technology helped explain variances in student technology skills (Penuel, 2006). A 2008 case study by Grimes and Warschauer compared state assessment scores of two California K-8 schools. Second year program results indicated that low SES students made significant gains in mathematics test scores in comparison to high SES students. It should be noted that while improvements were demonstrated in math scores, the majority of laptop use targeted ELA instruction. Page (2008) found that technology enriched classrooms improved mathematics scores for low SES students, while also improving self-esteem. Technology has enabled at-risk learners to achieve academic success by working at an individualized pace and improving student engagement (Cardon, 2000; Edmonds & Li, 2005). While technology can help bolster student achievement for at-risk learners, not all at-risk learners are ready to manage the responsibilities and independence afforded by online learning (Edmonds & Li, 2005). Grimes and Warschauer (2008) conclude that additional research is needed to “support hopes for laptop programs to help close the achievement gap between low and high SES students” (p. 328).

Ally and Samaka (2013) provided a different perspective on digital equity. With 5.3 billion mobile subscriptions worldwide, they contend that digital hardware is being provided to many through the use of cell phones. However, while many students have access to a device, equitable

access to learning resources is found to be lacking. Ally and Samaka (2013) contend there is a shift from providing hardware, to providing access to learning resources at low or no cost. The use of technology opens up learning opportunities that can have a positive impact on student learning. One such learning opportunity is the use of online tutoring to provide supplemental instruction for schools with limited resources. Online supplemental reading instruction has demonstrated improved student reading fluency (Vasquez, Forbush, Mason, Lockwood, & Gleed, 2011).

Technology not only provides a resource for online tutorial opportunities, it can also provide an avenue for self-paced and individualized instruction. The Summit Public School District in San Jose, CA is using technology to provide blended-learning mathematics instruction. This allows students the opportunity to benefit from traditional instruction, while receiving individualized instruction using Khan Academy (Childress & Benson, 2014). Whittemore Park Middle School in Conway, SC is also using technology to help provide individualized instruction. Whittemore Park consists of mostly low SES students, who traditionally have scored low in academic achievement. To combat low student achievement scores the school is grouping students by skill level, rather than grade-level. This is achieved by delivering most instruction in a digital format based on the need and achievement level of each student (Childress & Benson, 2014).

If technology skills are essential for college and workforce readiness, students that lack access to both devices and wireless connectivity may be at a significant disadvantage. Research concludes that there are positive outcomes associated with ubiquitous access to technology for low SES students (Ally & Samaka, 2013; Grimes & Warschauer, 2008; Penuel, 2006; Shapley, et al., 2011; Vasquez et al., 2011).

## **Conclusion**

Institutions looking to implement a 1:1 initiative are interested in understanding how these programs will impact student achievement (Penuel, 2006). A review of existing research on this topic yielded mixed results. Some studies have found a positive correlation between 1:1 technology implementation and student achievement (Bedell & Kay, 2010; Gulek & Demirtas, 2005; Kposowa & Valdez, 2013; O'Dwyer, et al., 2005). Others studies (Grimes & Warschauer, 2008; Hill & Reeves, 2004; Shapley et al., 2011; Silvernail & Gritter, 2007) found that 1:1 implementation does not produce statistically significant improvements in student achievement. It should be noted that an overall lack of research in measuring student outcomes was noted by Penuel (2006). While it is important for policymakers to understand the relationship between 1:1 implementation and student achievement, there are other factors to consider.

There is evidence supporting the use of 1:1 programs to create a student centered learning environment (Grimes & Warschauer, 2008). A study by Dextert et al. (2007) found that 1:1 classrooms are more interactive, help foster self-paced learning opportunities and afford opportunities for students to collaborate. Students also seem to be more engaged and have taken a more active role in learning through the use of 1:1 implementation (Lowther et al., 2003; Shapley et al., 2011).

Numerous studies have concluded that 1:1 programs are effective in helping students gain needed technology skills in the 21st century (Bedell & Kay, 2010; Kereluik, Mishra, Fahnoe, & Terry, 2013; Larson & Miller, 2011; Lei & Zhao, 2008; Lowther, 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011). There is solidarity in the findings of current research related to 1:1 programs and technology skills. Research also consistently associated improvements in

student writing with 1:1 implementation (Goldberg, Russell, & Cook, 2003; Lowther, Ross, & Morrison, 2003, O'Dwyer, et al., 2005; Silvernail & Gritter, 2007).

While improved writing and technology skills have been associated with 1:1 implementation, there are concerns regarding equitable access to technology for all students (Thomas, 2008). Studies have found that improved access to technology might help close the achievement gap for low SES students. Online reading instruction can help students improve oral reading fluency (Vasquez et al, 2011), while also offering opportunities to personalize instruction (Beyth-Marom, Saporta, & Caspi, 2005). Findings from project RED indicate that 1:1 schools utilizing technology to personalize instruction have noted increased student achievement scores (Devaney, 2010). Grimes and Warschauer (2008) also noted improved math scores for low SES students in the second year of a laptop program. However, this study did note that additional research is needed to support a relationship between laptop programs and improved achievement for low SES students.

A multitude of studies document the positive relationship between 1:1 implementation and improved technology and writing skills. Studies measuring student learning outcomes, such as academic achievement, are less robust and definitive in their findings. Additional research is needed to understand the impact of 1:1 initiatives and student achievement (Grimes & Warschauer, 2008; Penuel, 2006). Most research studies that measured the impact of 1:1, and how it relates to student achievement, utilized case studies at the upper elementary or middle-school level. Additional research is needed to not only determine the impact of 1:1 on academic achievement, but specifically, the relationship between 1:1 and student achievement at the high school setting.

Thomas Friedman (2005) stated in his bestselling book, *The World is Flat*, that the United States is part of a global marketplace. Consequently, graduates in the United States are now competing for jobs worldwide. Technology has allowed companies to hire from a global pool of qualified candidates, resulting in a very competitive job market. School districts have the responsibility to ensure all students are college and career ready. To fully equip students with the skills to compete in a global economy, it is important for policymakers to understand how to best utilize technology in the school setting. It is a goal of this research study to help school policymakers better understand the relationship between student outcomes and 1:1 implementation.

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SECTION FOUR:  
CONTRIBUTION TO PRACTICE

## Technical Report for the Integrated Technology Action Team

The Jackson R-2 School Board held a regularly scheduled meeting on January 12, 2016. A presentation by Cambridge Strategic Services was an agenda item for the meeting. Cambridge delivered a presentation to outline a strategic action planning process for the district (“January Board Minutes”, 2016). The proposal for strategic planning was approved at the next board meeting on February 9, 2016 (“February Board Meeting”, 2016). The result of board approval was the formation of a strategic action committee. The committee consisted of 32 people and was comprised of school administrators, teachers, support staff, school board members, parents and community members. The strategic planning committee met on three different dates and ultimately drafted a mission statement. The mission statement reads:

“The Jackson R-2 School District, a gateway to infinite possibilities and a community rich in tradition and excellence, promotes as its mission to graduate life-ready, service motivated citizens with a passion for life-long learning by:

- Igniting innovation within an evolving digital world
- Customizing successful, dynamic, individual learning experiences
- Transferring wisdom and support from parents, educators, community members and other partners in education
- Encouraging and engaging students in personal, social and civic responsibility
- Ensuring a safe and secure learning environment for all students and staff (“Strategic Plan”, 2016, “Mission Statement”).

Following the creation of a mission statement, the planning committee focused on creating five strategies to carry out action planning. The five themes that emerged were (a) instructional

learning networks, (b) learning environments and facilities, (c) integrated technology, (d) service, responsible citizens, partnerships and the whole child, and (e) fiscal responsibility. This technical report is focused on the theme of integrated technology and will review current research related to 1:1 implementation. It will also include a summation of current research by the author pertaining to 1:1 learning initiatives and the impact these initiatives have on English Language Arts (ELA) learning outcomes for low socioeconomic (SES) students.

### **Conceptual Framework**

Research has found student SES to be a strong predictor of academic achievement. Studies controlling for income levels at the community, district, school and family level all determined low SES to be a predictor of poor academic performance (Bolon, 2001; Perry & McConney, 2010; Sirin, 2006; Stull, 2013). In a study examining the relationship between student achievement, socioeconomic status, and ethnicity, socioeconomic status was found to be a much greater predictor of achievement (Abbott & Joireman, 2001).

Low SES students living in impoverished school districts lack access to needed resources (Sirin, 2006). Limited access to needed resources includes restricted access to technology (Thomas, 2008). Access to technology increases most rapidly at the highest family income levels, and most slowly for students in the lowest income levels (Martin & Robinson, 2007). There is a concern the increased use of technology in the educational setting can actually enhance inequities for impoverished students (Warschauer, 2000).

### **Review of Literature**

A review of current literature related to 1:1 implementation found three consistent themes. The three emerging themes were (a) student achievement, (b) technology skills, and (c) equity.

## **Student Achievement**

Due to the large financial investment needed to support a 1:1 technology initiative, many institutions are examining how these programs impact student learning outcomes (Penuel, 2006). Research examining the relationship between 1:1 and student achievement yields mixed results. Numerous studies found 1:1 to have a positive impact on student achievement scores (Bebell & Kay, 2010; Gulek & Demirtas, 2005; Kposowa & Valdez, 2013; O'Dwyer, Russell, Bedell, Tucker-Seeley, 2005; "Project RED", 2010). The School District of Mooresville (N.C.) is a notable 1:1 district. Mooresville implemented a 1:1 initiative in 2007, and since implementation has noted a 20% increase in English, Math, and Science state summative scores (Quillen, 2011). Improved writing proficiency has also been linked to the implementation of a 1:1 initiative (Goldberg, Russell, & Cook, 2003; Jeroski, 2008; Lowther, Ross, & Morrison, 2003, O'Dwyer, et al., 2005; Silvernail & Gritter, 2007).

While 1:1 proponents tout improved student achievement, writing, and technical skills, critics view these claims as unsubstantiated (Weston & Bain, 2010). A review of Georgia's Athen's Academy concluded there was little to no quantitative evidence of improved academic performance and achievement (Hill & Reeves, 2004). Vigdor and Ladd (2010) found a significant negative relationship between ELA and Math scores when additional access to home technology was provided. It was determined that enhanced access to technology in the home setting actually served as a distraction which crowded out study time.

Studies have also associated value added educational environments with 1:1 adoption. Improved student engagement, individualized and self-paced instruction, the promotion of student centered instruction and increased formative assessment are associated with 1:1 implementation

(Dextert, Dunleavy, & Heineket, 2007; Lowther, Ross & Morrison, 2003; Rutledge, Duran, & Carroll-Miranda, 2007).

### **Technology Skills**

While technology skills are not directly related to student achievement, student proficiency in the area of technology is essential to college and workforce readiness (Larson & Miller, 2011). Research finds a correlation between 1:1 implementation and increased technological skills in comparison to students who are in a non 1:1 environment (Bebell & Kay, 2010; Corn, Tagsold, & Patel, 2011; Kereluik, Mishra, Fahnoe, & Terry, 2013; Lei & Zhao, 2008; Lowther et al., 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011).

There is a need to ensure today's students develop 21<sup>st</sup> century skills as "education is the least technology-intensive enterprise in a ranking of technology use among 55 US industry sectors" (Vockley, 2008, p. 2). In addition to demonstrating improved technology skills, 1:1 initiatives provide students with opportunities to learn "digital citizenship". 1:1 students are "learning how to behave in a digital world" (Corn, Tagsold, & Patel, 2011, p. 17).

### **Equity**

There is evidence that a 1:1 initiative can close the proficiency gap in technology skills for economically disadvantaged students (Shapley, et al., 2011). 1:1 implementation has been associated with improved self-esteem and academic achievement (Grimes & Warschauer, 2008; Page, 2002). Technology has enabled at-risk learners to achieve academic success by working at an individualized pace and improving student engagement through the hands-on nature of learning in a digital environment (Cardon, 2000; Edmonds & Li, 2005).

If technology skills are essential for college and workforce readiness, students that lack access to devices and wireless connectivity may be at a significant disadvantage. Research

concludes there are positive outcomes associated with ubiquitous access to technology for low SES students (Ally & Samaka, 2013; Grimes & Warschauer, 2008; Penuel, 2006; Shapley, et al., 2011; Vasquez et al., 2011).

## **Research Design**

### **Setting**

A case study approach was utilized to examine two Missouri high schools. Smith High School (SHS) is in the third year of 1:1 implementation and has a student population of 1,102 students. SHS has a free and reduced lunch rate of 64.4%. (“District Report Card”, 2014). Clark High School (CHS) has a student body of 1053 students and a free-reduced lunch rate of 36.9% (“District Report Card”, 2014). CHS currently does not promote a 1:1 technology initiative, nor does CHS utilize a Bring Your Own Device (BYOD) initiative. A BYOD initiative utilizes the personal devices of students.

While the sites are not comparable demographically, differences in demographics were controlled by analyzing achievement outcomes of low SES students at each site. Participant sampling was determined by what Fink (2013) describes as stratified random sampling. The student body of SHS and CHS was divided into a subset of students that met the criteria for free and reduced lunch status. This subset of free and reduced lunch students was divided by male and female students. A minimum of 35 male and 35 female free and reduced lunch students were selected at random at both sites. Student learning outcomes were collected for each subset that measured: (a) student achievement data; and (b) student ELA II GPA. The data included student achievement data in the form of the ELA II EOC scale scores, and ELA II end of course GPA. The ELA II EOC state exam is administered to sophomores in the state of Missouri, and all students in the State are required to take the ELA II EOC (“LEA Guide”, 2014).

## **Data Analysis**

Student outcome data was examined through quantitative analysis using IBM SPSS software. Using Field's *Discovering Statistics Using IBM SPSS Statistics* (2013) as a guide, an analysis of variance (ANOVA) was utilized to better understand the relationship between categorical predictors.

## **Limitations, Assumptions, and Design Controls**

To ensure validity of statistical analysis, a proper sampling size was included in the data collection. Data was collected for 70 free and reduced lunch students at each site and divided evenly by gender. Statistical significance was set at the .05 level. It should be noted that this study analyzed data to determine the relationship between 1:1 technology implementation and ELA II student learning outcomes. Many factors impact student achievement including, but not limited to, the quality of instruction, curriculum design, and the fidelity of 1:1 technology implementation. While the study could not control for all of these variables, comparable data was collected by controlling for SES and gender. Data analysis was also used to compare all ELA II scores at CHS and SHS.

## **Research Questions**

The research questions for the study are:

- How do student English Language Arts (ELA) II end of course exam (EOC) scores in a high school fully implementing 1:1 technology compare to a high school not fully implementing 1:1 technology?
- How do lower SES student ELA II EOC scores in a high school fully implementing 1:1 technology compare to low SES students in a high school not fully implementing 1:1 technology?

- How does ELA II GPA for lower SES students in a high school fully implementing 1:1 technology compare to low SES students in a high school not fully implementing 1:1 technology?
- How do male and female student ELA II EOC scores in a high school fully implementing 1:1 technology compare to male and female students in a high school not fully implementing 1:1 technology.

## **Results**

Study results found a statistically significant negative relationship between 1:1 technology implementation and ELA II outcomes in the first research question. An analysis of variance was also utilized to study ELA II outcomes for low SES students. Research questions two and three examined the relationship between 1:1 implementation and ELA II outcomes for low SES students. Study results failed to discover a positive relationship between EOC scale scores, end of course GPA, and 1:1 implementation. ANOVA results for question two were not statistically significant and the null hypothesis was accepted. However, it should be noted the mean difference in scale scores between control group and 1:1 student scores was 1.41 points. The mean difference between groups in question one was 3.73 points. While not statistically significant, results suggest improved ELA academic performance for low income students in a 1:1 environment. Question three analyzed the relationship between ELA II end of course GPA and 1:1 implementation. The null hypothesis was rejected in question three as control group students exhibited a higher end of course GPA, at a statistically significant level.

The issue of student achievement, filtered by gender, was a focus of the study as males use technology more frequently than females (Ching, et al., 2005; Harris, et al., 2013; Shashaani, 1994; Vekiri & Chronaki, 2008). Although not statistically significant, female students scored

slightly better in a 1:1 environment when compared to non 1:1 peers, and the achievement gap between male and female students was reduced in a 1:1 environment. However, ELA II scale scores for male students was higher than female students in both a 1:1 and non 1:1 environment. The findings contrast current research associating improved ELA outcomes with female students (Zembar & Blume, 2009). It should be noted the fourth research question utilized scale scores collected solely from the low SES subgroup. While not statistically significant, low-income 1:1 female mean scores were marginally higher than control group scores.

### **Discussion and Recommendations**

Study results may serve as a resource for members of the integrated technology action team. While results did not associate statistically significant academic improvement with 1:1 adoption, there was evidence of a shrinking achievement gap for low-income students in a 1:1 setting. This observation is congruent with previous research which found positive outcomes associated with ubiquitous access to technology for low-SES students (Grimes & Warschauer, 2008; Penuel, 2006; Shapley, et al., 2011; Vasquez et al., 2011). Action team members should consider technology implementation from a viewpoint of equity. To adequately prepare low SES students for a digital and global marketplace, ensuring adequate access to digital resources should be a key consideration. Preparing every student to be career and workforce ready is a benefit of adopting a 1:1 initiative. Research does find a correlation between 1:1 implementation and increased technology skills in comparison to non 1:1 students (Bebell & Kay, 2010; Corn, Tagsold, & Patel, 2011; Kereluik, Mishra, Fahnoe, & Terry, 2013; Lei & Zhao, 2008; Lowther, 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011).

Improved instructional methods, such as the promotion of formative assessment, individualized instruction, student-centered instruction, and improved student engagement have

also been noted with the adoption of 1:1 programs (Dextert, Dunleavy, & Heineket, 2007; Penuel, 2006; Lowther, Ross, and Morrison, 2003).

This study is a resource for action team members examining the critical issue of technology implementation. Team members considering 1:1 adoption should utilize multi-frame thinking to critically examine the issue. While academic achievement is a key consideration of 1:1, issues such as equity, technology readiness, and improved pedagogical practices should also be considered. Understanding the full potential of 1:1 is important for school leaders, teachers, students, and community stakeholders.

The purpose of this study was to specifically examine the impact of 1:1 implementation on ELA learning outcomes for low-income students. While the study specifically studied 1:1 programs, other strategies such as 2:1 and BYOD may also be considered. Given the cost and expense of 1:1, alternative strategies to deliver improved access to technology might also be evaluated. Emerging themes from the review of literature (a) academic achievement, (b) technology skills, and (c) equity may help the action team establish goals for enhanced technology use and access.

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SECTION FIVE:  
CONTRIBUTION TO SCHOLARSHIP

## 1:1 Initiatives and Student Learning Outcomes: A Focus on Low Socioeconomic Students

A similar scene is acted out across the United States each day. Parents pick up their child from school and ask the age-old question, “What did you learn today?” Unfortunately, the culminating act of the school day crescendos with the disappointing “I don’t know” or “It was boring.” This is not the typical response from students in Mooresville, N.C. Students in Mooresville are immersed in a digital learning environment that provides engaging and highly personalized levels of learning. Mooresville students participate in a highly collaborative learning environment, which produces rigorous and sophisticated levels of student work (eSchoolNews, 2016). The results are demonstrated in increased student achievement scores, even as poverty levels increase throughout the school district (Quillen, 2011).

The Mooresville 1:1 technology initiative is symbolic of a growing trend in education. In the past 20 years, educational communities around the globe have seen an expansion of 1:1 technology initiatives (Dunleavy, Dextert, & Heinecket, 2007). 1:1 refers to providing technology, such as computers or laptops, for every student in a school. In 2000, approximately 1000 American schools used a 1:1 initiative totaling over 150,000 laptops (Johnstone, 2003). Since 2000, school districts continue to invest heavily in student devices. According to The National Center for Education Statistics (NCES); student to device ratios have improved dramatically from the ratio of 6.6 devices per student in 2000. In 2008, the student to device ratio dwindled to 3.1 devices per student (NCES, 2012). Shrinking student to device ratios and the adoption of large scale 1:1 programs point to a growing interest in utilizing technology for classroom learning. A simple Google search on educational technology will confirm what the statistics from the NCES seem to support. 1:1 initiatives continue to grow in popularity amongst P-12 educators.

While districts continue to invest in 1:1 programs, studies measuring the effectiveness of 1:1 yield mixed findings. The divide in research has led to differing opinions related to the cost-benefit of 1:1 adoption. Some research studies have shown positive student learning outcomes associated with 1:1 initiatives (Bebell & Kay, 2010; Gulek & Demirtas, 2005; O’Dwyer, Russell, Bedell, Tucker-Seeley, 2005), while others have concluded that despite the heavy financial investment, 1:1 programs do not lead to increased student achievement scores (Hill, 2004). Critics, such as Larry Cuban (2001), feel 1:1 depletes already limited budgets and serves as a distraction that actually has a negative impact on student learning.

A problem with the cost benefit approach is the use of academic achievement to evaluate effective technology implementation. This is understandable given the expensive nature of 1:1 adoption (Rhor, 2014). More than 10 billion dollars have been spent by local and state agencies on technology integration in the classroom, with the federal government spending an additional three billion on educational technology (O’Dwyer, Russell, Bebell, & Tucker-Seeley, 2005). While the cost of 1:1 adoption is quantifiable, the cost of not adopting 1:1 is more difficult to measure. Technological access for every student is an issue of equity for low income and female students (Farell, 2005; Margolis & Fisher, 2000; Warschauer, 2001). Low income students lack access to digital resources (Thomas, 2008) and female students are less likely to use technology outside of the school setting in comparison to male students (Harris, Straker, & Pollock, 2013; Vekiri & Chronaki, 2008). Failure to provide a device for each student could exacerbate a gap in technological access for female and low income students.

There is a need to ensure all students develop 21st century skills as “education is the least technology-intensive enterprise in a ranking of technology use among 55 US industry sectors” (Vockley, 2008, p. 2). The Partnership for 21st Century Skills, the International Society for

Technology in Education (ISTE), and the State Educational Technology Directors Association (SETDA) collaborated to address the issue of preparing students for a digital world (Vockley, 2008). This collaborative effort implores educational leaders to use technology comprehensively to develop 21st century skills, support teaching and learning, and to create robust education support systems (Vockley, 2008).

With heavy investment in time and financial resources, policymakers are looking to determine the impact 1:1 initiatives have on student learning. This study seeks to further examine the impact 1:1 initiatives have on English Language Arts (ELA) learning outcomes for low-income students. Student learning outcomes will be measured through ELA end of course scale scores and end of course grade point average. Learning outcomes will also be analyzed by gender to determine the impact of 1:1 on male and female student learning outcomes.

### **Conceptual/Theoretical Frameworks**

The Elementary and Secondary Education Act (ESEA) of 1965 was enacted to offer equitable educational opportunities to underprivileged children living in the United States (Thomas & Brady, 2005). The vision of ESEA was to provide an equitable education by ensuring “all children have a fair, equal, and significant opportunity to obtain a high quality education” (No Child Left Behind [NCLB], 2002). Research finds that this is not the reality for impoverished Americans.

A meta-analysis by Sirin (2006) measured the relationship between student achievement and socioeconomic status (SES). Sirin found a strong relationship between achievement and SES at the school level. Many low SES students live in poor and unsafe neighborhoods that are inadequately funded by a local tax levy. Consequently, achievement suffers among low SES students (Sirin, 2006). In a study examining the relationship between student achievement,

socioeconomic status, and ethnicity, socioeconomic status was found to be a much greater predictor of student achievement (Abbott and Joireman, 2001).

Stull (2013) found not only a linkage between SES and student achievement, but a linkage between parental expectations and student achievement. According to Stull (2013), expectations regarding academic achievement increases with family income. Research (Abbott and Joireman, 2001; Bolon, 2001; Milne & Plourde, 2006; O'Dwyer et al., 2005, 2008; Sirin, 2006; Stull, 2013; Wenglinsky, 1997, 2005) documents the negative relationship between SES and academic achievement.

Students living in impoverished school districts lack access to needed resources (Sirin, 2006). Limited access to needed resources includes restricted access to technology. Thomas (2008) found that students in low socioeconomic areas lack the same access to technology as higher SES students. Thomas' study of low SES students in the Mississippi Delta determined a technology gap did exist for low SES students, particularly in the home setting. "Students in rural areas indicated they had less computer access, usage, and technology skills than peers living in middle or higher socioeconomic areas" (Thomas, 2008, p. 13). Access to technology increases most rapidly at the highest family income levels, and most slowly for students in the lowest income levels (Martin & Robinson, 2007). A Pew research study (Purcell et al., 2013) found teachers believed the most impoverished students lack sufficient access to essential digital tools, both in school and at home. As a result, students living in poverty have diminished technology skills compared to wealthier peers. Hargittai (2007) contends the differential spread in internet access could lead to increasing inequalities, benefiting those who have access and denying access to the underprivileged. The increased use of technology in the educational setting

widens the gap between schools that have access to technology and those lacking access. (Warschauer, 2000).

Gender, as well as poverty, plays a role in the use of technology (Ching et al., 2005). Gender, income level, and race was a predictor in technology use. Females, low SES students, and students of color are the most unprepared for the collegiate digital environment (Farell, 2005; Margolis & Fisher, 2001). Males who had home computer access before the age of 10 displayed higher levels of technology use than other demographics (Ching et al., 2005). Males are more likely to own a home computer and consequently, display more self confidence in working with computers (Shashaani, 1994). Two international studies supported these findings by concluding males used computers outside of the school setting more frequently than females (Harris, Straker, & Pollock, 2013; Vekiri & Chronaki, 2008). Gender appears to be a predictor of technology use, with males using technology more frequently than females (Ching, et al., 2005; Harris, et al., 2013; Shashaani, 1994; Vekiri & Chronaki, 2008). A review of existing literature will discuss the impact of 1:1 on student achievement, providing equitable access to technology, and preparing students to learn in a 21<sup>st</sup> century learning environment.

### **Review of Literature**

Shrinking student to device ratios and the adoption of large scale 1:1 programs point to a growing interest in utilizing technology for classroom learning. School districts have implemented 1:1 to bolster academic achievement, enhance technological readiness, and afford equitable access to digital resources for students. With heavy investment in time and financial resources, policymakers are looking to determine the impact of 1:1 on student learning outcomes. Officials must consider the barriers of equity, cost, and teacher development to effectively infuse technology in the classroom.

Providing equal access to digital resources is a goal of many 1:1 programs (Penuel, 2006). Because at-risk students are most vulnerable to the digital divide (Madrado, 2011), 1:1 adoption can close the proficiency gap in technology skills for economically disadvantaged students (Shapley, et al., 2011). Early evaluations of laptop programs emphasized a need for equality. Results from these early evaluations suggested home access to technology explained variances in student technology skills (Penuel, 2006). A 2008 case study by Grimes and Warschauer compared state assessment scores of two California K-8 schools. Second year program results indicated low SES students made significant gains in mathematics test scores in comparison to high SES students. Page (2002) found that technology enriched classrooms improved mathematics scores for low SES students, while also improving self-esteem. Technology has enabled at-risk learners to achieve academic success by working at an individualized pace and improving student engagement (Cardon, 2000; Edmonds & Li, 2005).

Technology implementation provides an avenue for self-paced and individualized instruction. The Summit Public School District in San Jose, CA is using technology to provide blended-learning mathematics instruction. This approach provides students the opportunity to benefit from traditional instruction, while receiving individualized instruction using Khan Academy (Childress & Benson, 2014). Whittemore Park Middle School in Conway, SC is also using technology to help provide individualized instruction. Whittemore Park consists of mostly low SES students, who traditionally have scored low in academic achievement. To combat low student achievement scores the school is grouping students by skill level, rather than grade-level. This is achieved by delivering most instruction in a digital format based on the need and achievement level of each student (Childress & Benson, 2014).

Technology skills are essential for college and workforce readiness and students that lack access to both devices and wireless connectivity may be at a significant disadvantage. Research concludes there are positive outcomes associated with ubiquitous access to technology for low-SES students (Grimes & Warschauer, 2008; Penuel, 2006; Shapley, et al., 2011; Vasquez et al., 2011). With improved access and sound instructional practice, it would be a fair assumption that increased student achievement scores will follow.

Gulek and Demirtas (2005) found an increase in student achievement including cumulative grade point averages (GPAs), end of course grades, writing scores, and state mandated standardized test scores. Students participating in a 1:1 initiative were more engaged, demonstrated improved research skills and made gains in standardized ELA test scores (Bebell and Kay, 2010). The school district of Mooresville, N.C. implemented a 1:1 initiative in 2007. Since implementing 1:1, Mooresville has noted a 20% increase in the core subjects of English, Math, and Science as measured by state summative assessments. It should be noted this increase in student achievement occurred at the same time the district's free and reduced lunch rate increased by 9% (Quillen, 2011). Case studies by Kposowa and Valdez (2010) and Light, McDermott, and Honey (2002) noted a positive relationship between ubiquitous access to laptop computers and improvements in standardized ELA and math scores.

Writing proficiency has been shown to increase through the implementation of a 1:1 initiative (Goldberg, Russell, & Cook, 2003; Jeroski, 2008; Lowther, Ross, & Morrison, 2003, O'Dwyer, et al., 2005; Silvernail & Gritter, 2007). Students who use computers to write have produced higher quality work in both length and quality and 1:1 students demonstrated statistically significant improvements in writing proficiency (Goldberg, Russell, & Cook, 2003; Jeroski, 2008). A case study of three laptop programs by Warschauer, Zheng, Niiya, Cotten and

Farkas (2014) found that, “70% of students reported that they wrote more with their laptops, and 64% of students agreed that laptop use improved the quality of their writing” (p. 52).

While 1:1 proponents tout improved student achievement, writing and technical skills, critics view these claims as unsubstantiated (Weston & Bain, 2010). 1:1 critics point to early technology programs that yielded inconsistent or statistically insignificant results measuring academic achievement (Hill & Reeves, 2004; Vigdor & Ladd, 2010). One study found increased access and use of technology to have a negative impact on student achievement by serving as a distraction to students (Vigdor & Ladd, 2010).

Simply providing a computer to all students will not necessarily improve student learning. Classroom instructors must be trained to incorporate technology in the classroom to facilitate engaging learning experiences. Penuel (2006) found that many 1:1 initiatives focused on transforming instruction to be more student centered. 1:1 initiatives have the potential to provide value added experiences, which include formative assessment, individualized instruction, self-paced instruction, and the capacity for students to interact and collaborate online (Dextert, Dunleavy, & Heineket, 2007). The ease and access of providing individualized and self-paced instruction ultimately leads to increased student achievement and attentiveness (Lowther, Ross, and Morrison, 2003). The adoption of 1:1 also affords more opportunities for students to collaborate and be more creative in the classroom (Rutledge, Duran, & Carroll-Miranda, 2007). Ubiquitous access to technology not only impacts student achievement and engagement, it also provides opportunities for students to enhance technology skills. Student proficiency in the area of technology is essential to college and workforce readiness (Larson & Miller, 2011). Schools looking to implement a 1:1 initiative may do so to adequately prepare students for life in a technology rich culture (Penuel, 2006).

Larson and Miller (2011) reviewed The Partnership for 21st Century Skills, an advocacy group promoting technology skills in education. The term 21st century skills is used often in education, and The Partnership for 21st Century Skills is a framework of defined skills utilized by classroom instructors. The use of technology to access information is a needed skill for 21st century students (Kereluik, Mishra, Fahnoe, & Terry, 2013).

Ubiquitous access to technology affords additional research opportunities for students (Bebell & Kay, 2010). The increased frequency of research in a 1:1 environment ultimately allows students to develop increased levels of confidence in the areas of research and software application skills (Lowther, et al., 2003; Warschauer, et al., 2014). Multiple studies (Lei & Zhao, 2008; Shapley et al, 2001; Silvernail, Small, Walker, Wilson, & Wintle, 2008) associate improved technology proficiency as a result of 1:1 implementation.

In addition to demonstrating improved technology skills, 1:1 initiatives provide students with opportunities to learn and demonstrate “digital citizenship”. 1:1 students are “learning how to behave appropriately in a digital world” (Corn, Tagsold, & Patel, 2011, p. 17). 1:1 programs have not only demonstrated increased technology skills for students, but have also impacted 21st century skills for instructors as well. Teachers in a 1:1 environment displayed greater technological confidence, allowing them to model 21st century skills in the classroom (Lowther et al., 2012). Research supports a positive relationship between 1:1 implementation and increased technological skills. (Bebell & Kay, 2010; Corn, Tagsold, & Patel, 2011; Lei & Zhao, 2008; Lowther, 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011).

## **Methods**

A case study approach was utilized to examine two Missouri high schools, each located in the same county. Smith High School (SHS) is in the third year of 1:1 implementation and has a

student population of 1,102 students. SHS has a free and reduced lunch rate of 64.4% and is racially diverse. SHS is racially diverse as 29.9% of the student body is classified as African-American, while 58.8% are identified as Caucasian (“District Report Card”, 2014). Clark High School (CHS) has a student body of 1053 students. The free-reduced lunch rate is 36.9% and the student body offers little racial diversity as 91.7% of CHS students are identified as Caucasian (“District Report Card”, 2014). CHS currently does not promote a 1:1 technology initiative, nor does CHS utilize a Bring Your Own Device (BYOD) initiative. A BYOD initiative utilizes the personal devices of students.

While the sites are not comparable demographically, SHS is the only school in the region currently utilizing a 1:1 initiative with comparable student enrollment numbers. Differences in demographics will be controlled by analyzing achievement outcomes of low SES students at each site.

### **Participants**

Stratified random sampling was utilized to collect disaggregated student achievement data from each site. The student body of SHS and CHS was divided into a subset of students that met the criteria for free and reduced lunch status. This subset of free and reduced lunch students was divided by male and female students. A minimum of 35 male and 35 female free and reduced lunch students was randomly selected at both sites. Student learning outcomes was collected for each subset that measured: (a) student achievement data; and (b) student ELA II GPA.

### **Data Collection Tools**

Student outcome data was collected from both school sites. The data included student ELA II EOC exam scale scores, and student ELA II end of course GPA. The ELA II EOC state exam is administered to sophomores in the state of Missouri, and all students in the State are required

to take the ELA II EOC (“LEA Guide”, 2014). The data was further disaggregated by creating a sub group of students who qualify for free and reduced lunch status. All collected data was non-identifiable, but student data in IBM SPSS was given a numerical code to denote both the student’s attendance center and gender.

### **Data Analysis**

Student outcome data was examined through an analysis of variance (ANOVA) performed with IBM SPSS software. Student learning outcome data was derived from a subset of students who were categorized at a lower socioeconomic status determined by free and reduced lunch criteria. Data was also analyzed in SPSS to determine the relationship between gender and 1:1 technology implementation.

A second phase of data collection was utilized to answer the first research question. To gain further insight into the impact of a one student one device initiative, a review of ELA II EOC scale scores was conducted for all 10<sup>th</sup> grade students at SHS and CHS. An ANOVA was conducted on the mean of ELA II EOC scale scores at each site. A review of ELA II EOC scores from 2012-2014 reveal that CHS outperformed SHS. The three-year average for CHS ELA II EOC scores is 75.6% as compared to a 59.2% average for SHS (“Achievement Level Report”, 2015). The study examined the relationship between CHS and SHS student performance on the ELA II summative exam. While there is currently an achievement gap in SHS ELA performance, analysis of achievement scores seeks to understand if the student achievement gap can be reduced as a result of 1:1 implementation.

### **Findings**

A collection of scale scores was utilized at each site. Data collection included all 10<sup>th</sup> grade students with a valid ELA II EOC score. Collection also included ELA II end of course grade

point averages for 70 free and reduced students at each site. An analysis of variance (ANOVA) compared means for ELA II EOC scale scores and end of course GPA to better understand the relationship between 1:1 technology implementation and ELA II course outcomes. While a statistically significant positive relationship between 1:1 technology and ELA II outcomes was not discovered, study results and observations for each research question are addressed below.

The first research question compared ELA II scale scores for all 10<sup>th</sup> grade students at each site. Table 1 contains descriptive statistics used in the ANOVA. The analysis of 577 student scale scores found the results to be statistically significant at the .05 level. The results are shown in Table 2. The null hypothesis was rejected as non 1:1 student scale scores were on average 3.73 points higher than 1:1 student scale scores. A statistically significant negative relationship was found between 1:1 technology implementation and EOC scale scores.

**Table 1**  
*Descriptives for Overall ELA II EOC Scores*

	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>		<i>Minimum</i>	<i>Maximum</i>
					<i>Lower Bound</i>	<i>Upper Bound</i>		
Non 1:1	354	212.05	13.69	.728	210.61	213.48	174	250
1:1	223	208.32	15.65	1.048	206.26	210.39	169	250
Total	577	210.61	14.58	.607	209.41	211.80	169	250

\*.05 level of significance

**Table 2**  
*ANOVA Results for Overall ELA II EOC Scores*

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Between Groups	1895.665	1	1895.665	9.041	.003
Within Groups	120556.030	575	209.663		
Total	122451.695	576			

\*.05 level of significance

A chief aim of the study was to better understand the impact of 1:1 implementation on ELA II student learning outcomes for low SES students. The second research question analyzed ELA II outcomes for 70 low SES students at each site. The mean difference for 1:1 and non 1:1 student scores was 1.41 points; lower than the 3.73 difference found in the first research question. The results are highlighted in Table 3. While the descriptive statistics suggest a positive relationship between 1:1 and EOC scale scores for low SES students, ANOVA results found a significance level of .508. These results are summarized in Table 4. Statistical significance for the study was set at the .05 level, resulting in the acceptance of the null hypothesis.

**Table 3**

*Descriptives of Low SES ELA II EOC Scale Scores*

	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>			
					<i>Lower Bound</i>	<i>Upper Bound</i>	<i>Minimum</i>	<i>Maximum</i>
Non 1:1	70	206.1714	11.92242	1.42500	203.3286	209.0142	183.00	232.00
1:1	70	204.7571	13.26260	1.58518	201.5948	207.9195	174.00	232.00
Total	140	205.4643	12.58491	1.06362	203.3613	207.5672	174.00	232.00

\*.05 level of significance

**Table 4**

*ANOVA Results for Low SES ELA II EOC Scale Scores*

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Between Groups	70.007	1	70.007	.440	.508
Within Groups	21944.814	138	159.020		
Total	22014.821	139			

\*.05 level of significance

The third research question analyzed ELA II end of course GPA for 70 low SES students at each site. Descriptive statistics are found in Table 5. Statistical analysis found a negative

relationship between 1:1 implementation and ELA II course GPA. ANOVA results can be found in Table 6. ELA II students in a 1:1 environment demonstrated lower grade point averages when compared to ELA II students in a non 1:1 environment. The null hypothesis was rejected as results were found to be statistically significant.

**Table 5**

*Descriptives for Low SES Student End of Course GPA*

	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>		<i>Minimum</i>	<i>Maximum</i>
					<i>Lower Bound</i>	<i>Upper Bound</i>		
Non 1:1	70	5.36	2.959	.354	4.65	6.06	0	10
1:1	70	4.34	3.045	.364	3.62	5.07	0	11
Total	140	4.85	3.034	.256	4.34	5.36	0	11

\*.05 level of significance

**Table 6**

*ANOVA Results for Low SES Student End of Course GPA*

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Between Groups	36.007	1	36.007	3.995	.048
Within Groups	1243.843	138	9.013		
Total	1279.850	139			

\*.05 level of significance

The final research question examined ELA II scale scores for low SES students by gender. Scale scores were analyzed for 35 male and 35 female students at each site. The descriptive statistics located in Table 7 reveal female students in a 1:1 setting scored slightly better than non 1:1 peers. Female 1:1 students scored .23 points higher than non 1:1 female students, and the gap between male and female achievement (3.69 points) was reduced when compared to the non 1:1 control group (6.97 points). While descriptive statistics reveal a reduced achievement gap for male and female 1:1 student scores, ANOVA results were not

statistically significant, resulting in the adoption of the null hypothesis. These results are located in Table 8.

Study findings yield several implications for school practitioners contemplating 1:1 adoption. While a statistically significant gain in ELA achievement was not established, a closer examination of study results reveals the impact of 1:1 beyond the solitary focus of student achievement.

**Table 7**

*Descriptive Statistics for Low SES Male and Female EOC ELA II Scale Scores*

Gender	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1:1M	35	206.60	11.94645	2.01932	202.4963	210.7037	179.00	225.00
1:1F	35	202.91	14.39643	2.43344	197.9689	207.8596	174.00	232.00
Non1:1M	35	209.65	11.85933	2.00459	205.5833	213.7310	187.00	232.00
Non1:1F	35	202.68	11.08197	1.87320	198.8789	206.4925	183.00	225.00
Total	140							

\*.05 level of significance

**Table 8**

*ANOVA Results for Low SES Male and Female EOC ELA II Scale Scores*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	237.729	1	237.729	1.359	.248
Within Groups	11899.143	68	174.987		
Total	12136.871	69			

\*.05 level of significance

## Discussion

Study results found a statistically significant negative relationship between 1:1 technology implementation and ELA II outcomes in the first research question. An analysis of variance was also utilized to study ELA II outcomes for low SES students. Research questions two and three examined the relationship between 1:1 implementation and ELA II outcomes for

low SES students. Study results failed to establish a positive relationship between EOC scale scores, end of course GPA, and 1:1 implementation. ANOVA results for question two were not statistically significant and the null hypothesis was accepted. However, it should be noted a mean difference in scale scores between control group and 1:1 student scores was only 1.41 points. The mean difference between groups in question one was 3.73 points. While not statistically significant, results suggest improved ELA academic performance for low income students in a 1:1 environment. Question three analyzed the relationship between ELA II end of course GPA and 1:1 implementation. The null hypothesis was rejected in question three as control group students exhibited a higher end of course GPA, at a statistically significant level.

Study results failed to establish a positive relationship between 1:1 and ELA outcomes. However, valuable insights are offered in prior research. A case study by Grimes and Warschauer (2008) did not find a positive relationship between 1:1 implementation and student achievement in year one of 1:1 implementation. However, second year results did note a significant improvement in student achievement for low SES students. While Smith High School was in year two of 1:1 implementation, a positive relationship between 1:1 and ELA achievement for low SES students might be established if examined over a multi-year timeframe.

The two schools pursued very different approaches to professional development. Professional development at CHS centered on curriculum development and the utilization of student data to drive instruction. A well articulated curriculum, coupled with focused and meaningful classroom instruction is essential to academic achievement (Schmoker, 2011). The 1:1 initiative at SHS was predictably a focus of district professional development. 1:1 initiatives have the potential to add value to classroom instruction, but professional development is needed to ensure effective instructional practices (Dextert et al., 2007). Learning the specificities of the

device, and accompanying software needed to manage 1:1 is important. However, teachers need time and professional development to merge 1:1 with traditional classroom practice and pedagogy (Corn, Tagsold, & Patel, 2011; Drayton, Falk, Stroud, Hobbs & Hammerman, 2010). The adoption of learner centered pedagogical practices is a challenge of laptop initiatives (Hill & Reeves, 2004). While professional development accompanying 1:1 implementation is necessary, it has the potential to serve as a distraction to classroom instruction and curriculum development if solely focused on the technical aspects of 1:1 implementation.

The issue of student achievement, filtered by gender, was a focus of the study as males use technology more frequently than females (Ching, et al., 2005; Harris, et al., 2013; Shashaani, 1994; Vekiri & Chronaki, 2008). Although not statistically significant, female students scored slightly better in a 1:1 environment when compared to non 1:1 peers, and the achievement gap between male and female students was reduced in a 1:1 environment. Descriptive statistics are found in Table 7. However, ELA II scale scores for male students was higher than female students in both a 1:1 and non 1:1 environment. The findings are interesting as current research associates improved ELA outcomes with female students (Zembar & Blume, 2009). It should be noted the fourth research question utilized scale scores collected solely from the low SES subgroup. While not statistically significant, low-income 1:1 female mean scores were marginally higher than control group scores.

### **Limitations**

A small sample size was a limitation of the research study. Data collection was dictated by the availability of data from a 1:1 and non 1:1 high school. Each site was selected because of comparable school size and the stark contrast in technology implementation at each site. School technology initiatives can be defined in many different terms. However, the distinction of CHS

as a non 1:1 site with limited technological access, and SHS as a 1:1 site with open access to technology made each school ideal for the case study. The study selected low SES students at each site to analyze ELA learning outcomes, and controlled for special education status in the sample population. The parameters used to establish the sub-population greatly reduced the number of qualifying scores, limiting the *N* size.

A second limitation of the study is the nature of analyzing student achievement. Many factors impact student achievement including, but not limited to, the quality of instruction, curriculum design, and the fidelity of 1:1 technology implementation. The study only controlled for SES status, gender, special-education status, and technology implementation.

Limited availability of multi-year ELA 2 scale scores was a final limitation of the study. Missouri's assessment program assessed current state standards for the first time in 2015. ("Missouri Learning Standards", 2016). Scale scores for the 2014 EOC assessments were aligned to prior standards. The adoption of new standards limited comparable multi-year scale scores.

### **Implications for School Practitioners**

Study results may serve as a resource for school practitioners considering 1:1 implementation. While results did not associate statistically significant academic improvement with 1:1 adoption, there was evidence of a shrinking achievement gap for low-income students in a 1:1 setting. This observation is congruent with previous research noting positive outcomes associated with ubiquitous access to technology for low-SES students (Grimes & Warschauer, 2008; Penuel, 2006; Shapley, et al., 2011; Vasquez et al., 2011). School leaders should consider 1:1 adoption from a viewpoint of equity. To adequately prepare low SES students for a digital and global marketplace, ensuring adequate access to digital resources should be a key consideration. Preparing every student to be career and workforce ready is a benefit of adopting

a 1:1 initiative. Research does find a correlation between 1:1 implementation and increased technological skills in comparison to students who are not in a 1:1 environment (Bebell & Kay, 2010; Corn, Tagsold, & Patel, 2011; Kereluik, Mishra, Fahnoe, & Terry, 2013; Lei & Zhao, 2008; Lowther, 2003; Lowther, Inan, Ross, & Strahl, 2012; Shapley, et al., 2011).

Improved instructional methods, such as the promotion of formative assessment, individualized instruction, student-centered instruction, and improved student engagement have also been noted with the adoption of 1:1 programs (Dextert, Dunleavy, & Heineket, 2007; Penuel, 2006; Lowther, Ross, and Morrison, 2003).

School practitioners considering 1:1 adoption should utilize multi-frame thinking to critically examine this issue. While academic achievement is a key consideration of 1:1, issues such as equity, technological readiness, and improved pedagogical practices should also be considered. It is important school leaders view 1:1 implementation outside the single lens of academic achievement. Understanding the full potential of 1:1 is important for school leaders, teachers, students, and community stakeholders.

### **Implications for Future Research**

Research has found low SES to be a predictor of poor academic performance (Abbott and Joireman, 2001; Bolon, 2001; Milne & Plourde, 2006; O'Dwyer et al., 2005, 2008; Sirin, 2006; Stull, 2013; Wenglinsky, 1997, 2005). Given the negative relationship between SES and academic achievement, increased use of technology in the classroom might enhance inequities (Warschauer, 2000) as low-income students lack equitable access to technology (Sirin, 2006; Thomas, 2008). Future research should review the impact of 1:1 from an equity viewpoint. Gender equity also requires further study as males use technology outside of the school setting more often than females (Harris, Straker, & Pollock, 2013; Vekiri & Chronaki, 2008).

A review of current literature related to 1:1 and academic achievement found a lack of research in the high school setting. Most research related to 1:1 implementation and student outcomes is concentrated at the middle school level, while research related to 1:1 technology initiatives at the high school level (grades 9-12) is less robust. Additional research is needed to better understand the relationship between 1:1 initiatives and student achievement in the high school setting.

The results of this study did not find a positive correlation between 1:1 and academic achievement for low-income students. However, this issue requires further study. While many studies have examined 1:1, additional research is needed to compare 1:1 to BYOD or 2:1 initiatives. Current research is predominantly focused on comparing 1:1 sites to non 1:1 sites. Additional research comparing 1:1 to other technology initiatives would provide valuable information to school practitioners.

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SECTION SIX:  
SCHOLARLY PRACTITIONER REFLECTION

## Reflection

This reflection will discuss how the dissertation process has impacted me as an educational leader and as a scholar.

### **Dissertation Influence as an Educational Leader**

When I began writing my dissertation, I didn't spend a lot of time considering the impact it would have on my professional life. In fact, in many ways it served as a distraction. There is little unaccounted time for a public school administrator, and most free time was devoted to my dissertation. There were times I felt guilty considering there were often unfinished tasks on my desk at the end of the day. However, the topic I selected for my study ultimately had a meaningful impact on my role as an educational leader.

Our district has been working on a long-term strategic plan. One of the emerging themes from the strategic planning team was integrated technology. An action team was formed to “design, develop, align, and implement technology that is adaptable to future curriculum and instruction while meeting the evolving needs of all individuals” (“Strategic Action Plan”, 2016). I was able to share the technical report I prepared for my contribution to practice, allowing me to guide discussions with our action team. There was much debate related to the future of technology in our school district and whether or not we should consider a 1:1 initiative. The completion of my review of literature allowed me to share research with our action team. I tried to fairly present advantages and disadvantages of 1:1 to help the team draw their own conclusions on the topic.

Transformative experiences such as this were an overt goal of our cohort program. Donaldson (2009) states that “action by leaders to change the structures that constrain their own leadership performance and their organization's performance is fostering the learning of others”

(p. 74). My doctoral work provided an opportunity to share research related to 1:1, and address the impediment of limited technological access in our district.

### **Dissertation Influence as a Scholar**

The dissertation in practice format had a significant impact on my responsibilities as both a scholar and a leader. The findings of my study effected discussions with our action team. Ultimately, the group recommended the adoption of 1:1 throughout the district. I then had to share these recommendations with the strategic planning team, which included building principals, school board members, parents, and community members. It was critical my research was accurate and followed ethical research guidelines as it influenced our decision to adopt 1:1. The monetary impact of this decision could be millions of dollars.

The dissertation in practice format, and the requirement to produce a research document to impact professional practice, reiterated the importance of conducting a professional research study. To do this, a researcher must follow guidelines and protocols to ensure the information is valid and will stand up to scrutiny. The American Educational Research Association published the organization's "Code of Ethics" in February of 2011. While there are many components to the "Code of Ethics", it centers on the following principles

- Professional Competence: researchers work to maintain the highest levels of competence in their work, and recognize the limitations of their expertise;
- Integrity: researchers are fair, honest, and respectful in their professional activities;
- Professional, Scientific, and Scholarly Responsibility: researchers value the public trust in research and are concerned about their behavior that might compromise that trust;

- Social Responsibility: researchers are aware of their responsibility to apply and make public their knowledge for the greater good. (American Education Research Association, 2011, p. 146).

I believe my doctoral research complied with these ethical guidelines. I worked hard to produce competent and accurate research. I made certain to follow research protocols and worked in conjunction with my Dissertation Supervisor. Ultimately, I learned scholarly research can have a significant impact on professional practice. It is my hope this study can not only help our district, but can serve a resource for other districts considering the issue of 1:1 technology implementation. While being the first cohort to complete the dissertation in practice format has been a challenge, it gives me great personal satisfaction to know it was not just another assignment. It was a tremendous opportunity to hone my skills as a researcher, and ultimately make a significant impact on our school district.

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## VITA

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