Spring 5-7-2019

Examining the Relationship Between One-to-One Technology and Student Achievement

Joseph Kellie McClung
Arkansas Tech University

EXAMINING THE RELATIONSHIP BETWEEN ONE-TO-ONE TECHNOLOGY AND STUDENT ACHIEVEMENT

A Dissertation Submitted
to the Graduate College
Arkansas Tech University

in partial fulfillment of requirements
for the degree of

DOCTOR OF EDUCATION

in School Leadership

in the Department of Center for Leadership and Learning
of the College of Education

May 2019

Joseph Kellie McClung

Bachelor of Science, Arkansas Tech University, 2007
Master of Education, University of Arkansas, 2011
Educational Specialist, Henderson State University, 2017

Dissertation Approval

This dissertation, "Determining the Relationship Between One-to-one Technology and Student Achievement," by Joseph Kellie McClung, is approved by:

Dissertation Chair:

Mohamed Ibrahim
Associate Professor, College of Education

Dissertation Committee

John Freeman
Professor and Interim Department Head,
Center for Leadership & Learning

Steven Weber
Associate Superintendent for Teaching &
Learning, Fayetteville Public Schools

Program Director:

John Freeman
Professor and Interim Department Head,
Center for Leadership & Learning

Graduate College Dean:

Jeff Robertson
Professor and Interim Dean
Graduate College

Abstract

The purpose of this study is to examine the impact of one-to-one technology use on students and faculty compared to traditional use of technology. The researcher employed a quantitative study that utilized a quasi-experimental design to investigate the technology effect using survey instruments. Participants included in this study were from schools located in Northwest Arkansas. There were approximately 2,640 students across seven middle schools as well as 63 staff members in the same schools. The results of this study found that while the I3 schools did perform better than their counterparts, the differences were not statistically significant. However, the faculty predominantly supported the use of technology and indicated that technology is beneficial for student learning, instruction, and education overall. The study also found that there was common perception between faculty that the use of technology is needed for students to be not only able to perform tasks in classrooms but also necessary to compete in a changing workforce. Further, the result indicated that out of several independent variables, the only variable found to be a significant predictor of students' proficient ACT Aspire test scores in all subjects was their grade level. Additionally, the results of this study found that there was a strong, positive correlation between teachers' use of technology and their perceptions regarding students' learning. Finally, these results of this study found that students' scores in all subjects were different based on their cohort more than the method of technology use. The scientific implications of these findings in the light of the literature review are also discussed.

Acknowledgements

I want to express my gratitude to my dissertation chair, Dr. Mohamed Ibrahim, for his support, insights, and encouragement throughout the dissertation process. Your time and dedication to helping me complete achievement my goals is greatly appreciated and I am forever appreciative of your guidance. I would also like to thank the remaining members of my dissertation committee, Dr. Steven Weber and Dr. John Freeman, your advice and guidance are much appreciated. Thank you to all the members of Cohort Three, your advice and encouragement over the past two years is something I'll never forget. Lastly, I would like to acknowledge members of my family, not for your encouragement during the dissertation process but rather your support throughout my life. Specifically, I would like to thank my mother, Debby and my sister Holly. Mom, you taught me the meaning of hard work and dedication to family through your actions in raising and supporting a family all on your own. Holly, you have been my lifelong mentor in both my professional and personal life. I could never thank you both enough for the lessons you have taught me and the love that you have shown me throughout the years.

Dedication

I want to dedicate this work to my family, Trish, Beckett, and Emelia, who arrived on January 29, 2019. Trish, your support and love have carried me a long way through this process. You believed in me when few did, and for that, I could never thank you enough. Beckett, my life changed for the best when you came into my life nearly four years ago; thank you for being my best friend. Emelia, this world is yours, make it your own. If anyone or anything gets between you and your dreams, prove them wrong. I love you all so much, thank you for being my people.

Table of Contents

	Page
ABSTRACT	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
CHAPTER ONE: INTRODUCTION	1
Background of the Problem	1
Statement of the Problem	3
Research Questions	4
Conceptual Framework	5
Significance of the Study	8
Scope of the Study	8
Limitations	11
Definitions of Terms	13
Summary	15
CHAPTER TWO: LITERATURE REVIEW	16
Background of the Problem	16
Access to Technology	17
Impact on Student Achievement	22
Implications on Professional Development	26
Implications on Curriculum Design	27
Summary	30

CHAPTER THREE: RESEARCH METHODOLOGY 32

Rationale for Research Approach 33

Participants 34

Research Questions 35

Research Sample and Data Sources 36

Instruments 36

Procedure 37

Summary 39

CHAPTER FOUR: DATA ANALYSIS 40

Demographics 41

Participants 42

Data Preparation and Screening 44

Main Findings 45

Research Question One 45

Research Question Two 47

Research Question Three 49

Research Question Four 51

CHAPTER FIVE: DISCUSSION 54

Interpretations of the Findings 55

One-to-One Technology Compared to Traditional Use 56

Predicting Student Achievement 57

Teacher Perceptions on the Impact of Technology 59

Limitations of Study 62

Recommendations 63

Conclusion 64

Reflection 65

REFERENCES 66

APPENDICES 76

Appendix A: Teacher Survey 76

Appendix B: Informed Consent 78

Appendix C: IRB Approval Letter 79

List of Tables

Table 4.1 Student Demographics by District

Table 4.2 List of Schools Included in the Study

Table 4.3 Students Processed by ACT Aspire Subject, by Cohort

Table 4.4 Count of Teachers Surveyed in Each School

Table 4.5 Results of One-Way Between Subjects ANOVA I

Table 4.6 Descriptive Statistics I

Table 4.7 Survey Response: Is Your School Considered to be “One-to-One” School?

Table 4.8 Survey Response: How Frequently Do Students in Your Classes Use Technology?

Table 4.9 Descriptive Statistics II

Table 4.10 Results of One-Way Between Subjects ANOVA II

Table 4.11 Teachers’ Reports of Technology Impact on Student Learning

Table 4.12 Survey Response: Relation to How Technology Has Impacted Effectiveness of Your Instruction

Table 4:13 Survey Response: Relation to How Technology Has Impacted Student Learning

Table 4.14 Survey Response: Relation to How Technology Has Impacted Education as a Whole

Table 4.15 Results of One-Way Between Subjects ANOVA III

List of Figures

Figure 1.1 Student Achievement Variables

Figure 2.1 TPACK Framework

Figure 2.2 SAMR Model

CHAPTER ONE: INTRODUCTION

The focus of this chapter will be to identify critical components include in the research was conducted in the area of one-to-one technology, specifically in the middle-level grade levels. The key components identified in this chapter include identifying the purpose of this study, defining the conceptual framework, and laying out the scope of the study. The intention of this study was to provide valuable resources to school leaders and policymakers alike to potentially influence future instructional decision making in schools. Furthermore, this work will serve as a worthy contribution to the field of knowledge regarding educational technology.

Background of the Problem

Educational technology has grown exponentially over the past decade, with many schools moving to one-to-one technology models. During this time, technology has become more affordable and reliable, which has contributed to an increase in the purchasing of technology devices at a global level (Padovan, 2015). The current trend of increasing the number of devices (Chromebooks, iPads, Windows Surfaces, etc.) is due in part to technology becoming a more significant part of instructional practice. Because of the emphasis is placed on purchasing new technology, there is a need to investigate the relationship between one-to-one technology and student achievement.

The increase in technology is not only a trend is being witnessed in schools, but also in the home. In the United States, families have access to the internet at home has grown from less than 20% in 1997 to approximately 75% in 2012 (Bulman, 2016). This increase is also taking place on a global level, not just in the United States. In developed countries, approximately 78% of school-aged children have access to the internet in the

home, whereas only 31% of school-aged children have access to developing countries (Bulman, 2016). Even though there is a gap exists between both developed and developing countries, the increase in access to technology across the world is occurring at a rapid pace.

The addition of technology to a broader population of people at a global level as led to changes in the workplace as well. Increase in technological devices helps to streamline processes in educational environments, but also non-educational environments. The technological skills used in the modern workplace are often referred to as 21st-century skills (Collins & Halverson, 2018; Dunleavy, Dexter, & Heinecke, 2007; Mouza, 2008). A common perception is that these skills are needed for students to be not only able to perform tasks in a post-educational setting but also to compete in a changing workforce (Mac Iver & Mac Iver, 2010).

The increase in access to technology is changing many aspects of our daily routines; the same can be said for our routines in educational settings. Therefore, the purpose of this study is to investigate the impact of technology on student achievement in Northwest Arkansas public middle-level schools. The effectiveness of one-to-one technology was examined by focusing on the impact of one-to-one technology using the following themes: comparison of one-to-one technology and traditional use of technology, factors best predict student improvement on the ACT Aspire Summative Assessment, the relationship between teachers' use of technology and perceptions of student learning, and whether or not proficiency levels differ based on grade level cohort. Student data was examined from the ACT Aspire Summative assessment scores in order

to determine if there was a relationship between one-to-one technology and student achievement.

Statement of the Problem

Despite increasing amounts of technology purchased by schools, it is still unknown the exact impact technology has on student achievement (Chang, 2017). School districts spend large amounts of money to support new devices and the necessary professional development for implementation without adequate research (Singer, 2017). Therefore, a study was conducted which investigated impact of one-to-one technology using the following themes: comparison of one-to-one technology and traditional use of technology, factors that best predict student improvement on the ACT Aspire Summative Assessment, the relationship between teachers' use of technology and perceptions of student learning, and whether or not proficiency levels differ based on grade level cohort.

The impact of instructional technology has been measured in numerous manners through a variety of studies. The impact can be measured through achievement, motivation, teacher perceptions, and workforce readiness, to name a few. Higgins, Huscroft-D'Angelo, Crawford (2017) sought to determine if there was a relationship between motivation and math achievement through the use of technology in their classes. Studies have also been conducted to measure the effectiveness of instructional technology in pre-service programs (Brzycki & Dudt, 2005). Lastly, there have been a wealth of studies conducted to measure the effectiveness of instructional technology with regard to preparing students with the necessary skills for the workforce, i.e. 21st century skills (Collins & Halverson, 2018; Dunleavy et al., 2007; Lowther, Inan, Ross, & Strahl, 2012). Although these studies have been conducted on the impact of technology, few

examine the impact of the use of technology in the middle school environment, specifically in the geographic region of Northwest Arkansas.

Research Questions

Although many studies have addressed the use of one-to-one technology in various instructional settings, there is a need for further research on the impact of the use of one-to-one technology on students' academic achievement in the middle school environment. Therefore, the intent of this study was to investigate the following research questions.

- Does one-to-one use of technology affect students' test scores compared to traditional use?
    - Hypothesis: The use of technology in one-to-one settings will have a positive impact on student achievement, compared to the traditional use model.
- What factors best predict students' test score improvement on the ACT Aspire Summative Assessment?
    - Hypothesis: There is a strong relationship between schools that are rich in technology and student achievement.
- What is the relationship between teachers' use of technology and their perceptions regarding students' learning?
    - Hypothesis: Teachers who use more technology in their classrooms believe it has a positive effect on students' learning.
- Does students' level of proficiency in all tested subjects differ based on their cohort?

- Hypothesis: Students' cohort does not affect their level of proficiency in all tested subjects.

Conceptual Framework

While the perception does exist that familiarity with technology is necessary for the modern workplace, there is still the question as to whether or not the introduction of more technology impacts student learning. The introduction of one-to-one technology has drastically changed the landscape of classrooms across the United States. According to Sauers & McLeod (2018), one-to-one technology is defined as a school within a specific grade span provides a take-home laptop for all students. There are other variations of one-to-one exist, including programs where the devices remain at the school. Many schools are implementing a variation of one-to-one technology in their schools are beginning to show academic progress after the implementation of one-to-one technology; however, there are still many variables to consider when examining the impact (Bebell & O'Dwyer 2010; Maninger & Holden, 2009; Warschauer & Tate, 2015). Due to the variables can contribute to measuring the impact, there is still a need for research in this area to help determine the level of impact, while attempting to limit contributing variables.

The rate of technology growth in our student's lives has increased dramatically in recent years, but there is a lack of research to suggest the purchasing of technology is having an impact on our students. However, there seems to be a consensus that more technology has a positive impact on the educational progression of students. School districts and pre-service programs are now beginning to require a certain level of training or certification in the area of instructional technology for teachers within their

organization. Google Incorporated recently released a series of case studies detailed the efforts being implemented by many universities across the country. New York University Steinhardt Graduate Program, currently trains candidates to use the technology tools will help teachers be successful within their classrooms (Google, 2017). The program centers on not only introducing students to the technology tools that will help them be successful in the classroom but also helping them find the balance between pedagogy and technology integration. Currently, the program works in partnership with the New York City Department of Education (NYC DOE) by providing trainers to support the program.

Professional development and pre-service programs are a pivotal component to successful technology integration. It is essential to have an instrument help examine the impact of technology when integrated into instruction. The Substitution, Augmentation, Modification, and Redefinition (SAMR) model is one of several instruments educators use to drive curriculum design and the role technology plays in this process. The model represents the levels of implementation technology contributes to a lesson starting with substitution as the lowest form of implementation and redefinition as the highest form. The category of substitution means the task is being completed by the student is a task could be replicated using pencil and paper; whereas a lesson falls into the redefinition category is using technology to completely redefine the task at hand with technology serving as an enhancement to the process. Lessons and units redefine the processes are also helping lead to more personalized learning within schools (Cook-Harvey, Darling-Hammond, Lam, Mercer, & Roc, 2016). With new technology instruments aid in

curriculum design, educators are beginning to leverage technology to personalize learning opportunities and attempt to meet the needs of students on an individual basis.

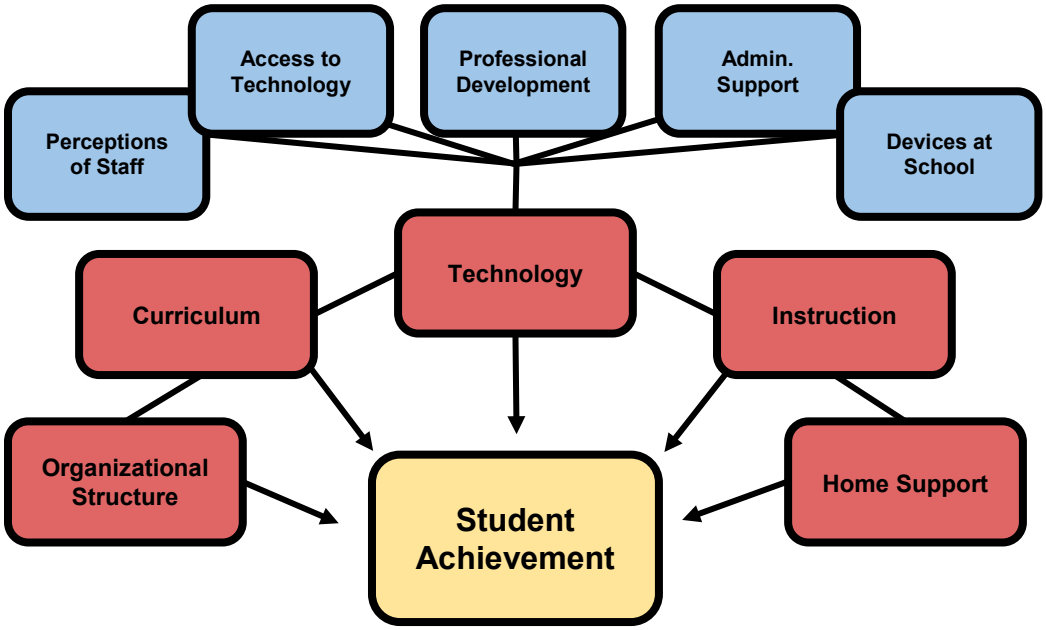

Figure 1.1: Student Achievement Variables

While the aforementioned literature suggests preparing preservice educators in integrating technology in the classroom is generally accepted best practice, there is little research to prove this can be statistically supported (Google, 2017). It is difficult to conclude how useful technology concerning student achievement due to the amount of contributing variables. As indicated in Figure 1.1, there are a multitude of variables that go into technology being utilized as a tool in the classroom. Prior to the purchasing of technology for a school, there are several considerations schools need to make in this process. A combination of pedagogy, support, and perception can drive a successful one-to-one technology program implementation.

Significance of the Study

The significance of the study was to determine whether or not there is a relationship between the implementation of instructional technologies and student achievement. This study analyzed multiple factors that can influence student achievement as it relates to instructional technology. The study examined what best practices are currently being used with the greatest success rate by measuring what combination of devices and professional development are having a significant impact on student success. Gaining greater insight into the relationship between technology and learning can assist school leaders in making well-informed decisions concerning the purchasing and implementation of instructional technologies in their schools.

The significance of this study rests on the potential to contribute to the already existing body of work, but more specifically to serve as a resource to inform educators and policymakers alike. This study has the potential to continue to add to the argument for policymakers that more emphasis needs to be placed on programs that promote one-to-one technology and allocating funds for more technology in schools.

Scope of the Study

Although there is an already existing body of work in the area of research in one-to-one technology, the intent of this study was to contribute to the body of work through the research design. Therefore, a quantitative study was conducted which utilized a quasi-experimental design in the area of one-to-one technology and its relationship to achievement scores, as measured by the ACT Aspire Summative Assessment. The study included schools in Northwest Arkansas participate in the Investing in Innovation Grant (I3) from the United States Department of Education in conjunction with the eMINTS

national program. In addition, other non-participating schools were included in the study as well to determine the level of impact the program can potentially have on student achievement.

eMINTS is a national program originated from Missouri in partnership with the Missouri Departments of Elementary and Secondary Education. The mission of this program is to help prepare teachers for the demands of meeting the need for implementing technology in their classroom (eMINTS National Center, n.d.). In 2015, the eMINTS National Center, in partnership with the University of Missouri College of Education, was awarded a 12 million dollar grant as a part of the Investing in Innovation Initiative (I3) from the United States Department of Education (eMINTS National Center, n.d.). Participating schools received one-to-one Chromebooks for seventh-grade students in the subjects of math, science, social studies, and language arts. In addition, each participating teacher received an issued Chromebook, Virtual coaching system, stipends for participating educators, and face-to-face follow up meetings (eMINTS National Center, n.d.).

The participants included students from schools in Northwest Arkansas that participate in the Investing in Innovation Grant (I3) from the United States Department of Education in conjunction with the eMINTS national program (eMINTS National Center, n.d.). Students from surrounding schools similar in size and demographic make-up were included in the study to help determine the effect the I3 program has on student achievement. Achievement in these schools was gauged by the percentage of students who score "Proficient" on the English Language Arts and Math components of the ACT Aspire Summative Assessment. The English Language Arts score consists of three sub-

tests which include English, Writing, and Reading (ACT, 2015). Proficiency on this component is measured by a composite score of the three assessments to determine if a student is proficient or not proficient. The Math assessment is measured by the score of one individual test and is categorized into four categories; Needs Support, Close, Ready, and Exceeding. Students who score in the "Ready" or Exceeding" category are considered to be proficient (ACT, 2015).

Schools and districts identified for this study will be not be referred to by their actual name. Schools will be labeled using the following naming scheme: School 1, School 2, School 3, etc. In total, seven schools were selected from the Northwest Arkansas area for this study. Four of schools were identified as participating schools included in the I3 2017 Cohort, the other three schools were identified as non-participating schools. The three non-participating schools were selected due to similarities in size, demographic makeup, and proximity to the four participating schools. In order to measure the perceptions of teachers concerning professional development, teachers within these schools were surveyed as well to determine the impact professional development has had on the integration of educational technology, concerning one-to-one technology.

The trend to increase technology in schools has a deeper connection beyond teaching students the application of technology in their everyday lives, it is a part of a growing global trend to personalize learning. Technology is being used as a tool to change pedagogical approaches to target instruction for all learners. Various schools are using technology to tailor instruction to students through the use of learning management systems to understand the needs and goals of each student better. In a study conducted by

the RAND Corporation in partnership with the Bill and Melinda Gates Foundation, the researchers compared schools utilizing a personalized learning approach to schools that did not use a personalized learning approach (Stecher et al., 2018).

While ultimately it was anticipated there would be a relationship between technology and achievement, it is understood a relationship does not equate to causation. Due to the complexity of student achievement, it was expected that it would be difficult to measure the impact of all potential variables related to student achievement. Additional factors can contribute to achievement data that have no relationship to technology; however, the study attempted to minimize the amount of additional variables in order to obtain the most accurate representation of the success of the technology integration.

Limitations

Limitations of this study include identifying schools participating in the I3 program while controlling variables involved in determining statistical relevance between participants of the program and achievement data. The challenging aspect of the study was to minimize the number of variables could affect student achievement in order to determine the significance of the I3 program. As previously mentioned, a multitude of variables potentially have an impact on student achievement. In order to determine the level of impact technology had on achievement, isolation of these variables was a consideration for this study.

The secondary limitation would be the sample size of the study. While the I3 program is a national program, the scope of this study focused primarily on the impact the program has students in Northwest Arkansas. The collection of data for the specific

geographic region was examined was not inclusive of any data that would be gathered on a national level; such as student ethnic background or socio-economic diversity.

The delimitations of the study included the following: location of schools in the study, the selection of data from school years to examine, and the size of the schools in the study. The number of schools included in this study were determined, in part, by how many schools participate in the I3 program. This study included four schools that participate in the program as well as various other schools from the same geographic region share similarities in demographic information.

The second delimitation is students were studied in a cohort in order to determine if there was a significant impact during the 7th-grade year, where the treatment has been applied. Specifically, the schools selected for the study were schools participating in year three of the I3 program. Examining multiple grade levels of data from the same cohort of students allowed for truer relevancy. The size of the school was also a delimitation considered for this study. In order to get a firm understanding as to the relationship between technology integration and student achievement, the researcher sought to find commonalities between each school when comparing.

ACT Aspire Summative Assessment data was used to analyze the impact between schools. Schools participating in the I3 Program were compared to schools similar in size and demographics not participating in this program. Furthermore, the selected non-participating schools had data collected through surveys to determine the level at which educational technology is used within the school.

Definitions of Terms

Several terms recur throughout the study. The following section will help clarify any unfamiliar terminology for the reader of the study.

ACT Aspire: Assessment system designed to track student progress toward college and career readiness from grade 3 to grade 10 anchored by the ACT test ("ACT", 2015).

Proficiency: Defined as a having scored in the categories "Ready" or "Exceeding" on the ACT Aspire Summative Assessment. Students scoring in the categories "Needs of Support" or "Close" are not considered as being proficient on the assessment.

21st Century Skills: Defined as skills needed for students in order to be successful in a modern day workforce. Skills include critical thinking, creativity, collaboration, communication, information literacy, media literacy, technology literacy, and flexibility (Collins & Halverson, 2018; Dunleavy et al., 2007; Lowther, Inan, Ross, & Strahl, 2012).

One-to-One Technology: Defined as having the same total amount of computing devices as students enrolled in the school.

Chromebook: Computing device that is created by various companies and operates using the Chrome Operating System, was developed by Google, Inc.

Google Apps for Education (GAFE): Referring to a collection of applications that are made available by Google Inc. and made available to public schools and users within their domain at no cost.

eMINTS: Organization created in partnership with the Missouri Department of Elementary and Secondary Education and the Missouri Department of Higher Education

to help schools and teacher meet the demands of digital age teaching and learning ("eMINTS", 2018).

Investing in Innovation (I3): Funding established under section 14007 of the American Recovery and Reinvestment Act of 2009 (ARRA), provides funding to support local educational agencies and nonprofit organizations in partnership with one or more LEAs or a consortium of schools. For the sake of this study, this will reference the partnership between eMINTS and I3 in order to invest in one-to-one computing for 7th-grade students (eMINTS National Center, n.d.).

SAMR: An acronym for an educational model designed to assist educations integration technology into their instruction as measured by the four levels of integration. The acronym stands for substitution, modification, augmentation, and redefinition. Substitution represents the lowest level of technology integration, and redefinition represents the highest level of technology integration. (Romrell, Kidder, Wood, 2014).

Summary

There is a lack of research in the area of the relationship between student achievement and educational technology; however, educational technology is still a substantial investment for many schools. The goal of this study is to help provide building and district level administration with a guideline to best practices when implementing technology in education. This study specifically sought to determine the relationship by analyzing the I3 program and how it compares to technology alternatives being implemented in comparable educational settings. This study is designed to determine if there was an impact on student achievement due to the treatment applied through the I3 program. This study included multiple middle schools across the Northwest Arkansas Region and utilized data from the ACT Aspire Summative Assessment to aid in making the determination. Examination of the data ultimately helped determine the level of impact that more technology in student's possession has on their achievement.

CHAPTER TWO: REVIEW OF LITERATURE

The literature review will provide insights into the body of work has been completed before the completion of the study. There are several components considered significant contributing factors to student achievement through the use of instructional technology. The scope of the literature review included a variety of literature that contributed to the field of knowledge. Chapter two is organized using the following themes to examine the body of literature: access to technology, impact on student achievement, implications for professional development, and implications on curriculum design. These themes will provide the appropriate framework to discuss the relationship between technology and instruction.

Background of Problem

Over the past two decades, schools have placed more emphasis on helping students develop 21st Century Skills; these skills are defined as critical thinking, communication, collaboration, and creativity which would help students be more prepared for the demands of the modern day workplace (Lowther et al., 2012). In order to help prepare students for the skills needed, many schools are moving to one-to-one technology implementation in order to prepare students (Mac Iver & Mac Iver, 2010). The amount of schools moving toward implementing one-to-one technology has created a market for large technology companies. According to venture capital research, educational technology sales grew from $385 million in 2009 to $1.87 billion in 2014 (Koba, 2015). Considering the amount of technology being added to classrooms, it begs the question as to whether or not the implementation of additional technology is having a positive impact on student learning.

The purpose of this literature review is to investigate the impact of technology on student achievement in K-12 public schools. The review of literature examined the extensive research already exists and highlighted the work or previous research in an effort to explore the impact of educational technology further. Considering the number of schools are racing to increase their technology inventory in schools, research focusing on this topic could prove to be very valuable for school leaders (Barkand, 2017).

Access to Technology

The impact of technology can easily be seen in the increase in access students now have at home. The number of families having access to the internet at home is growing exponentially from less than 20% in 1997 to approximately 75% in 2012 (Bulman, 2016). While there are still some barriers to be addressed to better bridge the gap between those with access and without, access to technology and the internet continues to increase (Rogers, 2001). The same is true for schools as well, thanks in large part to the E-Rate funding for schools (Garcia-Mathewson, 2017). Furthermore, in 2017 it was reported 94% of all school districts now meet the federal connectivity target (Herold, 2017). While ultimately the effectiveness of technology will gain attention, it is important to first discuss access before there is a discussion about implementation.

Improving access to the internet for schools has been a priority and has improved in recent years; however, improving school connectivity has not always been a priority. One method has been used to help address this access issue is through E-Rate funding. E-Rate is an initiative that was funded by the US Department of Education to provide discounted telecommunication services to primarily public schools and libraries (Puma, Chaplin, & Pape, 2000). Though this program was initially designed to target

impoverished areas, it has had a more significant impact on all public schools by increasing connectivity. Since 2013 schools considered to have "robust wi-fi" connection has increased from 30% to 94% as of 2017 (International Society for Technology in Education, 2017). The E-Rate Program and dedication of government support have been an initiative that has helped provide schools with the infrastructure necessary to support technology.

Support for schools through the E-rate program has allowed many schools to implement one-to-one technology plans designed to impact student learning by putting reliable infrastructures in place. Schools are rapidly moving toward obtaining one-to-one technology due in large part to the affordability of devices (Singer, 2017). These initiatives require a substantial investment on the part of schools, and the impact the technology has on achievement should be examined carefully in order to determine if this expense is justified. The Maine Educational Research Institute (2007) conducted a study on one of the first large-scale one-to-one programs in the United States in 2002. The study included participants in the seventh and eighth grades in a school district where students were issued laptops, and the students' writing achievement was measured to determine the relationship (Herold & Kazi, 2017). The study determined there was a strong relationship between achievement scores of writing by one-third of a standard deviation when compared to relative non-laptop schools. A similar study conducted in Farrington School District in California by Grimes & Warschauer (2008) examined one-to-one schools and relative non-laptop schools. The study showed in the first year of implementation there was an initial dip in achievement, as measured by reading and writing, but in the second year, the scores increased. This resulted in a neutral effect on

the relationship between one-to-one schools and student achievement (Grimes & Warschauer, 2008). Perhaps the most revealing study was conducted in Texas by the Texas Center for Educational Research (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2009). The study was able to match contributing variables, including school size, demographics, and overall performance on aptitude tests. Ultimately, the study determined one-to-one technology had no significant effect on tests scores in math and language arts but did show a slight positive effect on cognitive skills.

While some studies indicate there is little to no effect technology has on student achievement, Bulman and Fairlie (2015) emphasize in their studies one-to-one initiatives are the exception. One model commonly used in education is called computer-assisted instruction; which are self-paced programs adapted to the user's speed and ability. Schools frequently incorporate this model to help address needs for students who attend school in virtual settings, but this model can be incorporated into classroom instruction for small group or intervention, particularly in the area of math and reading. Research conducted by the United States Department of Education and Mathematical Policy Research (Campuzano, 2009) examined six reading programs and four math programs used as supplemental instruction for students in elementary, middle, and high school. Barrow, Markman, and Rouse (2009) examined the impacts of computer-assisted instruction in three large urban school districts in the United States. Their study focused on pre-algebra and algebra students who were taught in a computer lab using the software as additional or supplemental instruction (Barrow, Markman, & Rouse, 2009). Their study indicated there was a positive effect in using technology, specifically in classrooms having large enrollments.

One area of education that has benefited from computer-assisted instruction is the current personalized learning movement. Personalized learning is defined as practices that tailor instruction to the adequate pace and focus for each individualized student (Pane, J. F., Steiner E. D., Baird M. D., Hamilton L. S., and Pane, J. D., 2017). While technology is not essential to a personalized learning model, there has been research suggesting a personalized model utilizing technology can impact student performance in a positive manner. In a study which included students enrolled in asynchronous online secondary courses, results suggested the learning management system (LMS) that was used to administer the curriculum, had a positive impact on students that were enrolled in the system compared to their counterparts (Barkand, 2017). This study suggests there are added benefits to the use of technology that may or may not be utilized in all situations. The concept of flipped classrooms is an excellent example of how equipment can be utilized to have a positive impact on student achievement. Flipped classrooms are a combination of face-to-face instruction and instruction delivered in an online format; however, the online format usually benefits from the use of an LMS and proper planning (ChanLin, 2017). Due to the perception of educators of the effectiveness of such models, these approaches are becoming commonplace in teacher preparation and professional development (Brzycki & Dudt, 2005).

While schools are increasing access for students at school, there is still a disconnect between access at school and access at home. In the United States, there are approximately nine million out of approximately fifty million school-aged children who do not have access to the internet at home (Rideout, Foehr, Roberts, & Henry J. Kaiser Family Foundation, 2010). While access to technology is critical for students to perform

well in the modern educational setting, how technology is used in the home makes a difference for students as well. According to a report conducted by the Kaiser Family Foundation in 2010, school-aged children spend approximately 16 minutes a day on technology for the purposes of completing homework. This number measures low compared to other purposes technology serves, such as entertainment (Rideout, et al. , 2010). However, research does show early access can make a significant impact on student learning. A study conducted from North Carolina suggests early adopters, students who owned a computer before grade 5, show an increase in their normative test scores year to year compared to their counterparts who show a decline over the same time period (Vigdor, Ladd, & Martinez, 2014). Additional studies show there is a strong relationship between students who have access to a home computer and higher grades and graduation rates. While the possession of a computer does not solely lead to an increase in achievement, it does suggest access to information at an early age can be a contributing factor to student achievement.

The process of determining the impact of technology and internet access in the home can prove difficult due to a multitude of variables, including how technology and internet access are utilized in the home. The National Longitudinal Survey of Youth (1997-2002) found students who had access to a computer in the home were 6-8 percentage points more likely to graduate from high school than students who did not have access. This study not only indicated a strong relationship between student achievement and home computers, but it also indicated a negative relationship between suspensions and home computers as well. While this study and few others do suggest there is a strong relationship between access at home and student success, Bulman, George & Fairlie

(2016) suggest there is still more research needed on this subject in order to determine the impact on education.

Impact on Student Achievement

While there are many variations of different types of technology implemented in schools, most of these variations are derived from the implementation of one-to-one technology in schools. One-to-one technology is defined as every student within a specific grade are assigned a laptop (Sauers & McLeod, 2018). There are many ways in which schools can accomplish the goal of providing one-to-one technology. There are variations within the types of programs utilized by schools, which can vary between device of choice and whether or not students have access to technology or if they are assigned one specific computer throughout the day (Solomon, 2017). Regardless of the configuration, schools are increasing technology spending in the hopes the addition will have a positive effect on instruction and student learning.

The increase in technology in schools is not just a popular trend among school leaders, but The United States Government has also taken notice of the potential impact technology can have on education as well. In an effort to help boost the economy after the recession of 2008, the American Recovery and Reinvestment Act of 2009 provided funding to educational agencies and nonprofit organizations to invest in innovative practices (U.S. Department of Education, 2017). This act paved the way for the Investing in Innovation (I3) program, which provided funding to the program. While not all the innovative programs that received funding were required to implement technology, many of the programs used technology as a component of their innovative practices, such as the partnership between eMINTS and the University of Missouri (eMINTS National Center).

This partnership was one of the 67 innovative projects initially implemented with the hope of having a positive impact on student achievement.

The initial results from these innovative practices showed promise that I3 programs were having a positive impact on student achievement. However, further investigation into these programs suggests the programs are not as effective as once believed (Barshay, 2018). According to a report published in early 2018, 19% of the innovation projects demonstrated a positive impact between the student academic outcomes and the projects of innovation (Boulay et al., 2018).

Furthermore, the Boulay et al (2018) report concluded 46% of the projects had a "null" results as it relates to positive impacts on student academic outcomes. The remaining 35% of the results were a mix of mixed results, negative results, and no evidence (Boulay et al., 2018). The intention with the I3 grants was to identify best practices in education that could potentially impact student achievement, then replicate these in other schools. However, the initial findings suggest the search for positive impact on student achievement is still ongoing.

Technology has become more affordable and reliable, and this is evident in the growth of one-to-one programs in the United States over the past ten years, such as the I3 program (Bebell & O'Dwyer, 2010; Maninger & Holden, 2009; Warchauer & Tate, 2015). Implementing one-to-one technology is a substantial investment in equipment and preparation, so it is essential for school leaders to determine its effectiveness. There are commonly two ways in which one-to-one programs are evaluated, by perception or by evaluating achievement scores. There have been numerous studies conducted in an effort to collect the perceptions of teachers, students, administrators, and technology directors

to qualitatively evaluate the impact of one-to-one technology (Brzycki & Dudt, 2005; Gonzalez, 2017; Jahnke, Svendsen, Johansen, & Zander, 2014; Perry, 2018). There is not one common consensus between all the studies; however, it is worth noting often perceptions can help dictate the effectiveness of a program. In Perry's 2018 study, he concluded there was not a significant correlation between practices as related to technology integration, the district studied had shown improvement in achievement dating back to the implementation of one-to-one technology. Furthermore, Perry explains the strategic planning for the school district concerning the commitment by leadership and professional development opportunities have led to a strong commitment to academic achievement.

There have been a wide variety of qualitative studies conducted to measure perceptions of teachers, students, administrators, and parents alike regarding one-to-one technology. Perceptions can be a significant indicator of the success of a one-to-one program mainly due to the number of factors contribute to a successful program, such as administrative support, professional development, attitude towards integration, etc. (Clemensen, 2018; Perry, 2018; Robinson, 2018). Studies have shown training and attitude towards the technology implemented can affect pedagogical changes in instruction and can contribute to motivation towards the use of technology (Alharbi & Drew, 2014; Loescher, 2018). One such perception is how ready students are for the modern workforce, as measured by 21st-century skills. Twenty-first-century skills are defined as critical thinking, communication, collaboration, and creativity. While these skills are not explicitly tied to technology, technology can serve as a tool which helps accomplish these concepts (Mac Iver & Mac Iver, 2010). While 21st-century skills

cannot be quantified, they are skills that are commonly referred to as essential for students.

Much like perceptions, the effects of technology on achievement have yielded mixed results. The mixed results can be most commonly attributed to the number of variables that go into the type of technology implemented and how effectiveness is being measured. In addition, purchasing technology does not equate to guaranteed student success, but preferably there are many variables to consider, such as professional development. In a study conducted in Nebraska, there was no correlation between the expenditure on technology to student achievement (Robinson, 2018). Adversely, numerous studies do indicate there are positive impacts of the use of technology in schools, as it relates to student achievement (Higgins, Huscroft-D'Angelo, & Crawford, 2017; Hull & Duch, 2019; Rebecca Brown, 2018; Stephens, 2017). Ultimately, the determining factor in whether or not a one-to-one program is successful is how it is implemented and how success is defined (Clemensen, 2018). Success can be defined in a qualitative and quantitative manner just the same, and if the technology is not adequately implemented and supported through professional development, then it is likely not to be successful.

It is worth noting the type of devices used for one-to-one implementation should be taken into consideration as well. Each device type has a limitation associated with it when compared to other devices. For example, Chromebooks have limited storage and run mostly web-based programs which require an internet connection. This means additional knowledge about types of programs is necessary in order to accomplish academic goals (Loeshcer, 2018). However, it is not to say it is impossible to achieve,

but a certain level of knowledge about the product and training is required in order to accomplish the goals of the curriculum (Tsumura & Robertson, 2017). This point cannot be overstated; the support given to technology initiatives is valuable in the measured success of a program.

Implications on Professional Development

As previously established, in order for technology positively impact student achievement, school districts must provide quality professional development to support the technology being purchased. Organizations, including the International Society for Technology in Education, help support schools by providing a framework schools can follow to drive implementation of new technologies (Blanchard, LePrevost, Tolin, & Gutierrez, 2016). While there is a strong movement to implement technology and develop quality frameworks, research suggests there is significant work to be completed in this regard. In a study conducted by Gerard, Varma, Corliss, & Linn (2011), the research suggests many teachers are not prepared to integrate technology into instruction.

School districts and pre-service programs are now beginning to require a certain level of training or certification in the area of instructional technology for teachers within their organization. Google Incorporated released a series of case studies detailing the efforts being implemented by many universities across the country. New York University Steinhardt Graduate Program currently trains candidates to incorporate technology into their instruction. (Google, 2017). The program centers around not only introducing students to the technology tools that will help them be successful in the classroom but also helping them find the balance between pedagogy and technology integration. Currently, the program works in partnership with the New York City

Department of Education (NYC DoE) by providing trainers to support the program. The push for additional professional needs is not just seen in pre-service education, but it is seen throughout areas of the profession. Research suggests a successful program should include multifaceted supports for integration and effective use of technology supports student-centered learning (Stephens, 2017).

The decision to make professional development and training of pre-service educators is essential to implementing technology effectively. Especially in pre-service educators, training is received in these areas has the opportunity to ultimately change the pedagogical approaches of educators when it comes to instruction (Jahnke, Bergstrom, Marell-Olsson, Hall, Kumar, 2017). Best practice indicates technology should change the nature of a lesson based on the notion that technology serves as a means to enhance a lesson. Therefore, it is essential to take note of changes in curriculum frameworks that are intended to enhance instruction through the use of technology, such as Technological Pedagogical Content Knowledge (TPACK) and Substitution, Augmentation, Modification, and Redefinition [SAMR] (Perry, 2018).

Implications on Curriculum Design

When considering the implications of moving to one-to-one, the implications of technology on curriculum design should be heavily considered. As previously stated, the benefit of utilizing technology in the classroom is the enhancement that could not otherwise be accomplished without technology. In order to adequately plan on how to implement technology to enhance the content, curriculum frameworks such as TPACK exist (MISHRA & KOEHLER, 2006) Mishra & Koehler, 2006). TPACK is a framework

aids teachers in their understanding of what level of knowledge is necessary in order to implement technology into their instruction.

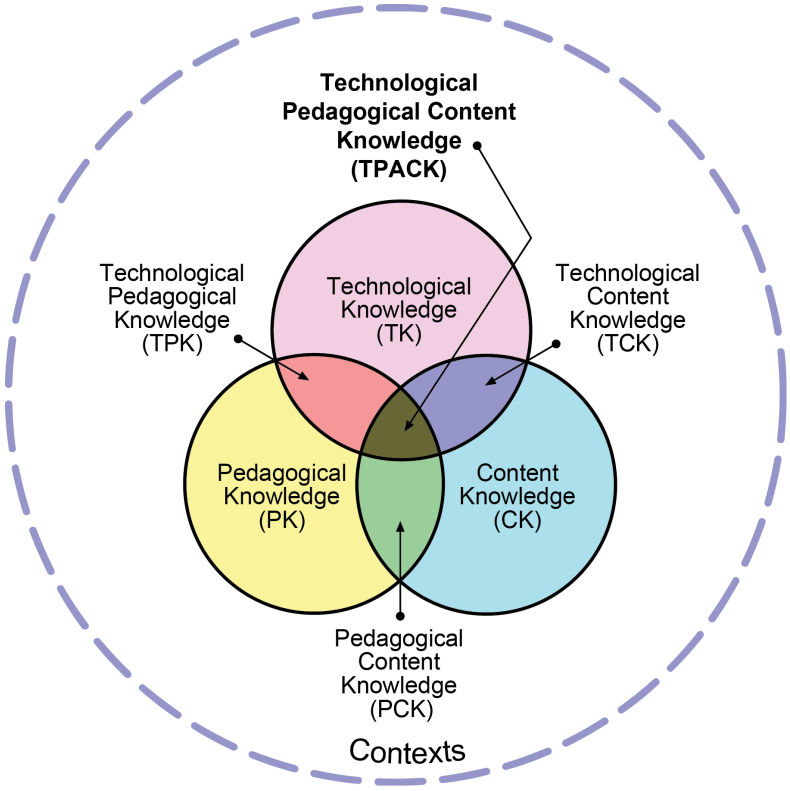

Figure 2.1: TPACK Framework (Mishra & Koehler, 2006)

There are three essential domains to TPACK which include technological knowledge, pedagogical knowledge, and content knowledge. The intersecting areas are essential to make note of because those areas indicate a deeper level of understanding. This framework serves as a means to help teachers understand the complexity between combining all aspects of instruction along with the demands to integrate technology (Mishra & Koehler, 2006). It further illustrates the need to have appropriate training for teachers to ensure technology is used in a fashion that enhances instruction.

Another framework commonly referenced concerning technology integration into instruction is the SAMR Model. The SAMR Model is one of several instruments

educators use to drive curriculum design and the role technology plays in this process (Green, 2014). The model represents the levels of implementation technology contributes to a lesson starting with substitution as the lowest form of implementation and redefinition as the highest form.

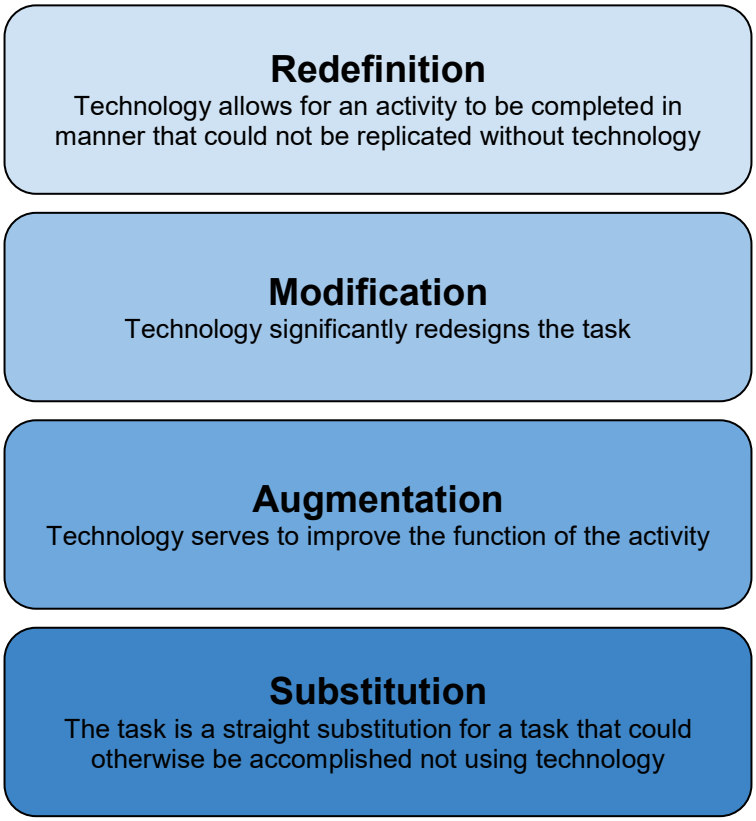

Figure 2.2: SAMR Model (Romrell, Kidder, Wood, 2014)

The category of substitution means the task being completed by the student is a task could be replicated using pencil and paper; whereas a lesson falls into the redefinition category is using technology to completely redefine the task at hand with technology serving as an enhancement to the process. Lessons and units redefine the processes are also helping lead to more personalized learning within schools (Cook-Harvey et al., 2016). With new technology instruments aid in curriculum design,

educators are beginning to leverage technology to personalize learning opportunities and attempt to meet the needs of students on an individual basis.

Ultimately tools such as TPACK and SAMR are excellent tools when it comes to measuring the level of integration of technology in instruction, but professional development on how to drive instruction to the higher levels identified in TPACK and SAMR is crucial for successful integration. In a study conducted by Ott (2017), influencers for integration that ultimately had an impression of student experience were considered; of those influencers, teacher professional development was found to be the most impactful. Furthermore, Ott (2017) points out through teacher efficacy, higher levels of technology integration can be reached. Having systematic plans in place help address professional development needs for schools moving to one-to-one is essential for the success of technology that is integrated into instruction (Lawless & Pellegrino, 2007).

Summary

There is evidence suggesting technology can have a positive impact on student achievement, but it is not entirely clear what configuration of instructional technology can produce the best outcomes. Equipment can enhance instruction, but this can be accomplished in a variety of ways. Variables that had a positive impact on student achievement include purchasing the appropriate equipment, providing targeted professional technology with these devices, and writing a curriculum is not only supported by technology but also enhanced by it to provide a richer learning experience. While research shows there are many variables to consider, there are some constants that present themselves throughout the research. The need for strategic planning is critical to the success of technology integration in schools. At the core of a good strategic plan

should be the professional development that emphasizes not only how to use technology at high levels of integration, but also reinforce the pedagogical needs for instruction.

While there is extensive research on the topic of one-to-one technology and the best configuration would best support student achievement, there is an essential gap in this research as it relates to the best educational technology resources meet the needs of educators and students in order to best support student achievement. In addition, a gap exists specifically as to how this research is applied to our geographic region for middle-level grades. A study examining the specific technology configurations, as well as professional development needs, would be a beneficial addition to the body of research. While it may be difficult to minimize the contributing variables related to this research topic, additional research in this area would greatly benefit school leaders and policymakers as it relates to funding for equipment and professional development needs for educators.

CHAPTER THREE: RESEARCH METHODOLOGY

The purpose of this study is to examine one-to-one technology using the following themes: comparison of one-to-one technology and traditional use of technology, factors best predicting student improvement on the ACT Aspire Summative Assessment, the relationship between teachers' use of technology and perceptions of student learning, and whether or not proficiency levels differ based on grade level cohort. A quantitative study was conducted with utilized a quasi-experimental design examining the impact of technology of two types of schools; schools participating in the Investing in Innovation (I3) Grant through eMINTS, and schools not participating in the program. Chapter three will address all aspects of the conducted research by addressing the following components of the study: rationale, research setting, data sources, data collection, and limitations of the study. It is the intention the findings from the study will help to inform school leaders and policymakers when it comes to decision making in schools. With the increasing amount of technology added in schools (et al. Singer, 2017), the purchasing of technology is no longer solely a financial decision leaders have to make, but rather an instructional decision. Due to this increase in devices being deployed in schools each year, there is a need for further research to examine the effectiveness of one-to-one technology.

The primary focus of the research was on schools located in Northwest Arkansas participating in the Investing in Innovative Program (I3), as compared to non-participating schools similar in demographics and size. The research focused on achievement data was collected from the state standardized assessment for grades 3-10, the ACT Aspire Summative Assessment. In order to address the second area of focus for

this study, surveys were administered that correspond with participating I3 schools and non-participating schools to identify effective professional development training attended by teachers.

Rationale for Research Approach

While there has been extensive research on the topic of one-to-one technology, there is a gap in this research as it relates to the best professional development opportunities for technology integration best supporting student achievement. Also, a gap exists specifically as to how this research is applied to our geographic region for middle-level grades. Therefore, a quantitative study was conducted with a quasi-experimental design in the area of one-to-one technology and its relationship to achievement scores, as measured by the ACT Aspire Summative Assessment, using a cross-sectional survey design. The primary focus of this study, from a researcher's perspective, was to collect data from a process that is already naturally occurring in schools. The conducted a study would include schools in Northwest Arkansas participating in the Investing in Innovative Program (I3) from the United States Department of Education in conjunction with the eMINTS national program. The cross-sectional survey component of this study is designed to capture data from educators using surveys indicating their perceptions towards professional development programs related to technology integration.

eMINTS is a national program originated from Missouri in partnership with the Missouri Departments of Elementary and Secondary Education. The mission of this program is to help prepare teachers for the demands of meeting the need for implementing technology in their classroom (eMINTS National Center, 2018). In 2015,

the eMINTS National Center, in partnership with the University of Missouri College of Education, was awarded a 12 million dollar grant as a part of the Investing in Innovative Programs (I3) initiative from the United States Department of Education. Schools participating in the program received one-to-one Chromebooks for seventh-grade students, a Chromebook for each participating teacher, Virtual coaching system access, stipends for participating educators, and face-to-face follow up meetings.

The selection of this particular program was made due to the fidelity the program offers. The literature review points out there is a gap in the research due to the number of variables need to be considered with various one-to-one programs. There are fewer variables to consider when comparing schools participating in the I3 program because the same treatment is applied to all schools.

Participants

Participants in this study were selected from schools located in Northwest Arkansas. In this study, two groups of participants were identified, the first being cohorts of seventh-grade students who attend schools participating in the I3 program. These schools included Schools 1, 2, 6, and 7. The second group of participants were selected for this study were cohorts of seventh-grade students who attend schools not participating in the I3 program. In addition, non-participating schools were identified by schools with similar demographics and size as compared to the participating schools. Non-participating schools included Schools 3, 4, and 5. The participating and non-participating schools were chosen due to similarities to their characteristics and make-up of student population. Characteristics considered include total student enrollment, the percentage of free and reduced lunch rates, and ethnicity.

The schools participating in the I3 program were selected for this research due to the uniformity of the implementation with regard to equipment and professional development. One limitation observed through the review of the literature was the difficultly in comparing the impact of technology when comparing schools due to the number of variables. By limiting the study to participating schools compared to non-participating schools, this would provide the opportunity to limit the number of variables in order to determine the relationship. If it is found there is a relationship between one-to-one configurations and the strategies taught through the eMINTS program, this discovery would have the potential to make a significant impact on educational technology.

Research Questions

In order to determine the relationship between one-to-one configurations and student achievement, this study was centered on the following research questions:

- Does one-to-one use of technology affect students' test scores compared to traditional use?
- What factors best predict students' test scores improvement on the ACT Aspire Summative Assessment?
- What is the relationship between teachers' use of technology and their perceptions regarding students' learning?
- Does students' level of proficiency in all tested subjects differ based on their cohort?

The study is considered to a quasi-experimental design because it compared two groups in the study (I3 participating and non-participating), but it is worth noting the group

selection lacks random assignment. Achievement data was collected by accessing public information through the Arkansas Department of Education upon identification of schools. It is the hope these questions provided the structure necessary for this study to provide additional evidence that would aid in the analysis of the impact one-to-one technology has on student achievement.

Research Sample and Data Sources

Data sources included achievement scores collected from archived ACT Aspire data from selected schools. As previously discussed, the schools were selected were identified through survey information gathered from Arkansas educational cooperatives. Data sources in the survey included information regarding the one-to-one programs implemented in schools, across grade levels 3-10. Specifically, data was collected from seventh-grade cohorts over two years, the 2016-2017 and 2017-2018 school years. Seventh-grade cohorts were selected due to the nature of the I3 Program and the specific one-to-one implementation in seventh grade. Data was not only collected from the seventh grade, but data was pulled from cohorts for an additional two years, either before or after the seventh-grade assessment.

Instruments

The instrument used in order to determine the relationship between achievement and the I3 one-to-one initiative achieved data from state standardized assessment were used. The state of Arkansas currently uses the ACT Aspire Summative; two years of data from seventh-grade cohorts from participating school would be included in the study. The following items were also considered when comparing participating schools:

- Location of the school

- Size of the school (number of students)
- Length of implementation of the program

Assessment data from the ACT Aspire was used in a correlational study to determine if there is a relationship between technology and achievement. The ACT Aspire was first implemented in the state of Arkansas in the 2014-2015 school year following the use of the PARCC assessment for one year. Given there were two years of assessment data for this study, this common assessment would provide a reliable instrument for this study.

This information would help determine the relationship between technology and student achievement. Participants were identified by their participation or non-participation in the I3 Program as well as the size and demographic information of the school. Participants outside the I3 Program were identified by similarities in demographic information as compared to the participating schools.

Procedures

Due to the complexity of the conducted research, it was important to include both quantitative and qualitative data points in an effort to accurately address the research questions. Surveys were used to collect data regarding technology use in schools, including schools with one-to-one technology configurations. Data collected from survey results would be used to determine if there was a significant relationship between technology in schools and student achievement. Schools were grouped according to similar characteristics and by technology configuration. These schools would then be compared to other schools of similar characteristics but have considerably less technology in their school. These schools were compared by analyzing achievement data from ACT Aspire assessment and was collected by accessing public information through

the Arkansas Department of Education and the University of Arkansas Office of Educational Policy. The achievement data would be collected to determine if there is a correlational relationship was archived data.

The trend to increase technology in schools has a deeper connection beyond teaching students how to use and application technology use in their everyday lives, it is a part of a growing global trend to personalize learning. Technology is being used as a tool to change pedagogical approaches to target instruction for all learners. Various schools are using technology to tailor instruction to students through the use of learning management systems to better understand the needs and goals of each student. In a study conducted by the RAND Corporation in partnership with the Bill and Melinda Gates Foundation, the researchers compared schools utilizing a personalized learning approach to schools not utilizing a personalized learning approach (Stecher et al., 2018).

While ultimately it was anticipated there would be a relationship between technology and achievement, it is recognized the relationship does not equal causation. Due to the complexity of this research, it was expected there would be variables that would prove difficult to measure or identify.

Summary

The success of the study rested in the ability to have limited the number of variables. As indicated through the literature review, the number of variables make it difficult to compare schools and one-to-one technology programs to each other. The guidelines included with the I3 program provide an opportunity to gain reliable data when comparing schools. The more difficult component to measure in this study to measure is the role that many variables can play in the impact on student achievement.

Having the common guidelines included with the I3 program should help provide additional information as to how impactful having a common set of is in this process.

CHAPTER FOUR: DATA ANALYSIS

The purpose of this study was to investigate the impact of technology on student achievement in Northwest Arkansas Public Schools, specifically in the middle-level grades. In addition, the study also sought out perceptions of educators as it relates to the efficacy of greater access to technology in the classroom. Data was collected from seven schools in the Northwest Arkansas region which included student ACT Aspire testing data throughout three years and a survey conducted with educators at the selected schools.

This chapter was structured around the research questions that drove the investigation into this topic. This study investigated the one-on-one technology use compared to selective use of technology and in classrooms with middle school students and its effects on students' academic achievements and teachers' perceptions. The collected data came from the seven school districts located in the Northwest Arkansas area. School districts were selected based on two pieces of criteria, the first being participation in the Investing in Innovation Program (I3) and similar demographic makeup of schools. The three non-participating schools were all selected because of their relative size and demographic makeup, as it relates to the participating I3 schools. Across the seven selected school districts, approximately 2,640 students were included in the study over the course of three years. Student achievement was measured according to the ACT Aspire Summative Assessment in the areas of English, reading, writing, math, and science. Table 4.1 summarizes the breakdown of the size of cohorts from each school included in the study. It is worth considering there are three years of data were collected for cohorts one and two, but only two years of data were collected for cohort

three, due to the fact implementation of the I3 program in participating schools began two years ago.

In addition to the student data collected in this study, teachers were surveyed from all of the identified school districts. Middle school or junior high staff members were identified in each district to complete the survey. The grade configuration was selected because the I3 Program focuses on the seventh grade school year.

Demographics

The schools were selected for the study are all located in the Northwest Region of Arkansas, total enrollment at each school ranges between 560 to 2,475 students in grades kindergarten through 12th grade. All schools included in the study have a predominantly white student population, with varying degrees of diversity in each community. Table 4.1, listed below, further illustrates the demographic makeup of each school district is included in the study.

Table 4.1
Student Demographics by District. Attendance data is from the 2017-2018 school year

District Name	Enrollment	Gifted & Talented	Special Education	Homeless	LEP	FRL	White	Hispanic	Black	Other Races	Overall Minority
School 1	560	8%	13%	8%	32%	100%	53%	37%	2%	9%	48%
School 2	2,475	10%	12%	1%	4%	34%	83%	9%	3%	6%	17%
School 3	1,462	5%	13%	5%	11%	63%	65%	14%	1%	20%	35%
School 4	1,909	5%	13%	0%	5%	46%	85%	7%	1%	7%	15%
School 5	1,169	9%	16%	1%	7%	70%	79%	10%	1%	11%	21%
School 6	2,124	8%	11%	6%	3%	41%	88%	8%	1%	3%	12%
School 7	1,918	9%	10%	3%	3%	42%	88%	5%	2%	4%	12%

Note. Demographics included: LEP, Limited English Proficiency; FRL, Free and Reduced Lunch.

The school district for School 1 by far has the lowest enrollment with 560 students and the school district for School 2 was the largest with 2,475 students enrolled for the 2017-2018 school year. Student population demographics of each school are very similar to each other except for two districts. Both School 1 and Schools 3 have a higher percentage of minority students enrolled, compared to the other districts included in the study. It is also worth noting school districts for Schools 1, 3, and 5 all have higher percentages of Free and Reduced Lunch students served, compared to other districts in the study.

Participants

Four of the seven school districts were selected for this study due to their status in the eMINTS I3 Program. Participating school districts in Northwest Arkansas included Schools 1, 2, 6, and 7. The schools in these districts were included in a cohort model in acceptance into the I3 Program. All schools are currently in their third year of implementation with the I3 program which includes device implementation (Chromebooks) and specific professional development administered to participating teachers. The additional school districts included in this study were Schools 3, 4, and 5 (see Table 4.2).

Table 4.2
List of Schools Included in the Study

School Name	I3 Status
School 1	Yes, participating I3 school
School 2	Yes, participating I3 school
School 3	No, not a participating I3 school
School 4	No, not a participating I3 school
School 5	No, not a participating I3 school
School 6	Yes, participating I3 school
School 7	Yes, participating I3 school

The schools labeled as "not a participating I3 School" were all selected based on their comparable size and student population demographics to the participating I3 schools.

There were two components of this study. The first included analysis of test data from approximately 2,640 students over the course of sixth grade to ninth grade. Students were grouped according to age cohorts over the course of two or three years of testing data. Due to the fact the I3 Program is implemented and focuses on the seventh grade school year, age cohorts were selected in middle-level grades in each respective school district. Table 4.3 illustrates the total amount of students processed for sub-component of the ACT Aspire Summative Assessment.

Table 4.3
Students Processed by ACT Aspire Subject, by Cohort
**2016-2017 year was used as baseline to represented amount of students processed*

School	Math	English	Writing	Reading	Science
			School 1		
Cohort 1	35	34	33	34	35
Cohort 2	44	44	44	44	44
Cohort 3	31	30	30	30	31
			School 2		
Cohort 1	195	194	194	194	195
Cohort 2	201	201	201	201	201
Cohort 3	181	181	181	181	181
			School 3		
Cohort 1	96	96	96	96	96
Cohort 2	86	85	85	85	86
Cohort 3	114	114	114	114	114
			School 4		
Cohort 1	147	146	146	146	147
Cohort 2	145	145	145	145	145
Cohort 3	140	140	140	140	140
			School 5		
Cohort 1	87	87	87	87	87
Cohort 2	92	93	92	92	93
Cohort 3	88	88	88	88	88

			School 6		
Cohort 1	167	167	167	167	167
Cohort 2	180	181	181	181	180
Cohort 3	162	162	162	162	162
			School 7		
Cohort 1	145	145	145	145	145
Cohort 2	150	150	150	150	150
Cohort 3	154	154	153	154	154

The second component of this study included a teacher survey. The survey presented to teachers was delivered using Google Forms and was delivered via email to each teacher individually. The opportunity to participate in the survey was given to 211 teachers across all seven school districts. The total responses totaled 63, which was a response rate of 30%. The highest response rate in the schools surveyed was School 2 with 63%, School 5 had the second highest response rate with 38% (see Table 4.4).

Table 4.4
Count of Teachers Surveyed in Each School

School	Total Surveys Sent	Submissions Received	Response Rate
School 1	7	1	14%
School 2	40	25	63%
School 3	30	10	33%
School 4	31	5	26%
School 5	24	8	38%
School 6	39	6	23%
School 7	40	8	28%

Data Preparation and Screening

All data entries were screened for incomplete data. The responses with more than 20% missing values were removed from the data set. The researcher also checked for the assumption of independence by checking the samples were selected random and independent from the populations and found it was met. Furthermore, an assumption of

normality was checked and found the dependent variable is normally distributed in each of the groups. Finally, the researcher checked for the assumption of homogeneity of variance and found the variances on the dependent variable are equal across the groups.

Main Findings

Research Question One: Does one-to-one use of technology affect students' test scores compared to traditional use?

To answer this question, a one-way between subjects' ANOVA was conducted to compare the effect of one-to-one use of technology on students' test scores compared to the traditional use of technology. Although the results of the analysis indicate students who used one-on-one technology performed higher in all tests in all subjects compared to the traditional use of technology, the differences were found to be statistically non-significant at p =.05 level.

Comparisons between all groups indicated the mean scores for students in science, math, English, reading, and writing using one-on-one technology condition were higher than scores for students in the same subjects using traditional technology. Taken together, these results suggest one-to-one technology use really do influence positively students' test scores. Specifically, results suggest when students use technology one-on-one, they improve their test scores. Table 4.5 and 4.6 summarize the one-way between subjects' ANOVA.

Table 4.5
Results of One-way between subjects ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Proficient Science	Between Groups	15042.893	1	15042.893	2.325	.144
	Within Groups	122944.250	19	6470.750		
	Total	137987.143	20			
Proficient Math	Between Groups	21728.571	1	21728.571	2.569	.125
	Within Groups	160710.000	19	8458.421		
	Total	182438.571	20			
Proficient English	Between Groups	36987.337	1	36987.337	2.604	.123

	Within Groups	269860.472	19	14203.183		
	Total	306847.810	20			
Proficient Reading	Between Groups	20178.671	1	20178.671	2.787	.111
	Within Groups	137565.139	19	7240.270		
	Total	157743.810	20			
Proficient Writing	Between Groups	1650.893	1	1650.893	.725	.405
	Within Groups	43238.917	19	2275.732		
	Total	44889.810	20			

Table 4.6
Descriptive Statistics I

		N	Mean	Std. Deviation
Proficient Science	NO	9	133.6667	76.32005
	YES	12	187.7500	83.31007
	Total	21	164.5714	83.06237
Proficient Math	NO	9	142.0000	102.38896
	YES	12	207.0000	83.58012
	Total	21	179.1429	95.50879
Proficient English	NO	9	210.7778	129.62714
	YES	12	295.5833	110.96065
	Total	21	259.2381	123.86440
Proficient Reading	NO	9	125.1111	87.99921
	YES	12	187.7500	82.90973
	Total	21	160.9048	88.80986
Proficient Writing	NO	9	81.0000	57.35634
	YES	12	98.9167	39.22072
	Total	21	91.2381	47.37605

From the quantitative standpoint, the research does indicate there is a difference between I3 schools and the non-participating I3 schools included in the study. While the results of the study did not indicate a statistically significant advantage in the use of one-to-one technology, there is evidence there is a positive relationship between the I3 Program and student achievement. It is important to note results should be viewed through the lens of a comprehensive initiative or plan and not merely a result of having technology made available to students. In the survey that was conducted with teachers in all schools included in the study, 50% of respondents indicated their entire school is considered as being one-to-one or one-to-one in some certain of the school.

Table 4.7
Survey Response: Is your school considered to be a "one-to-one" school?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	39.7	39.7	39.7

No	31	49.2	49.2	88.9
In some areas	7	11.1	11.1	100.0
Total	63	100.0	100.0	

Another indication of readily available technology is in each school, would be the rate at which teachers utilize technology in their school. Table 4.8 addresses the frequency in which teachers utilize technology on a weekly basis.

Table 4.8
Survey Response: How frequently do students in your classes use technology?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	31	49.2	49.2	49.2
	3-4 times a week	18	28.6	28.6	77.8
	1-2 times a week	13	20.6	20.6	98.4
	Less than 1-2 times a week	1	1.6	1.6	100.0
	Total	63	100.0	100.0	

The responses to this survey item indicate technology is readily available, even though the school may not be considered as one-to-one by the respondent. Nearly 78% of the respondents in the survey indicate their students have access to technology three or more times a week.

Research Question Two: What factors best predict students' test scores on ACT Aspire Summative Assessment?

To address this question, a Multiple Regression analysis was conducted. Multiple Regression Assumptions: The regression descriptive statistics output was checked for multicollinearity assumption between predictor variables and found correlations between variables were less than 0.7 and therefore none of the included predictors has multicollinearity. Further, all predictor variables correlate with the outcome variable (student's test scores) at a value greater than 0.3. The linear relationship between the independent variables and the dependent variable was checked through the probability plot and found all points were following a straight line. Then the scatter plot was checked and found regression standardized residual on the y-axis and the

regression standardized predicted value on the x-axis within negative 3-to-3. Next, the residuals statistics was checked through standard residual and found the standard residual the minimum -1.526 and the maximum 1.813. Finally, the Cooks Distance was checked and found the minimum was .000 and the maximum .505 and it was less than one. ANOVA table showed there is statistical significance and therefore we reject the null hypothesis that the regression slope is zero. The adjusted R-square (this research has a small sample size), and the dependent variable (subject test scores) is typically distributed (Kolmogorov-Smirnova = .200). A multiple regression analysis was conducted to identify the unique variance predicted by the independent variable.

Multiple Regression analysis: Regression finding: Multiple linear regression analysis was conducted to develop a model predicting students' ACT Aspire test scores from using one-on-one technology in classrooms, cohort and their grade level. The predictor model was able to account for 41% of the variance in the dependent variable and was statistically significant at $p < .000$. Individual predictors were examined further, and the result indicated out of the independent variables, the only variable found to be a significant predictor of students' proficient ACT Aspire test scores in all subjects was their grade level ($t = 3.163$, $p = .006$). Basic descriptive statistics and regression coefficients summarized in Table 4.9 & 4.10.

Table 4.9
Descriptive Statistics II

	Mean	Std. Deviation	N
PROFICIENT_All_Subjects	855.0952	430.33161	21
I3_Program_15_16	.57	.507	21
Cohort_15_16	2.00	.837	21
Grade_17_18	8.00	.837	21

Table 4.10
Results of one-way between subjects ANOVA II

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1841443.683	3	613814.561	5.603	.007b
	Residual	1862262.127	17	109544.831		

Total	3703705.810	20

a. Dependent Variable: PROFICIENT All Subjects
b. Predictors: (Constant), Grade_17_18, I3_Program_15_16, Cohort_15_16

Research Question Three: What is the relationship between teachers' use of technology and their perceptions regarding students' learning?

To answer this question, a Pearson product-moment correlation coefficient was conducted to assess the relationship between teachers' use of technology and their perceptions regarding students' learning. There was a positive correlation between the two variables, r = 0. 51, n = 63, p = 0.001. Overall, there was a strong, positive correlation between teachers' use of technology and their perceptions regarding students' learning. Higher teachers' use of technology was associated with their perceptions regarding students' learning. Table 4.11 summarizes the correlation analysis.

Table 4.11
Teachers' Reports of Technology impact on student learning: Correlations and Descriptive Statistics (N = 63)

		Technology impact student learning
Technology impact teacher	Pearson Correlation	.507**
	Sig. (2-tailed)	.0000
	Sum of Squares and Cross-products	12.667
	Covariance	0.204
	N	63

**. Correlation is significant at the 0.01 level (2-tailed).

According to the survey results from teachers in the selected schools, the general perception of teachers is technology has a positive effect on instruction and student learning. In table 4.12, over 95% of respondents reported technology had had either a positive or extremely positive impact on their instruction. It is also worth noting the survey item used for table 4.12, and tables 4.13 and 4.14 as well, was a Likert rating

using a 1-5 scale system. In table 4.12, there was not a score lower than a three using the Likert scale.

Table 4.12
Survey Response: Relation to how technology has impacted the effectiveness of your instruction.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	3	4.8	4.8	4.8
	Positive impact on my instruction	32	50.8	50.8	55.6
	Extreme positive impact on my instruction	28	44.4	44.4	100.0
	Total	63	100.0	100.0	

Similarly, the trend of a positive perception among teachers can be seen in table 4.13. When asked to gauge the impact of technology on student learning, nearly 89% of the respondents indicated technology does have a positive or extremely positive impact on student learning. Also, the same trend is true of the previous survey item; there were no record responses ranks lower than a three using the Likert scale.

Table 4.13
Survey Response: Relation to how technology has impacted student learning.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	7	11.1	11.1	11.1
	Positive impact on my students	28	44.4	44.4	55.6
	Extreme positive impact on my students	28	44.4	44.4	100.0
	Total	63	100.0	100.0	

Lastly, table 4.14 further illustrates the feeling among teachers on how impactful technology is to the educational process. When asked to assess the impact of technology on education as a whole, nearly 94% indicate technology has either a positive or extremely positive association with education.

Table 4.14
Survey Response: Relation to how technology has impacted education as a whole.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	4	6.3	6.3	6.3
	Positive impact on education as a whole	24	38.1	38.1	44.4
	Extreme positive impact on education as a whole	35	55.6	55.6	100.0
	Total	63	100.0	100.0	

Research Question Four: Fourth Question: Does students' level of proficiency in all tested subjects differ based on their cohort?

To answer this question, a one-way between subjects' ANOVA was conducted to compare students' proficiency scores in all tested subjects based on their cohort. The results of the analysis indicate students' test scores were statistically differencing at p=.05 level. Comparisons between students' test scores in all subjects based on their cohort indicated the mean scores for students in science, math, English, reading and writing in cohort one were different compared to their test scores in cohort two and they scored the lowest in cohort three.

Taken together, these results suggest students' scores in all subjects in cohort one were high. Additionally, in cohort two students' test scores in all subjects improved further. Finally, students' grades decreased sharply in cohort three in all subjects. Table 4.15 summarizes the one-way between subjects' ANOVA.

Table 4.15
Results of one-way between subjects ANOVA III

		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Proficient All Subjects	Cohort 1	7	847.0000	339.86762	128.45789	532.6749	1161.3251	464.00	1281.00
	Cohort 2	7	1178.1429	295.97997	111.86991	904.4070	1451.8787	843.00	1691.00
	Cohort 3	7	540.1429	420.25366	158.84095	151.4730	928.8127	121.00	1262.00
	Total	21	855.0952	430.33161	93.90605	659.2106	1050.9798	121.00	1691.00
Proficient Science 17-18	Cohort 1	7	54.86	20.400	7.710	35.99	73.72	23	77
	Cohort 2	7	82.57	23.358	8.829	60.97	104.17	45	113
	Cohort 3	7	35.57	32.398	12.245	5.61	65.53	1	90

	Total	21	57.67	31.530	6.880	43.31	72.02	1	113
Proficient Science All	Cohort 1	7	170.1429	69.82700	26.39212	105.5637	234.7221	88.00	274.00
	Cohort 2	7	220.7143	71.10957	26.87689	154.9489	286.4797	143.00	341.00
	Cohort 3	7	102.8571	70.06052	26.48039	38.0620	167.6523	29.00	227.00
	Total	21	164.5714	83.06237	18.12569	126.7619	202.3810	29.00	341.00
Proficient Math All	Cohort 1	7	169.5714	72.07833	27.24305	102.9101	236.2328	93.00	273.00
	Cohort 2	7	250.2857	57.42158	21.70332	197.1796	303.3918	198.00	355.00
	Cohort 3	7	117.5714	107.14143	40.49565	18.4821	216.6607	11.00	303.00
	Total	21	179.1429	95.50879	20.84173	135.6678	222.6179	11.00	355.00
Proficient English All	Cohort 1	7	257.7143	103.71550	39.20077	161.7934	353.6351	135.00	377.00
	Cohort 2	7	353.2857	84.96021	32.11194	274.7106	431.8608	257.00	477.00
	Cohort 3	7	166.7143	113.38829	42.85675	61.8476	271.5810	43.00	352.00
	Total	21	259.2381	123.86440	27.02943	202.8557	315.6205	43.00	477.00
Proficient Reading All	Cohort 1	7	156.8571	67.10298	25.36254	94.7972	218.9170	84.00	239.00
	Cohort 2	7	229.7143	69.07415	26.10757	165.8314	293.5972	146.00	351.00
	Cohort 3	7	96.1429	81.12013	30.66053	21.1192	171.1665	18.00	233.00
	Total	21	160.9048	88.80986	19.37990	120.4790	201.3305	18.00	351.00

The data provided from the school surveys and the ACT Aspire Assessment has provided context to properly examine the impact of technology. The findings in chapter

four will be put in to context through the discussion will take place in chapter five and each research question will be explored in detail.

CHAPTER FIVE: DISCUSSION

Chapter five will further examine the results discussion in chapter four and discuss the potential implications these findings could have on educational technology. The results will be discussed by using the following themes: one-to-one technology compared to traditional use, predicting student achievement, and teacher perceptions of the impact of technology. Through these themes, each research question previously indicated will be addressed, and the finding examined further. In addition, there will be a discussion regarding limitations of the study and recommendations for further research could further contribute to the body of literature.

In order to address whether or not there is a relationship between one-to-one programs and student achievement, a quantitative study which utilized a quasi-experimental design was conducted. The primary focus of the research was on schools located in Northwest Arkansas participating in the Investing in Innovation Program (I3), as compared to non-participating schools similar in demographics and size. The research focused on achievement data collected from the state standardized assessment for grades 3-10, the ACT Aspire Summative Assessment. In order to address the second area of focus for this study, surveys were administered that correspond with participating I3 schools and non-participating schools to identify effective instructional practices in technology rich classrooms.

Participants in this study, approximately 2,640 students across the seven middle schools, were selected for this study as well as 63 staff members in the same schools, and three age cohorts were identified in each district. The research questions were satisfied by the findings presented in chapter four. This chapter analyzes the findings of this study;

it is organized by addressing each of the four research questions individually. Limitations of the study were then presented along with future implications. The chapter concludes with recommendations and conclusion.

Interpretations of the Findings

Despite increasing amounts of technology purchased by schools, it is still unknown the exact impact technology has on student achievement (Chang, 2017). School districts spend large amounts of money to support new devices and the necessary professional development for implementation without adequate research (Singer, 2017). Therefore, a study was conducted which investigates the impact of technology on student achievement by focusing on the implications of access to technology, impact on student achievement measured by achievement tests, best practices in instructional technology professional development and curriculum.

To determine the impact of technology, a collection of schools in the Northwest Arkansas region were examined in the study. These schools were divided into schools who participate in the I3 Program and non-participating schools. The rationale for including I3 participating schools was due to the uniformity the program provides these schools with professional development and device configuration. With these two groups of schools selected, it was anticipated there would be a significant difference between the two sets schools. While I3 schools did perform better than none I3 schools, there was not a statically significant difference between the two groups of schools.

One-to-One Technology Compared to Traditional Use

The first research question intends to explore the effects of one-to-one technology and student achievement, as measured by state-mandated assessments. While it is often generally accepted the addition of technology in schools is good for education, it is difficult to determine to what extent technology aids instruction. There are a multitude of variables that can contribute to the educational process, let alone assessing the role technology plays into the process. However, through the study, there were common themes observed which suggest that technology does have a positive effect on the educational process.

It is important to note the schools chosen to represent one-to-one technology in the study were all participating in the same program. This was in large part due to the number of variables there are to consider for accessing technology. Throughout the literature review, it was evident technology was not the common denominator when it came to successful programs. While technology does play a role, the success of a technology program is very dependent upon many other factors. Furthermore, the results of the study support components of the literature review suggested there was not a strong relationship between technology and student achievement. This finding is consistent with the findings from a 2018 report concluded only 19% of I3 projects showed a positive relationship between achievement scores and technology (Boulay et al., 2018).

As previously listed in chapter two, the literature review demonstrates the role variables play into student achievement with technology. This further illustrates the importance the I3 Program played in the study. Selecting I3 participating schools provided a baseline for more reliable data from the research. All schools were selected

for the study receive the same treatment (resources) from eMINTS to help implement the technology program. Without this commonality between schools, it would be challenging to find similar schools that use the same technology, professional development, and resources. This finding is consistent with the literature review which details there are many variables to consider as it relates to student achievement. Therefore, it is suggested that further exploration into the resources used in the I3 Program to evaluate their value to the educational process.

Although the findings did not indicate there was a significant difference between I3 schools and non-participating I3 schools, the results from the conducted survey support that teachers feel strongly about the role technology plays in the classroom. The findings in chapter four detail two significant themes can be found in the findings of the study. These themes are classrooms in Northwest Arkansas are rich in technology and it is used with a high frequency. This is evident by the nearly 78% of the respondents in the survey indicating they access instructional technology three or more times a week. This high percentage indicates all the schools included in the survey, not just the I3 schools, have access to technology on a regular basis.

Predicting Student Achievement

The second research question was designed to address the components that could potentially serve as indicators for success on the ACT Aspire Summative Assessment. Purchasing technology is often a substantial investment for districts, especially in the schools included in the study due to their size. Considering purchasing technology requires adequate planning from district and building leadership, the question was

designed to examine the impact of technology further, and other factors, as indicators of student success.

In this study, the identifier of whether or not a school participated in the I3 Program was used to identify which schools consisted of technology rich classrooms. However, the results of the study indicated technology rich classrooms were not an accurate indicator of success on the ACT Aspire Summative Assessment. In addition, the only variable in the study that could reliably predict success was the grade level of the particular student. This suggests there is usual or expected growth within the selected schools over the course of the years selected.

The findings from this research questions further illustrate the point that there are many variables to consider when examining student achievement. While technology can serve as a one piece to the puzzle, the truth is that there is not a "silver bullet" when it comes to increasing student achievement scores. There are several potential implementations to the finding from the study, but the bulk of which surround the depth of the technology program being implemented. Through the review of the literature and the research conducted, there is evidence suggesting these programs need to be multifaceted and have longevity in mind. While the introduction of new classroom technology is generally welcomed and deemed to add value to the classroom, ultimately the technology is only as useful as the resources used to support its implementation.

It is worth noting the findings for research question two contrast what the general perception is among educators. Generally speaking, educators support the addition of technology in the classroom and consider it to have a positive impact on education as a whole. Additional findings related to teacher perceptions are explored through the

findings in research question three. Further investigation into the variables contributing to student achievement is suggested. The review of the literature and the findings from the study have shown it is difficult to identify one single variable which contributes to student achievement, which suggests they are all interwoven. Further research which desegregates these variables would further advance the research and provide valuable feedback for education leaders and policymakers.

Teacher Perceptions of the Impact of Technology

Throughout the review of the literature, it was clear two measures were commonly used to determine the effectiveness of educational technology; the first was test scores, as was addressed in the previous two questions, and the second was teacher perceptions of the effectiveness of educational technology. The third question was derived from exploring the connection between the effectiveness of technology, as measured by teacher perceptions.

While there may be a rush to define effectiveness by measuring achievement data, it is difficult to overstate the importance of teacher perception. While access to technology does not guarantee success for students, beliefs of the instruction are an essential variable in the effectiveness in technology rich classrooms.

The findings were discussed in chapter four suggest there is a positive correlation between teachers' use of technology and their perceptions regarding students' learning. The analysis concluded among teachers using technology on a regular basis believe there is a strong correlation between technology-assisted instruction and student learning. In this section of chapter five, discussion regarding the significant findings in the conducted survey with teachers led to this finding.

Chapter four explored whether or not the use of technology was an indicator of student success through research question two. While the findings from research question two did not support there was a strong connection between technology and achievement, the findings for research question three contrast this viewpoint. In the schools surveyed, the respondents predominantly supported the notion more technology was beneficial for student learning, instruction, and education overall. This is evident through the survey responses collected from teachers in each of the selected schools. The general perception of the surveyed teachers was technology has a positive effect on instruction and student learning with over 95% of respondents reported technology has had either a positive or extremely positive impact on their instruction. A similar trend of a positive perception among teachers was seen when asked to gauge the impact of technology on student learning. Nearly 89% of the respondents indicated technology does have a positive or extremely positive impact on student learning. These findings suggest there are likely other factors that teachers recognize as a benefit to education, which may not be easily measured by standardized testing scores. It is recommended would be to examine further what factors contribute to teacher "buy-in" and the extent to which positive teacher perceptions affect student achievement. Further research in this area would contribute to the body of research as well as have potential implications for teacher preparation programs and professional development.

In order to help determine the extent to which multiple variables impact achievement scores, the fourth research question was designed to determine the extent to which the cohort of particular students plays a role in measuring achievement. The findings from the study show there was a statistical difference between all cohorts.

Specifically, the findings show the first cohort scored better than cohorts two and three in all tested categories. Furthermore, the finds also show cohort three had the lowest scores of all the cohorts. This section will discuss possible causes for this difference in test scores among the cohorts and recommendations for further research.

Considering the demographics in all seven of the selected school districts, a statistical difference in achievement scores across all cohorts was not anticipated. One possible explanation for the difference in test scores could be the instrument is used to gauge student success itself. The ACT Aspire Summative Assessment was the instrument used to measure student achievement, and this instrument was introduced to the State of Arkansas in the 2015-2016 school year, which was the first measured year for cohorts one and two. Prior to this assessment, the state of Arkansas previously used the PARCC Assessment in the 2014-2015 school year and the ACTAAP Assessment in years prior to 2014-2105. Considering there was such change in assessments over the course of three years, it would be worth considering this information when viewing the data. Recommendations for further research in this area would be to further explore the metrics of the ACT Aspire Assessment and possible changes in subsequent years after initial implementation in 2015-2016.

When reviewing the findings for research question four, it is also worth taking into consideration the turn-over which takes place in all of the selected schools. While the cohort of students is likely to remain intact, for the most part, the mobility of students within these districts is a consideration. In addition, the turnover of teachers is also a factor which should be taken into consideration. This is especially true for the participating I3 schools, considering there is specific professional development is

required for participates of the program. While it is likely this contributing factor likely affects a small percentage of teachers, having to reteach new teachers to the school is a consideration nonetheless.

The last consideration in exploring this finding is cohort one, in participating I3 schools, was the original cohort in year one of implementation. This cohort set the seventh grade baseline for the other two cohorts to follow, whereas the baseline for the other two cohorts was the sixth grade. While this does provide relevant information for how cohorts two and three performed before the seventh grade year of implementation, it may also provide insight into why cohort one outperformed the other cohorts in the study.

Limitations of Study

The primary limitation of this study was that the research design was limited to the geographic region of Northwest Arkansas. While the study was designed to intentionally limit the scope of the research, in an effort to limit variables, having a larger area with which to draw data from would benefit the body of research. It is also worth noting while this study included schools located in Northwest Arkansas, it was limited to schools of a certain size. In an effort to have comparable data for schools of similar size, the selection of schools was limited based primarily on the size of district enrollment. All schools fell into a district enrollment size of 1,169 to 2,475, with the exception of the school district for School 1 with an enrollment of 560 students. The decision to include School 1 was based upon their participation in the I3 Program. Lastly, a limitation to the study was the instrument used for assessment in the state of Arkansas. The ACT Aspire is the selected assessment tool for the state; however, for the sake of this study, it did not provide a comprehensive analysis of the I3 participating schools compared to the non-

participating schools. While data from testing is made available through the state archives, there are limitations to the data that is made available to the general public. Further data could have furthered the study would have been item analysis of the scored items of the ACT Aspire.

Recommendations

While the four selected research questions did provide valuable findings which can contribute to the body of research, there are three recommendations to future studies would further the body of research. The first recommendation would be further research in the area of teacher perceptions and the effectiveness of technology in the classroom. Through this study, gaps were identified in teacher perception of effectiveness and actual effectiveness as measured by the ACT Aspire Summative Assessment. Further research in the area of how teachers' perceptions impact student learning would provide meaningful insight into how to build a supportive culture for technology integration and educational initiatives as a whole.

The second recommendation would be to explore additional variables contribute to student achievement, with regards to technology integration. Specifically, additional research in the area of educational technology professional development would provide valuable information on how to improve instruction with educational technology. As indicated in the study, purchasing technology is only the first step in the integration process. The exploration into high yield strategies would provide education leaders and policymakers with valuable information as to how to proceed beyond just the first step in the integration process.

The third recommendation to future studies would be to implement an independent assessment in order to gauge the effectiveness of one-to-one programs. While state-mandated assessments can provide valuable insight into the progress of students, there are barriers associated with these assessments. Assessment through an independent source could potentially provide additional information which might not be obtainable through the use of state-mandated assessments.

The final recommendation would be to reexamine the effectiveness of the eMINTS I3 program after a longer period of time. The research suggested there is a positive relationship between the implementation of the program and student achievement, albeit not a statistically significant relationship. Given this positive trend of the past three years, it would be worth revisiting to see if statistically significant findings are produced given a longer period to study the impact of the program. This would provide an even more accurate view of the success of the program over a longer period of time.

Conclusion

While technology can play an important role in the educational process, it is one of many variables can contribute to a student's success. It is my belief technology is often seen as a powerful tool in education because of its ability to make tasks easier for all users. Despite the benefits technology may add to the classroom setting, the research indicates there is not a direct connection between academic proficiency and increased use of technology. The findings in research question two are consistent with the viewpoint that educators believe technology adds value to the classroom, despite a lack of statistical significance in the testing data.

The implementation of new technology is no different than the implementation of other programs in education, success is often predicated on the resources and follow through. Effective implementation is reliant upon buy-in/culture, professional development, resources made available, just to name a few. In many ways the eMINTS I3 program, along with the other I3 programs, are trying to create a successful program which incorporates these aspects. While the data did not support that there was a statistically significant relationship between the eMINTS I3 program and student achievement, it's important to remember the program is still very young. Over the entire life of I3 program, there is still a chance for them to yield statistically significant findings. This is evident through the trend which was seen in I3 schools in Northwest Arkansas, which experienced slightly better achievement scores than their counterparts. Three years is a relatively short window to examine the potential positive effects the program can have on student achievement. These results could potentially have a statistically significant relationship in future studies, if given more time to develop.

Reflection

Throughout this entire process of research and writing, I have had the opportunity to personally reflect upon my own perceptions of technology use in the classroom. I tend to have a more positive perception when it comes to technology integration because I personally feel it is beneficial for all parties involved. It allows educators to conduct their job more efficiently and allows for greater access for students. However, it is clear as this process concludes, simply giving a student a laptop does not improve proficiency. When examining what are the essential components which drive student achievement, there are many components to consider and technology serves as just one of components,

but not necessarily the panacea. While I do still believe technology can play a key role in the educational process, I believe the role may be harder to quantify than first originally believed. This is not meant to diminish the influence technology can have on a student achievement, but rather to acknowledge student achievement is multifaceted.

I believe there are benefits to using technology more frequently in education exist in the periphery of success measured by standardized assessments. As technology becomes more common in our everyday life, it is reasonable to believe having more exposure would benefit students in their future endeavors outside of their K-12 educational career. While this may be difficult to quantify through the use of state assessments, it is important to keep these findings in context.

References

ACT, I. (2015). ACT aspire summative assessments. Retrieved from http://www.discoveractaspire.org/pdf/3982_ACT-Aspire_Summative-Web.pdf#_ga=2.179016420.1973123267.1536804459-858372103.1536804459

Alharbi, S., & Drew, S. (2014). Using the technology acceptance model in understanding academics' behavioural intention to use learning management systems. *International Journal of Advanced Computer Science and Applications, 5(1), 143-155. doi:10.14569/IJACSA.2014.050120*

Barkand, J. M. (2017). *Using educational data mining techniques to analyze the effect of instructors' LMS tool use frequency on student learning and achievement in online secondary courses* (Doctoral Dissertation). Retrieved from https://search.proquest.com/docview/2007550976

Barrow, L., Markman, L., & Rouse, C. E. (2009). Technology's edge: The educational benefits of computer-aided instruction. *American Economic Journal: Economic Policy, 1*(1), 52-74.

Barshay, J. (2018). The 'dirty secret' about educational innovation. Retrieved from https://hechingerreport.org/the-dirty-secret-about-educational-innovation/

Bebell, D., & O'Dwyer, L. (2010) Educational outcomes and research from 1:1 computing settings. *The Journal of Technology, Learning, and Assessment, 9*(1), 5-13

Blanchard, M. R., LePrevost, C. E., Tolin, A. D., & Gutierrez, K. S. (2016).

Investigating technology-enhanced teacher professional development in rural, high-poverty middle schools. *Educational Researcher, 45*(3), 207-220.

Boulay, B., Goodson, B., Olsen, R., McCormick, R., Darrow, C., Frye, M., Rimdzius, T. (2018). *The investing in innovation fund: Summary of 67 evaluations*. Retrieved from https://ies.ed.gov/ncee/pubs/20184013/pdf/20184013.pdf

Brown, R. (2018). Using laptop technology to improve mathematical achievement rates: A quasi-experimental study. *The Journal of Computers in Mathematics and Science Teaching, 37*(3), 217. Retrieved from https://search.proquest.com/docview/2089191697

Bulman, G. (2016). *Technology and education. Handbook of the Economics of Education,* 239-280. Retrieved from http://www.econis.eu/PPNSET?PPN=860843009

Bulman, G., & Fairlie, R. (2016). *Technology and education: Computers, software, and the internet* (NBER Working Paper No. 22237). Retrieved from https://www.nber.org/papers/w22237

Campuzano, L. (2009). *Effectiveness of reading and mathematics software products*. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Dept. of Education.

Chang, R. (2017). Report: Educator confidence in technology increasing. Retrieved from https://thejournal.com/articles/2017/07/21/report-educator-confidence-in-technology-increasing.aspx

ChanLin, L. (2017). Flipping the classroom for exploration of the world libraries. *Research Journal of Library and Information Science, 1*(1), 15-24.

Clemensen, J. M. (2018). *The perceived effectiveness of one-to-one technology in Smallwood high school* (Doctoral Dissertation). Retrieved from http://scholarworks.uark.edu

Collins, A., & Halverson, R. (2018). *Rethinking education in the age of technology. the digital revolution and schooling in America, second edition.* Retrieved from http://books.google.com

Cook-Harvey, C. M., Darling-Hammond, L., Lam, L., Mercer, C., & Roc, M. (2016). *Equity and ESSA: Leveraging educational opportunity through the every student succeeds act.* Palo Alto, CA: Learning Policy Institute.

Brzycki, D., & Dudt, K. (2005). Overcoming barriers to technology use in teacher preparation programs. *Journal of Technology and Teacher Education, 13*(4), 619. Retrieved from https://search.proquest.com/docview/200082977

Dunleavy, M., Dexter, S., & Heinecke, W. F. (2007). What added value does a 1:1 student to laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning, 23*(5), 440-452. doi:10.1111/j.1365-2729.2007.00227.x

eMINTS National Center (n.d.). Retrieved from http://i3.emints.org/

Garcia-Mathewson, T. (2017). Internet access in schools: E-rate trends and the end of net neutrality. Retrieved from https://hechingerreport.org/internet-access-in-

schools-e-rate-trends-and-the-end-of-net-neutrality/

Gerard, L. F., Varma, K., Corliss, S. B., & Linn, M. C. (2011). Professional development for technology-enhanced inquiry science. *Review of Educational Research, 81*(3), 408-448. doi:10.3102/0034654311415121

Gonzalez, R. (2017). *Perceptions of Texas school technology directors of one-to-one program implementations* Available from ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection. Retrieved from https://search.proquest.com/docview/1987937566

Google Incorporated. (2017a). Re: Empowering the Next Generation of Teachers with Google*: Northwestern's teacher education program is implementing a pilot this fall to certify their pre-service teachers on Google tools* [Electronic mailing list message]. Retrieved from: https://groups.google.com/forum/#!forum/gfe-certified-trainers

Google, Incorporated. (2017b). Empowering the Next Generation of Teachers with Google*: Select teacher education programs at NYU Steinhardt will offer students training on google tools to become google certified educators* [Electronic mailing list message]. Retrieved from: https://groups.google.com/forum/#!forum/gfe-certified-trainers

Google, Incorporated. (2017c). Empowering the Next Generation of Teachers with Google: *USC Rossier School of education expects teacher candidates to be comfortable with technology from day one* [Electronic mailing list message]. Retrieved from: https://groups.google.com/forum/#!forum/gfe-certified-trainers

Green, L. S. (2014). Through the looking glass: Examining technology integration in school librarianship. *Knowledge Quest, 43*(1), 36.

Grimes, D., & Warschauer, M. (2008). Learning with laptops: A multi-method case study. *Journal of Educational Computing Research, 38*(3), 305-332. doi:10.2190/EC.38.3.d

Herold, B. (2017). Internet access in schools: E-rate trends and the end of net neutrality. Retrieved from http://www.govtech.com/network/Analysis-94-Percent-of-School-Districts-Nationwide-Meet-Federal-High-Speed-Internet-Access-Targets.html

Herold, B., & Kazi, J. (2017). 1-to-1 computing under microscope in Maine schools. *Education Digest, 82*(5), 48. Retrieved from https://search.proquest.com/docview/1849263847

Higgins, K., Huscroft-D'Angelo, J., & Crawford, L. (2017). Effects of technology in mathematics on achievement, motivation, and attitude: A meta-analysis. *Journal of Educational Computing Research*, doi:10.1177/0735633117748416

Hull, M., & Duch, K. (2019). One-to-one technology and student outcomes: Evidence from Mooresville's digital conversion initiative. *Educational Evaluation and Policy Analysis, 41*(1), 79-97. doi:10.3102/0162373718799969

International Society for Technology in Education. (n.d.). E-rate works. Retrieved from https://www.iste.org/advocacy/public-policy/e-rate

Jahnke, I., Svendsen V, N., Johansen K, S., & Zander, P. (2014). The dream about

the magic silver bullet – the complexity of designing for tablet-mediated learning. Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work. 10.1145/2660398.2660404. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-93459

Kimberly A. Lawless, & James W. Pellegrino. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614. doi:10.3102/0034654307309921

Koba, M. (2015). Education tech funding soars - but is it working in the classroom. Retrieved from http://fortune.com/2015/04/28/education-tech-funding-soars-but-is-it-working-in-the-classroom/

Loescher, A. (2018). *Actualizing teacher pedagogical aims through one to one student to chromebook integration: A case study* (University Honors Theses). Retrieved from https://pdxscholar.library.pdx.edu/honorstheses

Lowther, D. L., Inan, F. A., Ross, S. M., & Strahl, J. D. (2012). Technology enhanced formative assessment for 21st century learning. *Journal of Educational Computing Research, 46*(1), 1-30.

Mac Iver, M. A., & Mac Iver, D. J. (2010). How do we ensure that everyone graduates? an integrated prevention and tiered intervention model for schools and districts. *New Directions for Youth Development, 2010*(127), 25-35. doi:10.1002/yd.360

Maninger, R. M., & Holden, M. E. (2009). Put the textbooks away: Preparation and

support for a middle school one-to-one laptop initiative. *American Secondary Education, 38*(1), 5-33. Retrieved from *https://www.jstor.org/stable/41406064*

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054. doi:10.1111/j.1467-9620.2006.00684.x

Mouza, C. (2008). Learning with laptops. *Journal of Research on Technology in Education, 40*(4), 447-472. doi:10.1080/15391523.2008.10782516

Singer, N. (2017, Mar 3). Amid stiff competition, apple devices lose luster in American schools. *New York Times.* Retrieved from https://search.proquest.com/docview/1873571372

Ott, J. L. (2017). *A study on the impact of teacher attitude/efficacy on the use of classroom technology.* Available from Dissertations & Theses @ Pepperdine University - SCELC. Retrieved from https://search.proquest.com/docview/1964291433

Padovan, F. (2015). 1 to 1 technology programs. *Momentum,* National Catholic Educational Association, summer 2015, 54-55.

Pane, J. F., Steiner E. D., Baird M. D., Hamilton L. S., and Pane, J. D. (2017). *How does personalized learning affect student achievement?*, RAND Corporation. Retrieved from: https://www.rand.org/pubs/research_briefs/RB9994.html

Perry, N. (2018). Teacher attitudes and Beliefs about Successfully Integrating Technology in their Classroom During a 1:1 Technology Initiative and the

Factors that Lead to Adaptations in their Instructional Practice and Possible Influence on Standardized Test Achievement. (Doctoral Dissertation). Retrieved from https://etd.ohiolink.edu/

Puma, M. J., Chaplin, D. D., & Pape, A. D. (2000). *E-rate and the digital divide: A preliminary analysis from the integrated studies of educational technology.* Washington, DC: US Department of Education. Retrieved from: http://webarchive.urban.org/publications/1000000.html

Rideout, V. J., Foehr, U. G., Roberts, D. F., & Henry J. Kaiser Family Foundation. (2010). *Generation M2: Media in the lives of 8- to 18-year-olds.* Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;query=Id:%22library/lcatalog/00161465%22

Robinson, W. R., Jr. (2018). *The cost effectiveness and instructional value of one-to-one technology investments among nebraska school districts* Available from ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection. Retrieved from https://search.proquest.com/docview/2034495648

Rogers, E. M. (2001). The Digital Divide. *Convergence*, 7(4), 96–111. https://doi.org/10.1177/135485650100700406

Romrell, D., Kidder, L. C., & Wood, E. (2014). The SAMR model as a framework for evaluating mLearning. *Online Learning, 18*(2) doi:10.24059/olj.v18i2.435

Sauers, N. J., & McLeod, S. (2018). Teachers' technology competency and technology integration in 1:1 schools. *Journal of Educational Computing*

Research, 56(6), 892-910. doi:10.1177/0735633117713021

Shapley, K., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2009). *Evaluation of the Texas technology immersion pilot: Final outcomes for a four-year study (2004-05 to 2007-08)*. Austin, TX: Texas Center for Educational Research.

Solomon, K. C. (2017). *Teachers and 1:1 technology in classroom activities: A quantitative study comparing perceptions and stage of adoption.* Available from ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection. Retrieved from https://search.proquest.com/docview/2080434910

Stecher, B. M., Holtzman, D. J., Garet, M. S., Hamilton, L. S., Engberg, J., Steiner, E. D, Robyn, A., Baird, M. D., Gutierrez, I. A., Peet, E. D., de los Reyes, I. B., Fronberg, K., Weinberger, G., Hunter, G. P. Chambers, J. (2018). Improving teaching effectiveness: Final report: The intensive partnerships for effective teaching through 2015-2016. (2018). RAND Corporation. Retrieved from Social Science Premium Collection Retrieved from https://search.proquest.com/docview/2063164119

Stephens, A. G. (2017). *The impact of 1:1 laptops on teaching and learning: How seven secondary educators perceive technology having enhanced their teaching and their students' learning* (Doctoral dissertation). Retrieved from https://search.proquest.com/docview/1970479162

Tsumura, L., & Robertson, L. (2017). Implementing technology in an early years program: Teachers and students as metacognitive thinkers. *International*

Journal for Infonomics, 10(3) doi:10.20533/iji.1742.4712.2017.0166

U.S. Department of Education. (2017). Investing in innovation fund (I3). Retrieved from https://www2.ed.gov/programs/innovation

Vigdor, J. L., Ladd, H. F., & Martinez, E. (2014). Scaling the digital divide. *Economic Inquiry, 52*(3), 1103-1119. Retrieved from http://www.econis.eu/PPNSET?PPN=816184267

Warschauer, M., & Tate, T. (2015). Teaching with mobile tech. *Educational Leadership, 72*(8), 60-65.

Appendix A: Teacher Survey

1. Please identify what school you represent.
2. What subject do you teach?
3. Is your school considered to be a "one-to-one" school? One-to-one is defined as students having access to technology at all times of the day.
    a. Yes
    b. No
    c. Other
4. If your school is considered as a one-to-one school, please describe the configuration that is used in your school.
5. Please select the device types that you have access to in your school, select all that apply from the list below.
    a. Chromebooks
    b. iPads
    c. PC (Desktop Running Windows)
    d. Mac (Laptop or Desktop)
    e. Other:
6. What is your preferred device type?
7. What is your reason for this choice?
8. Do you consider the access to more technology has beneficial for student success?
    a. Yes
    b. No
    c. Other
9. How frequently do students in your classes use technology?
    a. Daily
    b. 3-4 times a week
    c. 1-2 times a week
    d. Never
    e. Other
10. Do you believe that your school has adequate access to technology for students?
    a. Yes
    b. No
11. Please answer the following question in relation to how technology has impacted your job as a teacher.
    a. It's made my job much easier
    b. It's made my job easier
    c. It has not had much of an impact
    d. It has made my job harder
    e. It's made my job much harder

12. Please answer the following question in relation to how technology has impacted the effectiveness of your instruction.
    a. Technology has positively affected my ability to teach.
    b. Technology has not had an effect on the quality of my teaching.
    c. Technology has negatively affected my ability to teach.
13. Please answer the following question in relation to how technology has impacted student learning.
    a. Technology has positively affected my students' learning.
    b. Technology has not affected their learning
    c. Technology has negatively affected my students' learning.
14. Please answer the following question in relation to how technology has impacted education as a whole.
    a. Extremely positive impact on education
    b. Mostly positive impact on education
    c. Both positive and negative effects on education
    d. Mostly negative impact on education
    e. Extremely negative impact on education
15. Are you familiar with the SAMR model?
    a. Yes
    b. No
16. Are you familiar with the TPACK model?
    a. Yes
    b. No
17. Have you used either one of these models to aid in your instruction or lesson planning?
    a. Yes
    b. No
    c. Other
18. Please list any technology professional development that you have attended that has positively impacted your instruction.

Appendix B: Informed Consent

My name is Joe McClung and I am the principal of Farmington Jr. High School. I am also a doctoral student at Arkansas Tech working on my dissertation, which focuses on the one-to-one technology and student achievement.

I would like to invite you to participate in the study by completing a survey that should take no more than 10 minutes of your time. The information you provide will assist me in studying this important topic in our schools. The data collected will hopefully help provide valuable information to school leaders and policy makers when it comes to technology purchasing and professional development opportunities. No names are asked on the survey document. Responses to the survey will remain confidential.

Please feel free to contact me at my ATU email: **jmcclung@atu.edu** or my cell at 479-790-1095 should you have additional questions.

Appendix C: IRB Approval Letter

ARKANSAS TECH UNIVERSITY

Office of Sponsored Programs and University Initiatives
Administration Building, Room 207
1509 North Boulder Avenue
Russellville, Arkansas 72801

Office: 479-880-4327
www.atu.edu

November 9, 2018

To Whom It May Concern:

The Arkansas Tech University Institutional Review Board has approved Joe McClung's IRB application, "Examining the Relationship Between One-to-One Technology and Achievement by Examining Various Middle Schools and One-to-One Programs to Determine Best Practices," through November 9, 2021. The approval code is McClung_110918.

Thank you,

Masanori Kuroki, Ph.D.
Institutional Review Board Chair