The Effects of Elementary Student Participation in Technology Immersion Classrooms on Meeting Growth Targets

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Abstract

The purpose of this study was to identify the impact of total technology immersion on the reading and mathematics achievement of students in elementary school, Kindergarten through fifth grade. Archival data were gathered from over 9,000 students and over 400 classrooms from the initial three years of implementation of a Technology Immersion program. This data allowed for the investigation of the reading and mathematics achievement of students who were members of classrooms that implemented the Technology Immersion program as compared to classrooms not participating in the program. In addition, the impact of consecutive years of participation in a Technology Immersion classroom on reading and mathematics growth was examined.

Independent-samples *t* tests and analyses of variance (ANOVA) were conducted for the research questions. Analysis of the data revealed statistically significant differences in the percentages of students who met their growth targets in reading and mathematics between Technology Immersion classrooms and non-Technology Immersion classrooms. However, there were not statistically significant differences in observed reading and mathematics growth for students who had participated in the Technology Immersion program for 0, 1, 2, or 3 consecutive years.

Educational literature promotes technology immersion programs and the use of technology in elementary schools. The findings of the current study are consistent with the literature, supporting technology immersion programs in elementary schools. Results of this study could be utilized to refine selections of technology resources and analyze achievement. Further research analyzing technology in elementary schools is necessary for the identification of specific strategies or structures that promote student learning.

Dedication

This work is dedicated to the students and teachers that I have been privileged to work with throughout my career in education. As a former classroom teacher, mentor, curriculum leader, and current elementary school principal, the personal and professional growth of those whom I serve are the guiding forces that encourages me to pursue my own continual learning. I believe that each individual who I have been fortunate to connect with throughout my career has given me opportunities for learning and growth that have challenged me to be a better educator. I am enthusiastic about the future of education, the potential for continued improvement, and the initiatives and offerings that I will experience in my career. My intention is to continue to model life-long learning. Students and teachers deserve the best that I have to offer.

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I would be remiss without acknowledging the most important people in my life. My mother, Eleanor Browning, has been my lifelong model in the pursuit of educational excellence. Her passion for the field of education and more importantly, for children, has been endless. I am grateful to my children: Alexis, Kellen, and Tristan. You all are the reason for my drive to improve myself, and I am more than proud of the young adults you have become. Finally, I wish to thank my wonderful husband, Joel, for supporting my decision to go back to school and fulfill this dream.

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Chapter One

Introduction

Technology in elementary classrooms is one of the key components considered necessary to prepare learners for their future in the 21st century. Today's learners use technology daily, primarily as the dominant source of communication. However, with the overwhelming abundance of technology tools and resources, educators are faced with the challenge of selecting and implementing the most effective tools that lead to the highest level of student learning. Billions of dollars in educational funding are being disbursed to offer students access to computers and other technology tools (Shields & Behrman, 2000). School leaders are faced with the challenge to implement new technology tools at a rapid pace, with little or no research-based evidence to support the application of such technology. Given the cost factors associated with the purchase of the technology, it is crucial to make selections that have the greatest impact on student learning (Noeth & Volkov, 2004). Although reading and writing text, along with mathematics, have been the focus of learning for thousands of years (Myers, 1996), developments and changes in technology have had a vast influence on instruction and learning. However, the body of research connecting computers and other technologies to learning achievement continues to be inadequate, with extensive unrequited questions to the specific ages or subjects of effective impact (Shields & Behrman, 2000).

The rapid growth of technology use in schools led to the development of the Technology and Engineering Literacy Framework by the National Assessment Governing Board (2014) for the National Assessment of Educational Progress. The framework classifies the understandings, applications, and competencies of technology principles necessary for all students. The National Assessment Governing Board (2014) defines technology as "any modification of the natural world done to fulfill human needs or desires" (p. 3). The application of technology to the learning environment results in the goal for students to develop technology literacy, which is further defined as "the capacity to use, understand, and evaluate technology as well as to understand technological principles and strategies needed to develop solutions and achieve goals" (The National Governing Board, 2014, p. 3). Used in pedagogical practice, the use of technology within the instructional setting is referred to as educational technology. Educational technology, as defined by Richey (2008), is "the study and practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (pp. 24-25). Typically, technology is equated to equipment, but technology also comprises the projects, settings, and situations that engage learners (Jonassen, Peck, & Wilson, 1999). According to November (2010), integrating technology into classrooms prepares students to be successful learners in a dynamic world. During the last half of the 20th century, technological innovations were introduced that enabled unique practices to be implemented in elementary classrooms. Successful technology integration, combined with the best instructional practices, which are meaningfully connected to curriculum, produces positive results for learners (Boster, Meyer, Roberto, & Inge, 2002). Student engagement and learning are the pivotal goals when transitioning to practices involving the integration of technology into the learning environment (Toy, 2014). In addition to adding the physical technology components, educators must align the technology tool to the learning task for meaningful integration. Student success within an environment of technology immersion requires that effective pedagogical choices increase the opportunity for student achievement (Sun Associates, 2013). Technology resources in the classroom enable students to engage thoroughly in learning by changing the way teachers and students interact. Students are able to manage, store, and share their work in unique ways that creates an increase in confidence and empowerment for independent learning (Toy, 2014). Students have opportunities for inquiry, exploration, discovery, and evaluation while utilizing technology tools and resources. Successful technology integration should be driven by the specific content and skills of the adopted curriculum, guided by standards of best practice (Moeller & Reitzes, 2011). Roberts (2011) reports the following:

> The International Society for Technology in Education (ISTE) has developed National Education Technology Standards (NETS) which are a set of benchmarks that help to measure competence for the integration of technology in education. Originally conceived in 1998, NETS have now become the internationally recognized standards for technology in education across all international curricula. NETS are not subject content specific but address the skills students need for the digital literacy required for success in the 21st century standards. (p. 1)

The NETS provide a guideline of standards for the best practices supporting the development of technology literacy for students, teachers, and educational leaders, while also defining the skills and knowledge for students to learn effectively and live productively in an increasingly global and digital society. In order to evaluate the best practices in technology immersion, clarity of the standards within program implementation are crucial for successful student achievement. Furthermore, ISTE classifies 14 critical elements for the successful influence of technology use for learning outcomes. The three initial critical elements include a shared vision, empowered leaders, and implementation planning. Visionary leaders should work closely with all stakeholders in developing a strategic plan focused on student learning when infusing technology resources into the classroom. Once this is in place, the implementation phase of technology integration includes the next elements of consistent and adequate funding for the technology infrastructure, equitable access to technology resources for all students and teachers, skilled personnel who select and effectively use the appropriate technology resources, ongoing professional learning available for continuous learning opportunities, and adequate technical support for technology maintenance and renewal. Technology integration in the classroom comprises the next three critical elements of a clearly defined curriculum framework that supports student-centered learning, and allows for effective and ongoing assessment and evaluation. The final three critical elements include engaged communities in which schools partner and collaborate with all stakeholders, support policies that provide for financial and educational accountability, and an external context in which policies support the overall implementation and achievement of technology standards (ISTE, 2016).

When these elements are in place, ISTE reports that access to technology leads to improved student learning, particularly related to levels of engagement, independent work, and project-based learning experiences. Conversely, ISTE standards require that the technology resources must be grounded in quality and intentional instructional focus. Technology immersion in classrooms provides gains for personalized learning, formative assessment, and higher-order skills instruction, which are all documented strategies that promote higher achievement levels (ISTE, 2016).

Technology integration in the elementary school classroom is imperative for 21st century learners. Students are accustomed to quick access to information and collaboration with peers for processing information. Technology integration in the classroom allows students to meet the core curriculum expectations along with the 21st century goals for students in the areas of critical thinking, creativity, communication, and collaboration (Blair, 2012). Additionally, the implementation of technology resources transforms the teacher's role in the classroom. Collaborative dialogue replaces traditional forms of instruction. Communication among students, teachers, and parents is supported within learning goals, which produce meaningful projects, thus strengthening the educational community. As students use technology for self-expression, critical analysis, and collaboration, they develop digital literacy, a critically necessary fluency for the 21st century citizen (Vega, 2013).

Shields and Behrman (2000) affirm that the quality of the teacher continues to be the most critical factor to student achievement. As ISTE (2016) completes the revision process of the technology standards for students, one question that guides their evaluation of the standards is whether technology amplifies the learning, skills, or competencies gained by the student. This question corresponds to the current study designed to determine the impact of technology immersion on the academic performance growth of elementary students.

Background

The data for this study were obtained from District X, a suburban school district, encompassing 91 square miles and serving 21,967 students in a large Midwestern city (Kansas State Department of Education [KSDE], 2015). District X has historically been known as one on the cutting edge of advancements in instructional practices; thus, the innovation and integration of technology is a priority recognized in both the district's strategic plan as well as within individual building goals for student learning. District X offers traditional K-12 programming, including numerous support services to enhance unique student needs during their educational career. Additionally, District X provides an extensive Early Childhood Special Education program, as well as Special Education programming for students to age 21.

District X has a history of rapid growth since consolidation into a unified school system. The student population increased from a reported 11,043 students in the 1992-1993 school year to 22,206 students in the 2014-2015 school year (KSDE, 2015). During this study, the state and district have maintained consistency in the percentages of students identified as economically disadvantaged due to qualification for free and reduced lunch throughout this growth period. These groups of students are summarized in Table 1. According to the KSDE (2015) district report card, 8.07% of the district's students are economically disadvantaged, as compared to 48% of the state's students.

Table 1

Economic Diversity of Kansas and District X Students

Enrollment Group	2012-2013	2013-2014	2014-2015
Kansas			
Economically Disadvantaged	48.00	48.32	48.11
Non-Economically Disadvantaged	52.00	51.68	51.89
District X			
Economically Disadvantaged	8.07	8.42	8.39
Non-Economically Disadvantaged	91.93	91.58	91.61

Note. Adapted from "State report cards", by KSDE, 2012, 2013, 2014, 2015. Copies in possession of the author.

District X has one early childhood center, 20 elementary schools, nine middle schools, five high schools, one alternative high school, and one center for advanced professional studies. The school district varies from the state when categorized by ethnic diversity, as shown in Table 2. The diversity of the student population of District X did not change significantly during the three years of this study.

Table 2

Ethnic Diversity of Kansas and District X Students

Ethnicity	2012-2013	2013-2014	2014-2015
Kansas			
White	67.22	66.42	65.82
Hispanic	17.57	18.24	18.74
African American	6.95	6.89	6.86
Asian	2.78	2.91	2.95
Other	5.48	5.54	5.63
District X			
White	78.45	77.37	76.16
Hispanic	4.66	4.94	5.06
African American	3.09	3.22	3.13
Asian	10.00	10.38	11.33
Other	3.80	4.09	4.32

Note. Adapted from “State report cards”, by KSDE, 2012, 2013, 2014, 2015. Copies in possession of the author.

The school district employs 1,900 certified staff with 70% of the certified staff possessing a master’s degree or higher (District X, 2014). The district also has 1,400 classified staff members. The administrative team consists of a superintendent, two deputy superintendents, two assistant superintendents, nine executive directors, nine directors, 20 elementary school principals, nine middle school principals, nine middle school assistant principals, five high school principals, and 15 high school assistant principals (District X, 2014).

District X has been challenged financially with reductions in state aid per pupil. The expenditures per pupil show that the district spent an average of $13,010 dollars per student with an average annual total operating budget of $287,956,994. During the context of the study, the base state aid per pupil averaged $3,843, with significantly lower increases as compared to actual expenditures. Table 3 documents the base aid per pupil for the state of Kansas and District X expenditures per pupil during the three years of the study.

Table 3

Kansas Base Aid per Pupil and District X Expenditures per Pupil

Expenditures	2012-2013	2013-2014	2014-2015
Kansas	$3,838	$3,838	$3,852
District X	$12,367	$12,684	$13,981

Note. Adapted from KSDE 2012-2015 State Report Cards for District X. Copies in possession of the author.

The median income for a family living with this district is $101,824 (District X, 2014). Academic success is of traditional importance, with consistent growth achievement as determined by the No Child Left Behind legislation. This required annual yearly progress was met in each school for 10 consecutive years (District X, 2014). Increases in achievement have occurred on Measures of Academic Progress (MAP) as represented in Table 4, which shows the percentage of students who achieved their targeted score (District X, 2014).

Table 4

Percentage of District X Students Meeting Growth Targets

Content Area	2012-2013	2013-2014	2014-2015
Reading	55.4	60.0	61.8
Mathematics	61.2	65.6	69.2

Note. Adapted from District X Schools MAP Score History. Copies in possession of the author.

As schools across the country were challenged to prepare students for the 21st century, advances in the use of technology became a prevalent initiative in schools. Students face progressively more universal connections to one another via the use of technology resources, such as websites, cell phones, social networks, etc. While schools strive to prepare students for real-world experiences, technology resources create unique environmental and social issues that are quite prevalent in society (Partnership for 21st Century Skills, 2007a). Students need a varied set of skills that are different from the traditional skills learned in schools of the past. Schools are transforming their curricular focus and instructional practices to meet the needs of students in a technology-rich environment (Groff, 2013). Learning experiences have moved beyond the traditional paper and pencil strategies and are now combined with technology resources to lead students to authentic, real-world learning projects. Students are actively utilizing technologies to reach a larger source of information and to share their learning publicly. Wagner (2012) identified seven survival skills that students must possess for success and well-being in the 21st century: critical thinking and problem solving; collaboration and leadership skills; agility and adaptability; initiative and entrepreneurialism; effective oral and written communication; the ability to access and analyze information; and high levels of curiosity and imagination.

To support the development of the 21st century skills, District X created a Technology Immersion program in select elementary classrooms. The purpose of the program was to identify specific technology resources for effective student learning, while simultaneously supporting and providing technology-rich classroom spaces where the technology tools were seamlessly integrated into the teaching and learning (District X Technology Immersion, 2014). The implementation of the Technology Immersion program was planned with a gradual timeline. Prior to the start of the 2012-2013 school year, five elementary schools were selected for participation in the Technology Immersion program. Implementation of the program occurred in 30 classrooms, one in each grade level (Kindergarten through fifth grade). Additional classrooms and schools have been selected for program implementation each consecutive year. In the 2013-2014 school year, three additional schools were selected to join the program. School leaders were allowed flexibility within each of those schools for specific classroom selection, resulting in the expansion of the program to 86 classrooms. The third year of the Technology Immersion program involved the addition of four schools; therefore, the total number of individual classrooms reached 160 within 12 elementary schools.

Statement of the Problem

Rapid introduction of new technological tools has changed the very nature of what it means to be literate (Leu, O'Byrne, Zawilinski, McVerry, & Everett-Cacopardo, 2009). New technologies continue to impact society and culture, and thus the lives of children as they learn literacy and mathematics skills (Marsh, 2005). Identification of the most effective practices for technology implementation has yet to be made available to educational leaders. Educational technology leaders of the Technology Immersion program in District X were challenged with researching, evaluating, selecting, and providing professional development and technical support for each piece of technology placed in the classrooms (District X, 2014).

Harasim (2012) compared the juncture of learning theory and technology. He stated that educators have had little opportunity for research and reflection upon the use of technology within classroom instruction. Teachers have participated in professional development to learn to use specific technology tools, yet a methodology to renovate educational practices has yet to be developed based upon learning theory (Harasim, 2012).

Despite the rapid growth and implementation of technology integration programs, such as District X's Technology Immersion program, research studies that document the effectiveness of such programs are limited. Few studies have used rigorous methodology to investigate the effects of comprehensive technology immersion programs. The central question is whether technology immersion programs, which include numerous resources embedded within all curriculum areas, are making a difference, thus improving student achievement for elementary students. The evidence associated with patterns of targeted learning growth in the areas of reading and mathematics achievement can guide school leaders in making appropriate applications within future technology immersion programs, as well as guide District X with modifications to the current program. Further data analysis of specific curricular areas related to areas of positive learning growth or areas of concern offers educators opportunities to select tools and resources to further student learning while utilizing technology resources.

Purpose of the Study

The purpose of this study was to determine if the Technology Immersion program for technology integration had an effect on the reading and mathematics achievement of students participating in the program. Archival data representing the achievement growth for students who were placed in a classroom within the Technology Immersion program were examined, as compared to those students in classrooms that were not in the program. Two components of student participation were analyzed with this study. First, the percentage of students achieving individual growth targets within the Technology Immersion classrooms was compared to the percentage of students achieving individual growth targets in traditional classrooms. Second, the achievement of observed learning growth was compared across the number of years students were or were not participants in the Technology Immersion classrooms.

Significance of the Study

A limited body of research has been published specifically investigating the relationship between technology immersion programs and student learning growth and achievement. The current study was undertaken to explore the outcomes of the technology immersion in District X. The results of this study could provide insight into the effectiveness of the integration of technology tools into the elementary classroom and the impact on reading and mathematical learning of elementary students. The information from this study is significant to District X and other districts planning to implement technology with goals related to academic achievement.

The selection of technology tools involves important financial decisions as tools and resources are identified to be included in the technology immersion classrooms.

With respect to the impact on student learning, an additional significant factor is the cost of the technology tools and resources. The budget constraints of school systems require school leaders to be transparent with purchasing decisions, thus selections must provide students with effective resources that result in effective student learning experiences. This study will provide information to guide District X as they make expansion decisions for the Technology Immersion project.

Study results could assist future decisions for District X, as well as other districts, in determining new initiatives to improve student learning within the framework of technology immersion programs. This study of technology immersion addresses these critical issues and provides beneficial evidence regarding the effectiveness of the model on the academic domains of reading and mathematics. Particularly, results of this study may support the expansion or modification of the District X Technology Immersion program.

Delimitations

To strengthen the emphasis of the research, Roberts (2004) recommended that researchers set self-imposed boundaries, or delimitations, to “narrow the purpose and scope of the study” (p. 128). Given that goal, the following delimitations were placed on this study of the Technology Immersion program within the 20 elementary schools in District X.

- This study was focused solely on data from elementary classrooms in District X; thus, results may not generalize to grade levels other than elementary.

- Data were limited to the collection of specific assessment results in the content areas of reading and mathematics during the initial three years of the technology integration program.
- The study was further delimited by the choice of the types of data collected: the percentage of students in each Technology Immersion program classroom who reached their targeted learning growth, the observed learning growth, and the number of years in which a student participated in a Technology Immersion classroom.

Assumptions

Lunenburg and Irby (2008) defined assumptions as the "postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). The following assumptions were made during this study.

- Each school implemented district-adopted curriculum programs with fidelity.
- Each student in the Technology Immersion classrooms had equitable time for access to the technology.
- Teachers provided students with experiences utilizing technology as designed for full implementation of the Technology Immersion program.
- Teachers implemented best practices utilizing effective, quality instructional strategies.
- The MAP assessments were administered with fidelity and consistency in each learning environment.
- Students completed the MAP assessments with their highest academic effort.

- Teachers received comparable professional development to integrate the use of the technology within the guidelines of the Technology Immersion program.

Research Questions

The implementation of innovative programs often requires educators to investigate the effectiveness of the program on student learning. This study was conducted to investigate the impact of a new technology program on student achievement in the areas of reading and mathematics. The following research questions guided the study.

RQ1. To what extent is there a difference in the percentage of students who met their target growth in reading, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

RQ2. To what extent is there a difference in the percentage of students who met their target growth in mathematics, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

RQ3. To what extent is there a difference in students' observed reading growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

RQ4. To what extent is there a difference in students' observed mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

Definition of Terms

Terms specific to this study are identified and defined in this section. These specific terms, which go beyond common language, are intended to assist readers of this research in understanding the specific components of the study. The inclusion of these definitions may support individuals outside of this particular field (Creswell, 2009) in order to assist the reader with accurate interpretations of the findings of this study. The following terms were selected for a clear understanding of specific vocabulary used within this study.

21st century skills. The term 21st century skills refers to a comprehensive selection of knowledge, skills, work habits, and character traits that are determined to be critically essential to success in collegiate programs and contemporary careers. 21st century skills encompass all academic areas and all settings (Great Schools Partnership, 2014).

Academic achievement. Academic achievement is the "level of attainment or proficiency in relation to a standard measure of performance, or, of success in bringing about a desired end" ("Achievement," 2014, para. 1). Academic achievement in reading and mathematics are addressed by the research questions in this study as measured by results on MAP assessments.

Authentic learning. Authentic learning is learning that applies to real-life situations. Students are guided to develop a product through the teacher's facilitation of the process of learning through tasks that connect with the real world (Revington, 2015).

Cadre. A cadre is an identified group of teachers moving through professional development modules together (District X, 2014).

Constructivist methodologies. Constructivist methodologies refer to learning experiences in the classroom which are based upon the theory of constructivism. Students are encouraged to use experiments and real-world problem solving to construct their own understanding and knowledge from their experiences, while the teacher applies inquiry-based learning activities. Students formulate their understandings in a collaborative environment in order to draw conclusion and inferences (Educational Broadcasting Corporation, 2004).

Computer-assisted instruction. Technology programs delivering instructional content by means of a computer program are defined as computer-assisted instruction, which presents information in the form of a tutorial with skills practice (Encyclopedia Britannica, Inc., 2016).

Consecutive. The term consecutive refers to events which follow one after the other in a series. Such events, or occurrences, follow each other without interruption (Consecutive, n.d.). For this study, consecutive refers to students who participated and remained in a Technology Immersion classroom for two sequential years or three sequential years. Students included in the data analysis, who were Technology Immersion participants for two years of this study, were in a Technology Immersion classroom during years one and two of the study or years two and three of the study. Students included in the data analysis, who were Technology Immersion participants for three years of this study, were in a Technology Immersion classroom for all three years of the study.

Instructional space. Any area or environment that supports learning, such as a classroom or other location within a facility is an instructional space (District X, 2014).

One-to-one. The term one-to-one is applied to programs that provide all students in a school with their own technology device, such as a laptop, netbook, tablet, or another type of mobile computer device (Great Schools Partnership, 2014).

Professional development. This term refers to a wide variety of specialized training, formal education, or advanced professional learning intended to help educational professionals improve their professional knowledge, competence, skill, and effectiveness (Great Schools Partnership, 2014).

Professional learning community (PLC). A PLC is a group of educators that meets regularly, shares expertise, and works collaboratively to improve teaching skills and the academic performance of students (Great Schools Partnership, 2014). Professional learning communities operate under the assumption that the key to improved learning for students is continuous job-embedded learning for educators (DuFour, DuFour, Eaker, & Many, 2006).

Student growth. Student growth is defined as the change in student achievement for an individual student between two or more points in time (U.S. Department of Education, 2014). For this study, student growth is defined as the difference in MAP assessment scores from fall to spring.

Technology. Technology refers to a resource, web site, application, or electronic device that can support classroom instruction and engage students in their personal learning (District X, 2014).

Technology immersion classroom. The technology immersion classroom refers to the general education instructional space that contains more technology tools, resources, applications, and curriculum that supports and actively engages students in their learning than the typical District X classroom (District X, 2014).

Technology use. Technology use is the way in which students and teachers engage technology to accomplish an instructional purpose, objective, or task (Talley, 2012).

Overview of the Methodology

This non-experimental study involved an examination of archival data to investigate the reading and mathematics achievement of students who were members of classrooms that implemented the Technology Immersion program. The percentages of students in the classrooms who achieved their growth target, based on MAP assessment scores, were compared to those students who were not participants in the Technology Immersion classrooms using independent-samples *t* tests for statistical analyses. Differences in students' observed reading and mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience were also examined. Observed growth using MAP assessment scores from fall to spring were selected for comparison. One-factor analyses of variance (ANOVA) were conducted to determine differences in observed growth in reading and mathematics for students participating in the Technology Immersion program.

Organization of the Study

This study is organized into five chapters. Provided in chapter one was background information to explain the problem, purpose, significance, delimitations, and assumptions of the study. Additionally, research questions were identified, and definitions of key terms were provided with an overview of the methodology used for the study. Presented in chapter two is the review of literature. Chapter three contains the methodology, including the data analysis, the instruments used, the research hypotheses, and the limitations of the study. Presented in chapter four are the findings of the study. Chapter five includes a summary of the study, findings related to the literature of technology integration, and concludes with implications for action and recommendations for future research.

Chapter Two

Review of the Literature

The purpose of this study was to determine if the Technology Immersion program in District X had an effect on the reading and mathematics achievement of students participating in the program. Specifically, the study reviews achievement data for students participating in classrooms within the Technology Immersion program. A thorough review of the literature surrounding technology integration was conducted to understand the historical and current perspectives on effective instructional practices. This review represents a comprehensive effort to investigate the role of technology in the elementary classroom on student learning.

Presented in this chapter is a review of literature associated with developments in instructional technology integration in the elementary classroom. This literature review includes the historical perspective of instructional technology, the changes in classroom instruction with technology integration, the development of a technology integration plan, and the approaches used to assess the achievement gains of students who have access to technology tools and resources within their learning environment.

Historical Perspective of Instructional Technology Integration

The federal government has traditionally delivered extensive support for technology in schools. The use of technologies in the classroom has been documented in educational research for more than fifty years. Many questions remain about the benefits of the use of technology tools for learning. Computer technology gained importance in the 1970s, supported by federal Title I funding, predominantly used for computer-assisted drill and practice in elementary reading and mathematics programs (Jamison, Suppes, &

Wells, 1974). In 1983, the report, *A Nation at Risk*, endorsed computer proficiency for students. Cuban (1986) stated that technology brings a paradox of constancy amidst change to the school environment. This inconsistency is apparent in the interface between the classroom teacher and technology. While new technologies have been a classroom constant since the mid-nineteenth century, teachers have been noted as resistant to implementing the technology into daily practice. Traditional instruction, thus communicating knowledge, was sought to be simple, economical, and delivered in timely ways. However, the goal of increasing productivity was present in the school. Film and radio were the primary technology resources for teachers to implement prior to the 1980s. From the development of the academic lecture to the use of film, radio, and television in the classroom, the quest for increased productivity eventually expanded to the use of the microcomputer (Cuban, 1986).

The Clinton administration, in the 1990s, established the Technology Literacy Challenge Fund (U.S. Department of Education, 1996), to provide schools with computers, software, and teacher training programs intended to expand computer and Internet access in schools. The U.S. Department of Education's (2005) education technology plan proposed the expansion of eLearning to offer students more learning options with the development and availability of online courses and learning resources. The Partnership for 21st Century Skills (2007b) reported that students must receive the essential technology skills to be equipped and educated to enter the professional workplace. Today's students, who have grown up in the digital world, expect learning opportunities to prepare for a globally connected world (Boss, 2011).

According to Seeley (2014), technology is a force of change throughout the world on a consistent basis. Schools are confronted by the progressively varied and extensive choice and availability of technology tools that can cause a dramatic change in the function of schools; thus, educators are challenged with the decisions regarding the investment in technology. Teachers who implement selected technology tools must have the capacity to emphasize the priority of student learning around content knowledge and habits of mind for future student success. Maintaining focus on student learning is crucial for substantive progress with technology integration (Seely, 2014).

Early technology integration in classrooms. Papert (1980) was an early advocate for the potential change in education using technology. Papert noted that within the initial adoption of the computer, a commonality was that the computer was used as a supporting tool to supplement the status quo within the educational process. As such, the fundamental use of the computer did not change the educational process. Thus, Papert challenged the technological sophistication of the education community by seeking changes to traditional educational programs. Papert proposed that providing every child with a personal computer would be educationally effective. Early in the 1960s, Papert developed the Logo programming language and began to introduce students to computer programming. This resulted in students attaining capabilities in programming, but more importantly, a level of engagement in learning that was exceptional compared to the engagement during traditional drill and practice activities during class time.

Computer-assisted instruction became the predominant use of computers in education during the 1980s and early 1990s (Becker, 1998). Computer-assisted instruction includes multiple software programs offering basic skill and practice experiences for students. Papert (1996) believed that computers provided educational experiences that would keep each student internally motivated. Furthermore, Papert (1996) idealized that computer access in classrooms could promote the change in education that altered a school's trend to force new concepts into old methods.

A study of the statewide technology initiative in West Virginia documents improvements in basic skills in reading, writing, and mathematics (Mann, Shakeshaft, Becker, & Kottkamp, 1999). Programs that give students the opportunity to practice basic skills are prevalent in the elementary classroom due to the beneficial attributes of adapting to an individual student's ability level and providing immediate feedback (Reiser, 2001). Given the ease of implementation of computer-assisted instruction, teachers favorably utilized computers in their classroom instruction using this type of resource (Cuban, Kirkpatrick, & Peck, 2001). Studies examining the use of computer-assisted instruction have found improved outcomes for students as compared to students who experience more traditional instruction (Banerjee, Cole, Duflo, & Linden, 2007; Barrow, Markman, & Rouse, 2009). When computers are used for purposes in education beyond the replacement of basic practice drills to a level of sophistication in seeking knowledge and standards, the educational program is altered. This change constitutes an intellectual project representing authentic learning for students.

Claimed benefits of technology integration. Several studies have shown that technology has improved student achievement, student motivation, teacher-student collaboration, learning competence, and cognitive skills (Baker, Gearhart, & Herman, 1994; Cuban & Kirkpatrick, 1998; Kulik, 1994; Mann et al., 1999; Parr & Fung, 2000; Roschelle, Pea, Hoadley, Gordin, & Means, 2000; Scardamalia & Bereiter, 1994; Sivin-

Kachala & Bialo, 1999; Trotter, 1998; Wenglinsky, 1998). Results from studies show that the use of technology enhances both traditional and constructivist approaches to curriculum, instruction, and assessment (Berliner & Calfee, 1996). Technology tools have become more powerful and widespread, including computers, handheld devices, interactive whiteboards, digital video cameras, and a continually expanding assortment of Web 2.0 tools.

Wenglinsky (1998) completed a study for the Educational Testing Service and determined that when technology was used for challenging activities for students, the benefits were positive. Alternatively, when technology was used for rote practice on basic skills, the results were negative. To revolutionize the use of technology in instructional practices, Ertmer (1999) called for fundamental change to occur in educational environments, which would lead to new goals, structures, or roles within the integration of technology. For students to be successful beyond the elementary school years, learners must master more than the core curriculum (Ertmer, 1999). The educational technology movement gained momentum in the 1990s (Shattuck, n.d.); however, it was not fully embraced because of the implementation of the *No Child Left Behind Act (NCLB) of 2001*. Technology advancements were diverted due to the requirement that each school be accountable for student performance on a standardized test, resulting in the reluctance of schools and teachers to implement unique technology integration strategies (Ferending, 2003). Cuban, Kirkpatrick, and Peck (2001) contended that technology was used only as a first order change, in which instructional practices are not changed, but simply modified superficially.

Early research disclosed that computer-based instruction increased student achievement test scores (Kulik, 1994), and students who use a computer at home were more likely to graduate from high school (Gulek & Demirtas, 2005). Positive outcomes related to the integration of the laptop computer into classroom environments have been noted in several studies. Such benefits included improved student writing test scores (Gulek & Demirtas, 2005); higher quality within student products and papers (Suhr, Hernandez, Grimes, & Warschauer, 2010); increased student engagement and motivation; reductions in disciplinary referrals; improved attendance (Bebell, 2005); teacher-reported improvements in student achievement, cooperative learning and independent work (Russell, Bebell, & Higgins, 2004); and the development of effective learning strategies that are transferable across disciplines (Rockman, Chessler, & Walker, 1998). However, Kulik (2003) and Suhr et al. (2010) both noted that evaluative research is lacking in determining the effectiveness of digital technology in the classroom. Further, Cuban (1986, 2001, 2006) summarizes the use of technology in classrooms as a waste of funding, arguing that the better use of assets would be to expand previously verified programs and finding better qualified teachers.

Prensky (2006) discussed the accelerating technology changes in the world and the effect such changes have on the system of education, referring to children born during this period as digital natives. Thus, appropriately used technology can help students advance higher-order thinking skills, creativity, and inquiry skills (Boss, 2011). In addition to the traditional basics, Blair (2012) explained that critical thinking, communication, and collaboration are transformational skills for all learners. The learning environment essentially aligns with the technology-infused life and workplace.

The expectation was that the technology resources were not only available to students, but that the use of the technology progressively required students to solve complex problems, make decisions, work within teams, and apply innovative practices (Blair, 2012).

Toy (2014) reported that early advocates of integrating technology alleged that merely adding technology tools to classrooms would increase student learning. Thus, students and teachers were provided with laptops, digital cameras, interactive whiteboards, software programs, and internet access. In some cases, students were engaging in effective practices utilizing the technology resources, such as researching, writing, collaborating, and creating. However, it was commonly reported that computers were misused, damaged, or left unused in original packaging (Toy, 2014). In order to facilitate the more rigorous and authentic use of the technology resources, Toy (2014) found that schools were planning more purposeful technology integration with professional development, as opposed to simple widespread distribution of technology equipment.

Darling-Hammond, Zielezinski, and Goldman (2014), reviewed over 70 research studies in which technology was reported to have a positive impact on learning. Their analysis of the research led to their belief that technology, when implemented appropriately, can yield substantial gains in student achievement and engagement. Furthermore, the gains accelerate for students considered to be at risk. The report identifies three strategies for using technology effectively. First, the learning associated with the use of technology should be interactive. Second, the technology tool should allow students to explore and create rather than just drill and kill. Third, there should be a balance of direct instruction with technology use. Moreover, the findings showed that students in technology-rich classrooms experience more student-centered instruction, student and teacher interactions, and independent learning activities. The students reported being more invested in school, while also exhibiting improved attendance rates (Darling-Hammond et al., 2014). Johnston (2014) reviewed the data from Project Tomorrow's 2014 United States Speak Up reports and found that 74% of teachers believe that technology increases student engagement, and 46% of school leaders consider that technology has a pronounced effect on teaching and learning. Research on the effectiveness of educational technology has resulted in inconsistences and thus is considered inconclusive, with the majority of studies reporting insignificant, yet positive outcomes concerning the improvement of student learning (U.S. Department of Education, Office of Educational Technology, 2014).

Development of standards for technology integration. Technology enhances traditional curriculum with collaborative and communicative capabilities which allow for authentic learning experiences (Bransford, Brown, & Cocking, 2000). Multimedia and graphics provide multi-level, real-world experiences that guide learners through challenging simulations to cultivate a deeper understanding of curriculum content, in addition to accessing information and analyzing data. Internet capabilities connect students and teachers to communities around the world for communication and collaboration (Bransford et al., 2000).

Common Core State Standards (Common Core State Standards Initiative, 2012) targeted the transformation of digital literacy skills of students nationwide, with commendable goals and outcomes.

> Students employ technology thoughtfully to enhance their reading, writing, speaking, listening, and language use. They tailor their searches online to acquire useful information efficiently, and they integrate what they learn using technology with what they learn offline. They are familiar with the strengths and limitations of various technological tools and mediums and can select and use those best suited to the communication goals. (p. 1)

The Common Core standards include statements that proclaim students will have the capacity of a literate individual when they are able to "use technology and digital media strategically and capably" (Common Core State Standards Initiative, 2012, p. 1). Technology standards indirectly influence technology use in classrooms (ISTE, 2016). Technology standards, which have been established in most states, outline specific benchmarks defining student proficiencies with the use of technology (U.S. Department of Education, Office of Educational Technology, 2014).

Changes in Classroom Instruction with Technology Integration

Dwyer, Ringstaff, and Sandholtz (1990) document case studies which follow changes in teacher's basic entry level uses of technology to more innovative uses as technology becomes more prevalent in classrooms. Schachter and Fagnano (1999) reported that advocates for educational technology have asserted that the use of technology tools eases the learning process, while increasing productivity and enthusiasm. However, student achievement is improved only when significant, rigorous learning experiences are deliberately developed according to sound learning theory and pedagogy. Becker (2000) found that there are four predictors which can determine the utilization of technology in a classroom: 1) the teacher's basic general understanding of the technical functioning of the technology tools, 2) the teacher's informal leadership skills within and outside of the school, 3) the quantity of technology tools available within the classroom, and 4) the teacher's philosophical beliefs about teaching and learning practices. Furthermore, Becker revealed factors that may prevent a teacher's use of technology integration practices, such as lack of access to technology, the organizational structure of the day, and the lack of technical skill in using the technology tools.

Cuban et al. (2001) conducted a national survey of 4,100 teachers' pedagogy, computer use, and teaching environment. The analysis of these survey results indicated that a teacher's beliefs about teaching and learning were primary factors that inhibited quality technology integration pedagogy (Cuban et al., 2001). Goldberg, Russell, and Cook (2003) completed a meta-analysis of 26 studies published between 1992 and 2002 that compared student writing with computers and student writing using traditional pencil and paper. Results suggested that when students used computers for writing, they exhibited enhanced writing skills. Using computers increased their motivation, level of engagement in the writing process, and the quality of written products. Teachers reported using computers contributed to improvements in student writing achievement (Jeroski, 2005).

Leu, Kinzer, Coiro, and Cammack (2004) suggest that new technologies provide innovative opportunities to enhance traditional forms of literacy instruction and alter commonly held definitions of literacy. In order to access the Internet and utilize information and communication technologies, students need to understand the traditional forms of literacy, including, but not limited to, word recognition, decoding knowledge, vocabulary knowledge, comprehension, inferential reasoning, the writing process, and numerical literacy (Leu et al., 2004).

The North Central Regional Education Lab (NCREL, 2005), in a meta-analysis of research, concluded that several educational changes occur within technology implementation. Student achievement could not be isolated to the impact of the presence of technology, but may be attributed to other significant features in the instructional environment, such as educational goal setting, quality professional development for teachers, schedule adjustments, technical supports, and ongoing evaluation with adjustments to the instructional components of the classroom. Furthermore, teacher attrition contributed to the lack of technology implementation. Transforming teachers who are novice technology users to those who are capable of integrating effective technology to support student learning is a three to five year process (Brinkerhoff, 2006). While numerous innovative initiatives and advances are present in many schools, Lowther, Inan, Strahl, and Ross (2009) found that after over 30 years of technology initiatives, effective technology integration applied to student learning is much more the exception than the rule.

Blair (2012) claimed that the traditional role of the teacher in a classroom must shift toward the teacher serving as the facilitator or catalyst for learning. This shift affords more powerful experiences for students to explore and design learning tasks and projects using technology resources to solve real-world problems and maintain ownership of their learning. Students are able to design products using technological resources for authentic audiences. Examples include presentations, news broadcasts, website development, online publications through blogs and other web 2.0 tools, contests and competitions, and real-time connections with the world outside of the school. These effective uses of technology allow the learner the capability of connecting with and experiencing a global audience beyond the traditional classroom as recommended by the framework for 21st century learning (Partnership for 21st Century Skills, 2007b).

As society faces transformations with the presence of technology tools and resources, the decisions for school leaders extend not only to the necessity of integrating technology, but also to the effective use of technology for increased student learning (November, 2010). The purpose of technology instruction is to improve the quality of teaching and learning to support the curriculum goals and the school improvement efforts, with the primary goal of having all students reach high academic standards (November, 2010).

Modifications to traditional curriculum. Byrom and Bingham (2001) believe that integrating technology requires changes in teaching methodology. Teachers should utilize strategies for student-focused learning. Using technology places the student in a different role in relation to learning the curriculum content. Problem solving, critical thinking skills, and authentic, problem-based learning structures align with pedagogically sound practices that enhance curriculum when technology is present.

Brabec, Fisher, and Pitler (2004) align technology into seven categories for effective instructional practice, which include word processing applications, organizing and brainstorming software, multimedia, data collection tools, Web resources, spreadsheet software, and communication software. Pitler, Hubbell, Kuhn, and Malenoski (2007) acknowledged that teacher decisions regarding the selection of technology tools and resources are guided by the availability of technology, the student's ability to use the technology, the curricular goals, and the timeline of the specific project. The essential component for technology use is the ability of the teacher to design meaningful, impactful instruction. Planning focuses on what students will learn, which strategies will provide evidence of learning, which strategies will help students gain and assimilate learning, and which strategies will help students practice, review, and apply learning. Further addressed were the implementation and access to technology with the introduction of a subset of curricular content areas for educators and students to apply at all levels of learning. Concepts involving copyright and plagiarism lead to instruction within the practice of digital citizenship. Likewise, instruction related to internet safety allows students to develop understanding around the ethical and appropriate use of technology resources (Pitler et al., 2007).

Saxena (2013) noted that the development of a more authentic and engaging curriculum is essential to the process of integrating technology resources in classrooms. Problem-based activities can replace traditional lectures and afford opportunities for students to collaborate with peers. Technology improves student access to visualizations, simulations, and interactions with curriculum content within real-world problems, resulting in the enhancement of problem solving approaches, reflective judgments, and higher order analysis. Among technology tools used in classrooms, numerous computer-assisted instructional programs are available for supplementing traditional curriculum. Educational software and Internet-based instructional programs are marketed with great promise for academic achievement. Research findings suggest that such programs may have positive effects on student learning. Dorris (2014) analyzed the application of the program called Headsprout for Kindergarten (K) students in a school district in Maine.

Results suggest positive outcomes on reading achievement, with statistically significant gains as compared to the control group. Long-term benefits were evident through analysis of assessments given at one and two years after the study.

Instructional approaches for technology integration. Ringstaff and Kelley (2002) reported that today's students are using complex software programs and cutting-edge network technologies as they transition to more interactive and collaborative project-based learning. Students actively use technology tools for gathering, organizing, and analyzing learning content material, for solving problems, and communicating information. The Partnership for 21st Century Skills (2007a) prioritizes the use of technology tools for research, organization, analysis, and communication. Particularly noted skills include the ability to display an array of functional and critical thinking skills related to information, media, and technology. Students living in a technology and media-rich environment need skills to navigate the abundance of information and the rapid changes to the technology resources, along with the ability to collaborate and develop individual contributions using information literacy, media literacy, and information, communications, and technology literacy (Partnership for 21st Century Skills, 2007a).

Suhr et al. (2010) noted the potential of using technology to improve literacy in the classroom:

> New digital technologies, if used wisely, are believed to have the potential to expose students to a wide range of academic language; provide scaffolding so that students can comprehend challenging and interesting texts; engage students in text-based simulations that spark their interests and motivate their learning; and

> provide a wide range of tools for analyzing texts, brainstorming their ideas, organizing their thoughts, writing, peer editing, and publishing their work. (p. 7)

Wells (2012) noted that classrooms must become centers for collaborative interaction for discovery and creation as opposed to using technology only for skill drills. The mindset for effective and ideal technology use is guided by the NETS, which outlined the scope and sequence for technology skills for students (Wells, 2012).

Assessment of student understanding of curriculum content can be achieved through traditional methods, such as paper and pencil quizzes or other overt strategies. However, technology has the potential to accelerate the process for teachers to assess student learning using numerous electronic resources and tools (Vega, 2013). Given that on-going assessment that is embedded into curriculum results in increased student learning, the use of technology resources offers teachers more efficient and accurate opportunities for instructional decisions (Vega, 2013).

Development of Technology Integration Plan

November (1998) advised that developing a technology plan begins with convening a planning team of key stakeholders to evaluate the status of technology use and the needs of the district. Indicators for successful planning include building a knowledge base, developing a collective vision, analyzing budget requirements, designing learning and curricular applications, and implementing professional development for teachers. Additionally, technology plans must address the technical support needs for troubleshooting and managing the hardware components. Finally, a crucial step in the planning process is to assess the value for student learning and adapt the implementation plan as needed (November, 1998).

Byrom and Bingham (2001) identified leadership as the most essential factor to the implementation of a quality instructional program involving technology. Programs with visionary leaders who maintained a commitment to teaching and learning using technology prove to be the most successful. Beyond the attainment of a vision for using technology, effective skills portrayed by leaders include the application of technology in all components of the school environment and the celebration and recognition of teachers who actively implement technology, while maintaining the focus on technology integration by providing teachers with the resources, skills and time necessary, sharing the leadership for decisions about technology integration, and monitoring the use of the technology resources as part of program evaluation. Teachers proceed to carry out such a vision through specific actions, thus creating technology-rich learning environments for students. They reported that a school's success with the use of technology is dependent upon the implementation of a comprehensive quality plan. Important components include a clear vision, mission, and goals for guiding teaching practices and learning experiences. Furthermore, the designation of a technology coordinator solidifies accountability for technology plan implementation, which ensures that the plans actualize to reality as opposed to simply being written. Important focus areas for technology planning include curriculum integration, professional development, community engagement, and infrastructure development (Byrom & Bingham, 2001).

When developing a technology plan for integration, school leaders are guided by six purposes for educational technology recommended through a study by Cisco Systems and the Metiri Group (Fadel & Lemke, 2006), which included to: (a) improve learning; (b) increase student engagement in learning; (c) improve the economic viability of students; (d) increase the relevance and real-world applications of academics; (e) close the digital divide by increasing technology literacy for all students; and (f) build 21st century skills, including critical thinking, global awareness, communication skills, information and visual literacy, scientific reasoning, productivity, and creativity. Educational technology presents a multidimensional curriculum expansion, which is subjective to student access and use, instructional practice, and assessment and program evaluations.

Researchers have recognized that technology, as a school improvement initiative, is challenging to implement and evaluate. Schools often choose multiple goals for technology implementation, which increase the complexity when attempting to determine the evidence of successful impact on student learning (U.S. Department of Education, Office of Educational Technology, 2014). Darling-Hammond et al. (2014) further supports the importance of the teacher when evaluating the success of technology initiatives and implementation plans.

Purpose and rationale for technology integration. Teachers need to recognize how children acquire literacy, and shift from traditional instructional styles (Bus & Neuman, 2009; Marsh, 2005). Marsh (2005) noted that it is necessary for educators to recognize that digital literacy development is an essential part of the early childhood curriculum. Critical issues for educators include a) the selection of effective technology tools, b) the cost impact of the technology tools, c) the appropriate application of technology to classroom practice, d) the professional development and efficacy level of teachers intended to utilize the technology tools, and e) the impact to student achievement with the implementation of the technology tool (Marsh, 2005).

Technology literacy is of precedence to educators to developing 21st-century skills as students prepare to contribute to a universal technological society (Trotter, 1998). The Partnership for 21st Century Skills (2007b) advises that students and teachers need to incorporate high-level academic thinking, collaboration, and technology proficiency. Schools are challenged with the development of a plan for integrating technology into the curriculum that aligns with a district's vision for student learning. November (2010) identified the importance of the technology being used for strengthening current programs and sustaining meaningful, engaged learning for all students. Technology should be an essential element for improving and transforming teaching and learning in the greater effort for student achievement of high academic standards (November, 2010). Students who develop technology literacy gain and process information, cultivate unique means of self-expression, and connect and share ideas with others. Additionally, teacher response to technology implementation has not maintained a pace comparable to the pace at which students are using technology (Barseghian, 2011). Educators have to consider how the effective use of technology can enhance learning and enable cognitive development in early learners (Kaumbulu, 2011).

Role of school leaders. Byrom and Bingham (2001) confirm that leadership is the significant influential factor affecting the successful integration of technology in classrooms and schools. Specifically, in schools showing high levels of progression toward technology integration, leaders commit their energy and focus to develop and maintain a school-wide vision for the use of technology, while leading the staff with models of effective technology use and active participation in professional development opportunities related to technology integration. Technology integration becomes genuine when leaders support and provide reinforcement for the teachers as they implement new practices using technology, while continuously maintaining the focus for student learning impact. School leaders expand leadership for technology by including teachers in decision-making and utilizing tools for evaluating the effectiveness of the technology integration practices (Byrom & Bingham, 2001).

According to Toy (2014), school leaders play a key role in the success or failure of technology integration with the classrooms. The leaders are critical to the promotion of the vision of the school technology plan as they expand and support staff ownership and buy-in to the advancement of technology practices. From modeling the use of technology to ensuring appropriate access for the staff to the technology, leaders are accountable for setting consistent and realistic expectations while visibly advocating for effective classroom technology use (Toy, 2014).

Seeley (2014) reviews the importance of the selection process for specific technology resources. Evaluating the resources to support specific learning needs, determining the implementation process, and using the resources effectively are responsibilities of school leaders. To determine the ultimate value of a specific resource, Seeley (2014) poses these questions to aid decisions:

- Does the technology resource allow access to higher-level and/or increased challenges to the content than other traditional resources?
- Does the technology resource support, enrich, or stimulate student learning in unique ways that are unavailable?
- Does the resource increase or improve teacher-student interactions or assist with the management of student information?

- Does the resource offer students deeper examination or dialogue related to the learning content?
- Does the preparation involved in using the resource correlate to the benefits the resource may bring to teachers and students?

Professional development for teachers. Professional learning for teachers is crucial for success in the area of technology integration. Fullan (2001) believes the use of technology creates changes or innovations that in turn produces teachers teaching within zones of uncertainty. Furthermore, teachers need to internalize the significance of innovation in education and then apply that change to practice in their classroom for successful innovation implementation.

Byrom and Bingham (2001) suggested an ongoing analysis of teacher technology skills through self-assessments, rubrics for implementation, and open-ended classroom observation protocols. These tools are most effective when they include best practice indicators and benchmarks, which help teachers recognize their subsequent strategies for professional growth in technology integration (Byrom & Bingham, 2001). As technology is implemented, plans for on-going professional development are valuable for teachers to become proficient with using the technology for quality learning activities. The use of the technology should afford the development of projects that extend the learning for students (Gahala, 2001). Christensen (2002) documented that unprepared or unenthusiastic educators will lack success with the integration of technology. The difference between success and failure in a technology immersion classroom is dependent upon the teacher's methodology, comfort level, and knowledge of instruction using technology resources. With effective professional development regarding the best practices using technology and a supportive school setting, teachers have a strong, positive indicator for success with technology integration (Grant, Ross, Wang, & Potter, 2005).

Heffernan (2012) studied the factors that motivated teachers to use and select technology resources. The five constructs that were the focus of the study included technology acceptance, personal factors, playfulness, self-efficacy, and anxiety. Results indicated that as technology acceptance increased, technology usage increased. Personal factors, self-efficacy, playfulness, and skill level were positive predictors of technology usage, while anxiety was a negative predictor of technology use. Hartley (2014) identified four barriers to integrating technology, noting that teachers move through the change process as they progress toward technology use in the classroom. The four barriers identified in the study are lack of training and technical support, lack of administrator priorities and support, lack of resource allocation and convenience, and inability to reduce teacher workload. The National Education Technology Plan (U.S. Department of Education, Office of Educational Technology, 2014) indicated that technology use in education has been less than successful due to the lack of training for teachers who were in the position to implement technology. Darling-Hammond et al. (2014) noted that teachers need to understand the basics of technology in addition to the application in classrooms with effective instruction for students, yet also need professional learning opportunities to collaborate with colleagues.

Potential Student Achievement Gains with Technology Integration

Anderson, Corbett, Koedinger, and Pelleteir (1995) stated that the use of computers may provide a more efficient learning venue, since student achievement gains are exhibited more quickly than with instruction that does not include computers. November (1998) established that the benefits of technology integration on student achievement are realized within effective planning for curriculum programming implementation. The improvement of student learning, related to academic achievement and technology literacy, is the key objective for technology immersion programs in schools.

Coley, Cradler, and Engel (1999) summarized an analysis of 176 studies between 1990 and 1995 and concluded that computer-assisted instructional programs, which incorporate drill and practice exercises, produce positive increases in reading and mathematics achievement. The Computers Helping Instruction and Learning Development (CHILD) program was included in the meta-analysis with data from nine Florida elementary schools. Six computers were placed in each classroom and teachers received specific training. Standardized test scores indicated positive and significant results across all grades, schools, and subjects, with the largest effects appearing for students who had been in the program for more than one year (Coley et al., 1999). With meaningful integration into curriculum and instruction, the results of studies indicate that technology positively affects student learning and achievement (Boster et al., 2002).

Project Hiller, implemented at Union Hill High School between 1998 and 2001, was reviewed by Light, McDermott, and Honey (2002). They found that after two years in a one-to-one laptop program, students scored significantly above their peers in all subject areas on the New Jersey State High School Proficiency Test. Additionally, Holcomb (2009) reported that Maine's statewide project, a one-to-one computer initiative, resulted in a 7.7% increase in attendance and a 54% decrease in disciplinary reports. Numerous studies report evidence that technology, when used effectively, does improve student learning (Becker, 2000; Parr & Fung, 2000; Kulik, 2003: Roschelle, Pea, Hoadley, Gordin, & Means, 2000; Wenglinsky, 2005).

Between 2000 and 2005, the average writing scores on the Maine Educational Assessment resulted in an effect size difference of .32, thus the average student score in 2005 was better than approximately two-thirds of all students in 2000. Jeroski (2005) reported an increase in students meeting writing performance standards, with access to computers, from 74% in the fall of the first year of the program to 94% in the spring of the second year of when reviewing pre-post writing assessment results. These results were from the Wireless Writing Program, implemented in the Peace River North schools in British Columbia, Canada where 1,150 students were provided with an iBook on a one-to-one basis in sixth and seventh grades.

Research reviewing specific components of technology integration, such as one-to-one computer programs, computer-assisted instruction, or media programs, results in various outcomes. Investigations of one-to-one computer programs show positive effects in literacy, mathematics, and writing skills, and in using productivity and design tools (Mouza, 2008; Penuel, 2006). When technology use incorporates constructivist methodologies, research has revealed evidence that active, student-centered learning activities encourage communication that improves achievement (Means, 2010; Wenglinsky, 1998, 2005).

The National Center for Education Evaluation and Regional Assistance (2007) conducted a study, mandated by the U.S. Department of Education, of 33 school districts, 132 schools, and 439 teachers. Test scores were not significantly higher in classrooms using the reading and mathematics software products compared to the classrooms that did not use the software. However, various studies show that mathematics scores increase with computer use. Holcomb (2009) reported increases in mathematics achievement in Maine, Texas, Missouri, and South Carolina, where students in the various technology programs outscored non-participating students on standardized assessments. On the other hand, Holcomb (2009) reviewed Maine's statewide one-to-one computer program initiative with evaluation measures that showed little effect on student achievement, with the exception of writing skills.

The One-to-One Institute (2010) conducted a comprehensive national study, known as Project RED, to pinpoint and prioritize reasons that various technology programs result in better student performance. The research included 997 schools, representing 49 states and the District of Columbia. The hypotheses tested focused on student achievement and the financial considerations of technology in schools, with 22 categories of independent variables tested in the study. Findings included nine key factors linked to educational success. The project determined that for educational technology to positively impact student learning, all factors must be consistently implemented for success of any technology project. Project RED's research determined that schools which employed a one-to-one computer ratio along with these key implementation factors outperformed other schools. The key implementation factors were intervention classes, change management leadership, online collaboration, core-subject integration, online formative assessments, one-to-one student-computer ratio, virtual field trips, search engines, and principal training. Daily technology use was summarized in the Project RED study as the most important finding. Incorporating technology into daily teaching correlated to the anticipated student achievement, in addition to improved behavior and learning engagement, increased attendance and college readiness.

Suhr et al. (2010) examined the writing and literacy skills of fourth grade students in the Estrella, California school district and found that a one-to-one computer program in which each student had a laptop resulted in students exceeding growth, as compared to their peers, in literacy response and analysis, as well as writing strategies on English Language Arts components of the California Standards Test. Significant increases in assessment scores continued in the consecutive years of the program. Apple, Inc. (2014) published results from studies of the use of iPads in classrooms. Writing results from a Kindergarten iPad pilot in Charleston, South Carolina showed the percentage of students reading above grade level increased from 39% at the beginning of the year to 100% at the end of the year. Kindergarten students utilizing iPads in Maine showed a 40% increase in reading proficiency over students without access to iPads. A similar study in California revealed that 175% more students were at advanced levels in mathematics, as measured by MAP assessments, as compared to students without iPads (Apple, Inc., 2014).

Teachers, researchers, and policy makers have argued whether technology immersion programs increase student learning. Used as a tool for transforming teaching and learning, technology can move students to higher academic standards (November, 2010). Technology integration used to enhance a traditional curriculum potentially provides meaningful and engaged learning experiences for all students. With the changes that technology has brought to society, schools not only must incorporate technology, but also must ensure that it improves student learning. While researchers agree that technology access is necessary for student learning, they recognize that mere access is not a sufficient condition for learning (Becker, 2000; Cuban, 2001; Wenglinsky, 2005).

Stakeholder response to technology integration. The CEO Forum School Technology and Readiness Report (2001) determined technology can increase student learning when immersed into the curriculum with the implementation of higher-order thinking skills. Noeth and Volkov (2004) expressed that complex issues are involved in evaluating the effectiveness of technology in education. As an educational tool and resource, users of technology must be held accountable for improving teaching and learning experiences. Stakeholders must use reliable data to respond to questions and monitor results concerning comprehensive plans for technology integration.

As school systems apply effective technology resources, Noeth and Volkov (2004) recommend three benchmarks for accountability of technology plans. First, all significant stakeholders should reach agreement on the purpose and projected results of the technology implementation. Second, the technology plan needs to include a component for the evaluation of the projected results, and third, school leaders and teachers should participate in ongoing, applicable professional learning for accountability in effectively implementing the comprehensive technology plan (Noeth & Volkov, 2004). Yet, barriers are still present in the classroom. Ertmer (2005) identifies examples of the barriers including, but not limited to, stakeholders that challenge the status quo of the traditional approach to instruction, the selection of resources, lack of professional development, and lack of appropriate instructional application. Such barriers can be overcome when stakeholders embrace the change that emerges from the paradigm shift with technology immersion programs (Ertmer, 2005).

Most teachers are excited to utilize and implement new technology due to the increase in student enthusiasm and engagement in learning, according to Pitler et al. (2007). They recognize the value of technology as it affords opportunities for differentiated instruction and alters the classroom environment with the application of dynamic learning experiences and strategies that propel students further as independent learners. Keengwe (2007) further expressed that stakeholders continue to place pressure on teachers to use and integrate technology in the classroom. Collins and Halverson (2009) reported that, while technology is altering the way people read, write, calculate, and think, technology is not being fully implemented in classroom instruction. During the first decade of the 21st century, the availability of technology tools transformed classroom instruction, yet the necessary change for thorough implementation was slow-paced, or in some classrooms, not at all (Collins & Halverson, 2009). Technology purchases continue to increase, professional development is offered, and traditional courses and schedules are adjusted to meet the technology advances.

The importance of technology is established in a school system when district and school administrators ensure that teachers, school boards, and parents understand the role of technology in the schools. Developing a vision for the purpose and implementation of technology standards will set the tone for the outcomes of a technology immersion program. As stakeholders are aware of the benefits of technology in the schools, they are able to support the efforts of educators adjusting to student-centered, authentic, collaborative, and challenging instructional approaches in their classrooms (Moeller & Reitzes, 2011). Wells (2012) suggested that innovative educators document student achievements, discoveries and creations using technology to help all students, staff, parents, and other school officials comprehend the vision for the use of technology in the school.

Hart Research Associates (2012) surveyed parent and teacher attitudes and opinions on technology in education. According to this study, these stakeholders considered technology a significant issue to students' educational preparation. However, the belief that schools in America have not maintained levels of technology use commensurate with other areas of society was a commonly held opinion among those surveyed. A high percentage of teachers and parents supported the investment in technology in schools, noting that technology use can address numerous goals in education. Such goals include personalizing learning experiences, providing interactive learning, and improving student engagement, while connecting to the real world through exposure to experts and unique resources, which offer varied perspectives. Teachers expressed concerns about the need for higher levels of professional development related to technology. Over 90% of teachers and parents expected schools to make good use of technology resources, with 95% of teachers and 91% of parents surveyed believing that additional investments in technology would be worthwhile (Hart Research Associates, 2012). Hartley (2014) found that successful technology integration ensues when teachers network with and support each other with the innovation. Commitment to continuous improvement and collaboration among teachers will lead to successful technology integration.

The effects of technology integration on student learning. Baker, Gearhart, and Herman (1990) reported on the Apple Classrooms of Tomorrow project. The project resulted in little to no gains for students in basic skills on standardized assessments, yet the anecdotal evidence from the project indicated that students gained advanced skills while engaging in collaborative learning experiences involving challenging problem solving. Alternatively, other studies report negative effects for students when technology is implemented into classroom instruction. Wenglinsky (1998) found that the frequency of computer use was negatively associated to mathematics achievement, due to the lower-level practices, such as the use of drill and practice software.

Conversely, Sivin-Kachala (1998) reviewed 219 research studies to determine the impact of technology integration on all levels of student learning across all curricular content areas. The results of his review revealed that students immersed in technology-rich settings experienced positive effects, with increased achievement in all major subject areas from preschool through higher education. Study results showed that students using computer-based instruction scored at the 64^{th} percentile on achievement tests, while students not using computers scored at the 50^{th} percentile. The elementary studies analyzed showed a 14 to 16 percentile gain with technology integration in classrooms over the classrooms without technology.

Moreover, students' attitudes concerning learning and their self-concept improved with the addition of technology to the educational setting. In addition to increasing student learning, technology integration, when used effectively, extends motivation to learn, encourages collaborative learning, and supports the progression of critical thinking and problem-solving (Schacter & Fagnano, 1999). Barley et al. (2002) reported that research consistently documents the benefit of technology use for at-risk and students with specials needs. Further analysis specified that computer-assisted instruction intensified the learning for at-risk students since it offers non-judgmental, frequent and direct feedback, delivers motivational, multisensory learning experiences, and allows teachers to differentiate for alignment to specific student needs.

Lowther, Ross, and Morrison (2003) compared fifth, sixth, and seventh grade classrooms with five computers each to classrooms in which students were provided individual computers for home and school access. Students from four elementary schools and three middle schools, in a suburban middle-class school district were involved in the study. Students with individual access to computers experienced more extensive and independent use of the technology due to consistent access. The writing assessment results for students with individual computers showed significant advantages over students with only classroom access, with six of eight effect sizes exceeding +0.80. Results of problem-solving assessments, for students with individual computers, showed significant increases for five of the seven components of the problem-solving task, indicating advantages with the inclusion of technology resources.

Russell et al. (2004) studied a laptop initiative in a Massachusetts elementary school. Students participated in a one-to-one program, with findings that one-to-one classrooms use technology more frequently and with more meaningful, higher-level instructional activities. Students showed increases in engagement and motivation, along with growth in writing production and collaboration with peers on classroom projects. Alternatively, Fuchs and Woessman (2004) issued results from the 2000 Programme for International Student Assessment (PISA). The findings were less than desirable to educators who alleged that technology had a positive effect on student achievement. The results showed that students who had one computer at home performed 22.7 achievement points better than students without a computer at home, a statistically significant positive difference. However, when the availability of computers in schools was analyzed, students with computers in their schools scored at a statistically significant lower rate. Additional examination found that the outcome was based only on the variable that students had computer access at school, home, or both, thus results imply that merely having technology does not determine an increase in achievement (Bielefeldt, 2005). Various researchers have studied the influence of technology on standardized achievement test scores and have found no clear evidence that technology has a direct effect on increasing student learning (NCREL, 2005).

Trucano (2005) investigated the impact of technology on learning outcomes when information and communication technologies are incorporated into the classroom. Trucano determined the impact of technology use on learning is unclear and furthermore, there are not standard methodologies for assessing the impact of technology. Technology has not been proven to directly increase student learning, but an indirect influence is associated with effective technology use through sound instruction, clear learning targets, and student motivation. Warschauer (2006) studied 10 schools in California and Maine, at all levels, which had executed one-to-one computer immersion programs. Findings of the study determined the influence of three classroom practices: “scaffolding, epistemic engagement, and page-to-screen shift” (Warschauer, 2006, p. 36). While the results influenced instructional practices and student engagement, no evidence presented improved standardized test scores. Warschauer stated that this type of outcome is reasonable, given that the focus on skills and knowledge of technology immersion would not be measured by traditional assessments.

Pitler et al. (2007) also recognize that the use of technology fosters more student ownership and initiation of personal learning for students. Classrooms become more student-driven environments, thus offering teachers greater options for differentiation and guided instruction. Results on the 2002 Global History Regents exam showed increased achievement on the standardized test, yet the researcher could not determine whether the technology was the cause for the increase in student achievement. The researcher concluded that changes in the instructional practices may have been a possible result for the increase in achievement.

According to Kemker, Barron, and Harmes (2007), when technology corresponds with authentic or meaningful instruction, five behaviors result. First, higher order thinking skills are accessed as students use technology to learn to view information. Second, knowledge is deepened with the active presentation of concepts in small, detailed selections, readily available with technology tools. Third, connections are extended beyond the classroom when real-world experiences with a personal effect on students are implemented into the instruction. Fourth, high levels of dialogue and collaboration concerning the subject matter result in teacher-facilitated, rather than teacher-dominated classrooms. Finally, the non-intimidating environment of the technology-rich classroom provides strong social support for students.

Knight (2008) investigated the correlation between technology and standardized achievement scores. Analysis of the data showed a small positive correlation between technology access and student scores on the National Assessment of Educational Progress (NAEP), while also presenting a small negative correlation between the use of technology and student scores in reading and mathematics for fourth grade in 2003, 2005, and 2007. Kao (2009) recognized the importance of the teacher and their instructional practices as a key indicator to the successful integration of technology use. The extent to which computer use is supported within the curriculum, along with the instructional practices of the teacher, can either support the clarity of difficult concepts and further understanding and learning or simply replace traditional classroom activities (Kao, 2009).

The effectiveness of educational technology, according to Ross, Morrison, and Lowther (2010), is reliant on the attainment of the desired instructional goals of teachers and students. Their research pinpointed three categories for educational technology use, which determined the levels of impact on student learning. The first category was computer-assisted instruction that delivers basic tutorials and drill-and-practice programs. Existing research proposes that this methodology yields similar results to traditional, teacher-led instruction. The second category employed technology as an assistance to teachers to organize and deliver instructional content. When teachers use multimedia, such as video, presentations, and interactive whiteboards, learning develops into a more engaging and interactive experience for students. The third category for technology use involves in-depth use of the tools for authentic learning purposes (Ross et al., 2010). For maximum effect on student achievement, Darling-Hammond et al. (2014) recommend that technology-access policies target goals for students to have one-to-one computer access, guarantee that high-speed internet connections are accessible, endorse concentrated levels of interactivity and engagement, promote the creation of content as well as practice of skills, and provide opportunities for students to collaborate with one another as supported by technology use.

Summary

Chapter two included a review of the literature on instructional technology integration in the elementary classroom. Research documented within this chapter validates the impact that technology has on the elementary student when used in appropriate ways to enhance the curriculum. The literature also demonstrates the need for educators to participate in effective professional development and collaborate with colleagues for developing authentic learning experiences for students. The reviewed literature demonstrates the continuous development of the use of technology in the elementary classroom to enhance and increase student learning experiences.

In chapter three, research methods are explained. The chapter includes the research design, the population and sample, sampling procedures, and the instrumentation used in the study, including specifics about the measurement with validity and reliability information. Data collection procedures, data analysis and hypothesis testing, and the limitations of the study are explained in chapter three.

Chapter Three

Methods

The purpose of this study was to analyze the effects of student participation in technology immersion classrooms as determined by the attainment of growth targets and observed learning growth on MAP assessments in reading and mathematics. District X implemented the Technology Immersion program to enhance effective instruction utilizing technology tools and resources, to support teachers and students with technology implementation, and to provide classroom teachers and students with technology-rich learning environments. Presented in this chapter is a description of the research methodology for the study and details of the research design, population and sample, sampling procedures, instrumentation, data collection methods, data analysis and hypothesis testing, and limitations of the study.

Research Design

This quantitative, non-experimental study was designed to evaluate the effect of participation in the Technology Immersion program on elementary student growth in the academic areas of reading and mathematics using archival data. All students were randomly assigned by District X to classrooms that were either Technology Immersion classrooms or non-Technology Immersion (traditional) classrooms. The Technology Immersion group included students who received instruction in technology-rich classrooms, while the other group included students placed in the traditional classrooms. This study involved a comparison of growth target scores for students in Technology Immersion classrooms and traditional classrooms in the district, as well as analysis of the effect of the number of years students participated in Technology Immersion classrooms on their observed reading and mathematics growths. The variables of this study were percentages of students who met their target growths in reading and mathematics, Technology Immersion students' observed growths in reading and mathematics, number of years students were in the Technology Immersion classrooms, and the type of classroom (Technology Immersion or non-Technology Immersion).

Population and Sample

The population for this study included all students, grades Kindergarten through fifth, enrolled in the 20 elementary schools during the 2012-2013, 2013-2014, and 2014-2015 school years. District X is a suburban school district located in a metropolitan area in Kansas. Enrollment varied slightly from year to year, as represented in Table 5. The specific elementary schools chosen for participation were those selected by the school district's development team, which included the Educational Technology Director, the Director of Curriculum and Instruction, and the Deputy Superintendent for Education Services. The sample group of students participating in the Technology Immersion project consisted of the students from elementary schools during the initial three years of the study who were assigned to the technology immersion classrooms. Table 5 is a comparison of the sample size of students in Technology Immersion classrooms to the total district enrollment in the elementary schools.

Table 5

District X Enrollment

Student Enrollment	2012-2013	2013-2014	2014-2015
Technology Immersion Classrooms	1,127	2,001	3,703
K-5 Total Enrollment	9,472	9,479	9,404

Note. Director of Educational Technology for District X, personal communication, June, 2015.

Sampling Procedures

Purposive sampling was used in this study. Lunenburg and Irby (2008) define purposive sampling as sampling that "involves selecting a sample based on the researcher's experience or knowledge of the group to be sampled" (p. 175). For the initial phase of the project, District X administrators selected five buildings in which to implement the Technology Immersion program based on observations, walk-through data, and interviews with building administrators. Data were collected on the various types, frequencies, and integration of technology being utilized in all elementary learning spaces. Each of the five building principals agreed to support the project within their building and to identify the teacher candidates for participation. Each principal selected one teacher at each grade level in the building to participate in the project; therefore, six teachers at each of the five schools participated in the Technology Immersion project.

Student participation in the Technology Immersion classrooms varied from year to year based upon the random placement of students in Technology Immersion classrooms each year. Students were placed in Technology Immersion classrooms based solely on their random selection assignment to a teacher in the Technology Immersion classrooms. No choice was available to students to participate in the Technology Immersion classrooms.

Students were placed in classrooms based on the district protocol for balancing classroom populations. Gender, specific academic and learning needs, academic achievement, race/ethnicity, parent request, and discipline concerns were factors considered in an effort to balance the students in each classroom. Within each school, the building principal identified specific classrooms at each grade level to participate in the Technology Immersion program. Data from all K-5 students in academic years 2012-2013, 2013-2014, and 2014-2015 were used in the study.

Instrumentation

District X administers the MAP assessments to all elementary students during a fall testing window in the content areas of reading and mathematics. The MAP assessments are repeated during a spring testing window. The MAP tests are computer-based, multiple-choice, adaptive tests developed and marketed by the Northwest Evaluation Association (NWEA), which are aligned to the Kansas State Curriculum Standards. The adaptive component of the assessment allows for the adjustment of the individual student's difficulty of items based on the student's ability to answer the questions correctly. When students answer a question correctly, the next item is more difficult; yet, if they answer incorrectly, the next item is easier.

The MAP test is used to measure growth over time and reflects the instructional level of individual students and groups of students (NWEA, 2012). MAP assessments provide teachers with specific details to inform and guide instruction for individual students. Teachers use MAP assessment results for the following purposes: (a) to identify skills and concepts that students have mastered, (b) to diagnose instructional needs for individual students and groups of students, (c) to monitor academic growth over time, and (d) to make data-driven decisions to guide instructional choices.

The content of the assessments includes questions based upon the reading and mathematics standards of the Kansas Career and College Readiness Standards. KSDE (2015) defines the standards as content and skills that students should understand and be able to do by the end of each grade level. The standards for reading include the analyzing text for key ideas and details, understanding the craft and structure of text, integrating knowledge and ideas from the text, and developing a range of reading and level of text complexity. The reading standards address reading literature and informational text in addition to the foundational skills of reading. The mathematics standards also define what students should understand and be able to do. The mathematics standards are structured into clusters of related standards, such as counting and cardinality, operations and algebraic thinking, number and operations, measurement and data, and geometry.

Measurement. MAP scores are presented as Rausch Interval Unit (RIT) scores, a number on a continuous equal interval scale. The score represents an instructional level as opposed to a mastery level. The resulting RIT score represents an instructional level, which informs teachers about the knowledge, skills, and concepts in which individual students are currently exhibiting proficiencies (NWEA, 2012).

The MAP is a nationally normed assessment. Research and norming of specific test items allows for student achievement levels with item difficulty on the same scale. The MAP RIT scale ranges from values of 140 to 300. Student scores are individually determined with each test administration, with student reports developed to monitor growth over time. Based on statistical analysis and research, student reports provide a predictor of performance known as the growth target for the next MAP test. Resources are available that provide learning targets to guide instruction, as well as predicted performance levels on Kansas state assessment (NWEA, 2012). The MAP test is administered to all students in the district in the fall and in the spring. Students achieve a score, known as the RIT score, representing their achievement within the reading and mathematics standards. The change in the RIT score between the fall and spring assessment is the observed learning growth for an individual student. Based upon the fall RIT score, a target score is identified for the spring RIT score, known as the growth target. The growth target is a statistically calculated number of points predetermined for attainment on the spring MAP test. This growth target is based upon the student's fall MAP score, the history of individual student's MAP scores, and the projection to achieve a specific percentile rank. For a class of students, the percentage of students achieving their growth target is a comparison, reported in a percentage, of students who did achieve their targets as compared to those students who did not achieve their growth target.

Validity and reliability. NWEA has conducted research to determine the validity and reliability of the MAP assessments. The MAP test provides alignment of content within question items at the student's grade level and beyond through the adaptability of the assessment. The content of the assessment is based upon the Kansas Career and College Readiness Standards across all applicable grade level material. Items have gone through a rigorous analysis and development for specific alignment with standards. As students take the MAP test, the computerized assessment adapts to the student's ability. While the test items have a range of difficulty for a given test taker, all items administered to each student must satisfy the content requirements of the test to insure content validity and domain coverage. Thus, content validity for the MAP test has been thoroughly evaluated with confirmation that this test measures the expected intentions of the test. The Pearson correlation coefficient was used to establish the concurrent validity of the MAP test. Concurrent validity addresses how well the scores referenced in a RIT scale correlate to scores obtained from an alternate assessment with a different scale, in the same subject area. NWEA analyzed how well scores from the MAP assessment corresponded to scores from another normed assessment in the same subject area. The MAP test showed strong relationships, thus strong concurrent validity when the correlations between both reading and mathematics assessments were in the mid-.80s (NWEA, 2012) across abundant test administrations.

The NWEA reports that 24 million assessments have been given over 30 years. Using the test-retest approach to reliability answers the question “To what extent does the test administered to the same students twice yield the same results from one administration to the next?” (NWEA, 2004, p. 2). The equal-interval RIT scale increases the stability of assessment, providing grade-independent analysis of a child's learning. The marginal reliabilities of tests across 50 states and grades are consistently in the low to mid .90s (NWEA, 2012) for both reading and mathematics. MAP tests have been developed and modified over an ample time period, which allows for the collection of reliability evidence. Valid correlations between multiple test sessions for the same student over significant amounts of time yield statistically consistent results. Equally significant has been the reliability between test items. The volume of the item bank and the adaptive nature of the MAP test provide further evidence of test reliability.

Data Collection Procedures

Based upon the formal request to receive approval for access to student assessment data (see Appendix A), the Deputy Superintendent of Education Services and the Director of Assessment and Research for District X approved this study following a review of the study questions and data collection procedures (see Appendix B). Participating school administrators approved the access to teacher and student participation data for the purpose of this research. The Director of Assessment subsequently approved access to individual student data from the MAP assessments administered to students in the fall and spring of the school year. The proposal for this research (see Appendix C) was submitted to Baker University's Institutional Review Board (IRB). Data collection began following Baker University's IRB approval of this study (see Appendix D). A District X representative provided all data from the MAP assessment reports website. All personally identifiable information (i.e., student names) was removed from the data reports in order to maintain anonymity of the subjects. All schools provided full access for the purpose of this study.

The MAP tests were administered by the classroom teachers in a computer lab setting at each school in District X. Data from the fall administration of the MAP tests were used to determine the student growth targets for the spring administration, as reported by the assessment results from NWEA. The percentages of students within each classroom in District X who achieved their individual growth targets were used as data for this study. The observed learning growth data, determined by the difference in RIT score from fall to spring, were also used for this study. Data for this study was imported into the IBM® SPSS® Statistics Faculty Pack 23 for Windows software program, which was used to complete statistical analyses.

Data Analysis and Hypothesis Testing

The research questions of this study address the differences in attainment of projected learning target growth in reading and mathematics for students in Technology Immersion classrooms in comparison to those students not in Technology Immersion classrooms, as well as the difference in students' observed reading and mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience during the study. The following research questions and subsequent hypotheses were proposed:

RQ1. To what extent is there a difference in the percentage of students who met their target growth in reading, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

H1. There is a difference in the percentage of students who met their target growth in reading, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms.

An independent-samples *t* test was conducted to address RQ1. The sample means of the percentage of students who met their target growth in reading were compared between Technology Immersion classrooms and non-Technology Immersion classrooms. The level of significance was set at .05.

RQ2. To what extent is there a difference in the percentage of students who met their target growth in mathematics, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

H2. There is a difference in the percentage of students who met their growth target in mathematics, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms.

An independent-samples *t* test was conducted to address RQ2. The sample means of the percentage of students who met their target growth in mathematics were compared between Technology Immersion classrooms and non-Technology Immersion classrooms. The level of significance was set at .05.

RQ3. To what extent is there a difference in students' observed reading growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

H3. There a difference in students' observed reading growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience.

A one-factor ANOVA was conducted to address RQ3. The categorical variable used to group the dependent variable (observed reading growth) was the number of years of participation in a Technology Immersion classroom (0, 1, 2, 3). The level of significance was set at .05.

RQ4. To what extent is there a difference in students' observed mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

H4. There is a difference in students' observed mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience.

A one-factor ANOVA was conducted to address RQ4. The categorical variable used to group the dependent variable (observed mathematics growth) was the number of years of participation in a Technology Immersion classroom (0, 1, 2, 3). The level of significance was set at .05.

Limitations

Limitations are the elements that cannot be controlled within the study and are "factors that may have an effect on the interpretation of the findings or on the generalization of the results" (Lunenburg & Irby, 2008, p. 133). It is imperative to identify specific limitations to understand the boundaries of interpretation and generalization of the research results. Limitations may be found within the research methods, data collection, or data analysis. The limitations for this study were:

1. The selection of the specific schools, teachers, and students involved in the Technology Immersion program occurred outside of this study.
2. The Technology Immersion project provides the tools and hardware to classrooms and is specific to the participating schools within the district. The outcomes of this study may not be generalized to other schools.
3. Teachers' use of the technology provided through the Technology Immersion project in the classroom could not be controlled. Some teachers may have more naturally integrated the technology as compared to others. This could impact individual student results on reading and mathematics growth.
4. Many variables outside the control of the researcher may impact the student growth in reading and mathematics. Possible variables may include prior experience that students and teachers bring to the project, the quality of

instruction that accompanies the technology integration, the amount of time that students are engaged with the technology at school, and the additional time that students may spend utilizing technology outside of the school environment.

Summary

The purpose of this research was to investigate the effectiveness of the Technology Immersion project on student outcomes in the areas of reading and mathematics. Archival data from the 3-year period following initial implementation of the Technology Immersion program were used for this study. The target growth of K-5 students participating in Technology Immersion classrooms was compared to the target growth of K-5 students who did not participate in Technology Immersion classrooms. Differences in observed learning growth for students participating in Technology Immersion classrooms for consecutive years were compared to students who did not participate at all. Results of statistical analyses are presented in chapter four.

Chapter Four

Results

This quantitative, non-experimental study was designed to determine if students who were immersed in technology-rich classrooms would have greater achievement in reading and mathematics based upon their MAP assessment scores. Independent-samples *t* tests and ANOVAs were conducted to test the research hypotheses. This chapter comprises a summary of the data collected, the statistical analyses regarding the research questions, and the results of the hypotheses testing.

Descriptive Statistics

Archival reading and mathematics MAP data for students in Kindergarten through fifth grade from the initial three years of the Technology Immersion program were used for this study. Data from 1,265 classrooms were used for the analyses of research questions one and two (see Table 6).

Table 6

Frequencies of Classroom Types by Grade Level and Year of Implementation

Type of Classroom	2012-2013	2013-2014	2014-2015
Kindergarten			
Technology Classrooms	5	8	20
Non-technology Classrooms	66	56	47
First Grade			
Technology Classrooms	5	15	26
Non-technology Classrooms	68	58	47
Second Grade			
Technology Classrooms	5	16	27
Non-technology Classrooms	67	54	47
Third Grade			
Technology Classrooms	5	16	29
Non-technology Classrooms	67	52	40
Fourth Grade			
Technology Classrooms	5	15	25
Non-technology Classrooms	63	56	46
Fifth Grade			
Technology Classrooms	5	15	26
Non-technology Classrooms	67	50	46
Total Classrooms	428	411	426

Note. Director of Educational Technology for District X, personal communication, June, 2015.

Table 7 represents the total numbers of students with MAP assessment scores for reading and mathematics within the classrooms listed in Table 6. The average class size was 21.55, with a range of 11 to 38 students.

Table 7

Frequencies of Students in Classrooms

	Reading			Mathematics		
Year	Technology	Non-Technology	Total	Technology	Non-Technology	Total
2012-2013	675	8,556	9,231	675	8,556	9,231
2013-2014	1,834	7,077	8,911	1,819	7,074	8,893
2014-2015	3,277	5,842	9,119	3,270	5,834	9,104

Research questions one and two required analysis of the percentages of students within the classrooms who met their target growths for reading and mathematics, respectively, from the first three years of the Technology Immersion program. The average number of students within a classroom who met or exceeded their RIT target growth was 13.67 (63%), with a range of 2 (.8%) to 29 (100%).

Research questions three and four required the analysis of individual student MAP data, specifically the observed growth from the fall RIT score to the spring RIT score. Data were disaggregated based upon the number of years of consecutive enrollment in Technology Immersion classrooms. Data from 2014-2015 Technology Immersion classrooms were used for analysis. Kindergarten and first grade data were not included, so as only to include students who had the opportunity to participate in a Technology Immersion classroom for three years. Statistical analysis included observed growth scores from 3,209 cases in reading (n = 1,606 students) and mathematics (n = 1,603 students). Thirty-eight cases were removed due to missing data.

Data Analysis and Hypothesis Testing

Four research questions were investigated for this study. The hypothesis testing results of the hypotheses related to the research questions is presented.

RQ1. To what extent is there a difference in the percentage of students who met their target growth in reading, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

H1. There is a difference in in the percentage of students who met their target growth in reading, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms.

The results of the independent-samples t test indicated a statistically significant difference between Technology Immersion classrooms (n = 268) and non-Technology Immersion classrooms (n = 997), t = 2.72, df = 1,263, $p < .01$. The sample mean for Technology Immersion classrooms (M = 62.01, SD = 13.752) was higher than the sample mean for non-Technology Immersion classrooms (M = 59.34, SD = 14.393). Technology Immersion classrooms had a higher average percentage of students meeting or exceeding their RIT target growth in reading than non-Technology Immersion classrooms. This analysis provided evidence that the Technology Immersion program is having a positive impact on student learning in reading. This supports H1.

RQ2. To what extent is there a difference in the percentage of students who met their target growth in mathematics, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms?

H2. There is a difference in the percentage of students who met their target growth in mathematics, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms.

The results of the independent-samples *t* test indicated a statistically significant difference between Technology Immersion classrooms (n = 268) and non-Technology Immersion classrooms (n = 997), t = 6.007, df = 1,263, p < .001. The sample mean for Technology Immersion classrooms (M = 72.422, SD = 15.592) was higher than the sample mean non-Technology Immersion classrooms (M = 65.48, SD = 17.103). Technology Immersion classrooms had a higher average percentage of students meeting or exceeding their RIT target growth in mathematics than non-Technology Immersion classrooms. This analysis provided evidence that the Technology Immersion program is having a positive impact on student learning in mathematics. This supports H2.

RQ3. To what extent is there a difference in students' observed reading growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

H3. There is a difference in students' observed reading growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience.

The results of the analysis indicated there was not a statistically significant difference in observed reading growth, as measured by the MAP assessment, among students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience, F = 1.050, df = 3, 1,602, p = .369. See Table 8 for the means and standard deviations for this analysis. This provides evidence that the number of years a student participates in the Technology Immersion classroom does not impact the student's reading growth. This does not support H3.

Table 8

Observed Reading Growth for Students in Technology Immersion Classrooms

Years in Class	*M*	*SD*	*n*
0	9.29	9.062	504
1	8.40	7.985	125
2	9.20	8.596	719
3	8.34	7.310	258
Total	9.03	8.510	1606

RQ4. To what extent is there a difference in students' observed mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience?

H4. There is a difference in students' observed mathematics growth, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience.

The results of the analysis indicated there was not a statistically significant difference in observed mathematics growth, as measured by the MAP assessment, among students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience, $F = 0.858$, $df = 3, 1{,}599$, $p = .462$. See Table 9 for the means and standard deviations for this analysis. This provides evidence that the number of years a student participates in the Technology Immersion classroom does not impact the student's mathematics growth. This does not support H3.

Table 9

Observed Mathematics Growth for Students in Technology Immersion Classrooms

Years in Class	*M*	*SD*	*n*
0	13.79	7.266	503
1	12.89	7.744	125
2	13.88	7.212	717
3	13.41	6.384	258
Total	13.70	7.145	1603

Summary

Chapter four opened with a summary of the descriptive statistics, followed by the results of hypothesis testing for this study. Results for RQ1 and RQ2 indicated statistically significant differences in the percentages of students who met their reading and mathematics growth targets between students who participated in the Technology Immersion program and those who did not. Results for RQ3 and RQ4 indicated there were not statistically significant differences in the observed reading and mathematics growth of students across the number of years the students were involved in the Technology Immersion program.

Chapter five includes an interpretation of the results from the study as well as recommendations for future research. Additionally, a study summary, including an overview of the problem, the purpose statement, research questions, review of the methodology and major findings are reviewed in chapter five. Conclusions from the study, implications for action, and recommendations for future research are also included along with the concluding remarks for the study.

Chapter Five

Interpretation and Recommendations

Technology access and instruction is beneficial for student success, providing opportunities for learners to achieve in a modern world. Technology tools and resources are embedded into daily lives, and will be a part of future educational and professional opportunities for current students. According to the U.S. Department of Education (2014), students use technology for self-expression, research, analysis, communication, and collaboration. Within technology learning environments, students experience more rigorous learning through problem solving, critical thinking, and inquiry-focused learning.

The purpose of this study was to determine if the Technology Immersion program for technology integration had an effect on the reading and mathematics achievement of students participating in the program. This chapter opens with the study summary, includes findings related to the literature study, and closes with conclusions of the study.

Study Summary

This study focused on the impact of the Technology Immersion program on the reading and mathematics achievement of students in elementary school, Kindergarten through fifth grade. Student growth on MAP assessments in reading and mathematics from fall to spring was analyzed from the initial three years of the Technology Immersion program. This section includes an overview of the problem, the purpose statement and research questions, review of the methodology, and major findings.

Overview of the problem. The problem addressed within this study was the lack of documented evidence of the effectiveness of comprehensive Technology Immersion programs. It is uncertain if Technology Immersion programs, which include numerous technology resources embedded within elementary classrooms, are making a difference, thus improving student achievement for elementary students. Evidence associated with patterns of targeted learning growth in the areas of reading and mathematics achievement has the potential to guide school leaders in making appropriate applications within future technology immersion programs, as well as guide District X with modifications to the current program.

Purpose statement and research questions. The purpose of this study was to determine the effect of implementation of the Technology Immersion program, a technology integration initiative implemented in elementary schools in District X. The impact of this instructional approach was evidence using MAP assessment data. Research questions one and two of this study were formulated to explore the extent to which there were differences in the percentages of students achieving individual growth targets within the Technology Immersion classrooms as compared to the percentage of students achieving individual growth targets in traditional classrooms. Research questions three and four explored the observed learning growth across the number of consecutive years students were participants (or not) in the Technology Immersion classrooms.

Review of the methodology. This study was non-experimental in design and included archival data for elementary students in grades K-5 enrolled in a large suburban school district in the Midwest. MAP assessment data from the initial three years of the

Technology Immersion program were analyzed. The data obtained included the percentages of students attaining projected growth target scores in reading and mathematics as participants in Technology Immersion classrooms and traditional classrooms. Additionally, observed growth data in reading and mathematics during the final year of the program were analyzed based upon the number of years of student participation in the Technology Immersion classrooms. Independent-samples *t* tests and ANOVAs were conducted to address the research questions.

Major findings. Results from this study indicated that for grades K-5 there were statistically significant differences between students who participated in the Technology Immersion classrooms and those who did not. The Technology Immersion classrooms had higher average percentages of students who met or exceeded their RIT target growth in both reading and mathematics than non-Technology Immersion classrooms. Such results for research questions one and two indicate that participation in Technology Immersion program classrooms does have a positive effect on students meeting their growth targets in reading and mathematics.

The examination of the number of years of Technology Immersion classroom experience among students who had 0, 1, 2, or 3 years of consecutive experience did not result in statistically significant differences in observed growth in either reading or mathematics. There were not statistically significant differences in the means or standard deviations for students with only one year of experience in a Technology Immersion classroom, or for students with 2 or 3 consecutive years of experience in the Technology Immersion classrooms. These results do not support the hypotheses that participation in a

Technology Immersion classroom for consecutive years has an impact on student learning growth for reading or mathematics.

Findings Related to the Literature

The goal of this study was to determine whether Technology Immersion classroom participation had a positive effect on student learning growth. Research related to technology integration in the elementary classroom was presented in chapter two. This section contains a summary of the results from the current study as they relate to the literature.

RQ1 and RQ2 required the investigation of the extent of difference in the percentage of students who met their target growth in reading and mathematics, respectively, as measured by the MAP assessment, between Technology Immersion classrooms and non-Technology Immersion classrooms. Results from RQ1 and RQ2 indicated a statistically significant difference between Technology Immersion classrooms and non-Technology Immersion classrooms. The outcomes reflect the study conducted by Kulik (1994) who disclosed that computer-based instruction increased student achievement test scores. This study’s findings are consistent with those of Anderson et al. (1995) who established that student achievement gains are more proficient when computers are used in learning experiences. Results from RQ1 and RQ2 are also aligned with the research conducted by November (2010) who determined that with meaningful integration, technology positively affects student learning and achievement. These findings are consistent with Darling-Hammond et al. (2014) in their review of over 70 research studies reporting that technology has a positive impact on learning with gains in student achievement and engagement. The results from this study mirror the findings of numerous studies by Becker (2000), Parr and Fung (2000), Kulik (2003), Roschelle et al. (2000), who report that when used effectively, technology does improve student learning.

In contrast to the perceived positive effects of technology presented within studies aforementioned research, the U.S. Department of Education (Office of Technology, 2014) summarizes the research of educational technology as inconclusive due to insignificant, yet positive results concerning the improvement of student learning, perhaps due to the lack of training for teachers who were in the position to implement technology. Christensen (2002) documented concerns with a lack of teacher preparation to implement the use of technology using effective instructional methods, thus not providing a quality learning environment for students when technology is present.

RQ3 and RQ4 were designed to investigate the extent of the difference in students' observed reading and mathematics growth during the final year of the three-year study, respectively, as measured by the MAP assessment, among those students who had 0, 1, 2, or 3 years of consecutive Technology Immersion classroom experience. Results indicated that there were not significant differences in observed growth for consecutive years of participation in Technology Immersion classrooms. Research with a focus on student participation in technology immersion programs for consecutive years is limited. Thus, few examples in the literature are directly aligned to this study. The findings from the current study are inconsistent with Light et al. (2002) who found that students who participated for two consecutive years in a technology classroom resulted in greater achievement in all academic areas. The findings of RQ3 and RQ4 support the study by Ross et al. (2010), who established that the effectiveness of technology is reliant on the teacher's goals for the students instead of time spent using technology. Both studies did not result in significant student learning growth with more time spent participating in the Technology Immersion classrooms. Warschauer (2006) identified other variables, not technology, as responsible for student achievement. The results for RQ3 and RQ4 also align with Baker et al. (1990), whose research on the availability of technology resources resulted in little to no gains on standardized assessments.

The results of this study reflect components of the literature and research available as presented in chapter two. Multiple variables can be associated with the research on technology integration in elementary classrooms. Among the studies of technology immersion in classrooms, some emphasize a specific technology tool, a specific software program use, the teacher's level of experience or training, or a multitude of other variables. Other studies do not consider student achievement, but instead review a qualitative component to the use of technology. The body of research related to technology in elementary classrooms is ever-changing, as is the technology being implemented. Noeth and Volkov (2004) noted the complexity involved with evaluation of technology in education. Hartley (2014) offers that commitment to continuous improvement and collaboration among teachers is the key to successful technology integration. The current study would reflect this concept given that the teachers in the Technology Immersion classrooms received specific professional development, which in turn may have had impact on student learning within the classroom data, as reflected in the results of RQ1 and RQ2.

Conclusions

Results from the study indicate the Technology Immersion program did have a positive effect on students meeting their growth targets, but consecutive years of involvement in the program did not have a significant impact on their observed growth in reading and mathematics. Further conclusions are expanded in the following discussion through implications for action and recommendations for future research. Concluding remarks summarize this study.

Implications for action. The findings from this study have potential implications for all elementary schools for further action. The classroom data from the current study indicate the Technology Immersion program had a positive effect on students meeting expected growth targets in reading and mathematics. However, the data for individual students participating for consecutive years in the Technology Immersion program did not yield statistically significant results in observed learning growth. Further data analysis beyond the initial three years of the Technology Immersion program would offer District X evidence to support ongoing efforts for technology integration expansion.

Given the impact of the Technology Immersion program, a valuable area for attention for District X would be that of professional learning for teachers implementing the program. Consistencies in program implementation and execution would bring continuity and fidelity to the Technology Immersion program. Regular, ongoing professional development for all teachers would improve practices and support the focus on student learning.

To fully implement the Technology Immersion with fidelity, District X could consider specific non-negotiable uses of the technology resources, specific to each grade level. Advancing the specificity of the curricular programming for the Technology Immersion program, including student assessment rubrics, would allow for deeper analysis of program implementation and effectiveness, thus impact on student learning.

Utilizing stakeholder surveys would provide District X with valuable feedback regarding the Technology Immersion program. This level of communication would provide school leaders with information to guide future decisions. The identification of the strengths and weaknesses of the Technology Immersion program would allow for adaptations and improvements to support the growth of the current plan. Connecting with other school systems or researchers in the area of Educational Technology would also provide District X with numerous means to evaluate the current program.

Recommendations for future research. The purpose of this study was to identify the extent of impact the Technology Immersion program had on students meeting their growth targets, and on their overall observed growth, in reading and mathematics as measured by the MAP assessments. While there are studies assessing the impact of technology immersion programs on student achievement, the implementation of technology in elementary classrooms involves a relatively new area of research in education. Technology is rapidly changing, thus research is continually producing new results. Although this study was helpful for investigating the impact the Technology Immersion program had on student growth, there are recommendations for future research.

In addition to the initial years in which District X was implementing the Technology Immersion program, this study could be replicated to determine to what extent participation in the technology classrooms became more or less effective in the future years of implementation. Future research could investigate the use of the different components of technology resources, such as the impact of laptops, iPads, or interactive whiteboards, as well as to determine the impact of specific educational software programs, such as productivity, presentation, or curriculum software.

District X may extend the current research to the other grade levels that are implementing the Technology Immersion program to determine the impact on the academic growth of middle school and high school students. Further, a closer inspection of the impact of the Technology Immersion program for each grade level in the elementary schools would assist educators in determining if a specific grade level benefits from greater use of technology resources. Results could be disaggregated for analysis of subgroups of students, such as ethnic or economic diversity, or males compared to females. A study similar to this would help District X identify the specific schools with the greatest amount of students meeting their growth targets and with the greatest amount of observed learning growth. This potentially would allow staff members in District X to better understand the practices of the most effective technology classrooms and then replicate them across the district. District X would benefit from research comparisons with other school systems that are implementing similar Technology Immersion programs. Reviewing outcomes that other schools are experiencing would provide important data for future planning and decision-making.

Components of this study could be replicated with various sources of data selected to determine the effects of technology immersion on student growth. Research could look at different assessments instead of the MAP assessment, such as curriculum-based measurements, state assessments, or classroom data. The data selected for analysis could be modified to use individual observed student growth, the individual student growth index, or the percentile rank information from MAP assessment results. For thorough long-term analysis, this study could be extended to further years of program implementation and include the student data for each year of participation in a Technology Immersion classroom. Given the research of Brinkerhoff (2006), who states that developing technology instructional skills is a three to five year process for teachers, continued research beyond the initial years of the program would be valuable for analysis to determine outcomes of the program.

Further mixed methods research could delve into the practices of the classroom teachers, from quality of specific instructional approaches to the quantity of time spent utilizing the technology resources. Research into the effects that technology has on subgroups within the population may also provide insight to the effects of technology programs. Qualitative research has further potential to provide feedback from groups of stakeholders to guide educational leaders with decisions regarding future technology integration opportunities, thus gaining the perspectives of students, parents, and other important groups impacting by the inclusion of technology resources in classrooms.

Concluding remarks. "Technology is not a silver bullet and cannot -by itself- produce the benefits we seek in learning, but without technology, schools have little chance of rising to 21st-century expectations" (U.S. Department of Education, 2014, p. 15). The partial positive significant results of the current study provide support for the continuation of the Technology Immersion program in District X. As schools are charged with establishing learning environments to prepare students for their future aspirations, technology is a vital presence in the elementary classroom. It is essential for District X and other school systems to ensure instructionally sound and pedagogically effective programs for executing technology immersion. The results of the current study identify potential gains in learning, thus endorsing investments in technology integration for elementary students. When educators implement research-based, best practices using technology, there is an unlimited capacity for student learning growth.

References

Achievement. (2014). *In Education.com's online Glossary of Education.* Retrieved from http://www.education.com/definition/achievement/

Apple, Inc. (2014). *iPad in education results.* Cupertino, CA: Apple, Inc.

Anderson, J. R., Corbett, A. T., Koedinger, K. R., & Pelletier, R. (1995). Cognitive tutors: Lessons learned. *Journal of Learning Science, 4*, 167-207.

Baker, E. L., Gearhart, M., & Herman, J. L. (1990). *Apple Computers of Tomorrow (ACOT) evaluation study: First- and second-year findings.* Cupertino, CA: Apple Computers Inc.

Baker, E. L., Gearhart, M., & Herman, J. L. (1994). Evaluating the apple classrooms of tomorrow. In E. L. Baker and H. F. O'Neil, Jr. (Eds.), *Technology assessment in education and training.* Hillsdale, NJ: Lawrence Erlbaum.

Banerjee, A. V., Cole, S., Duflo, E., & Linden, L. (2007). Remedying education: Evidence from two randomized experiments in India. *Quarterly Journal of Economics, 122*, 1235-1264.

Barley, Z., Lauer, P. A., Arens, S. A., Apthorp, H. S., Englert, K. S., Snow, D., & Akiba, M. (2002). *Helping at-risk students meet standards: A synthesis of evidence-based classroom practices.* Aurora, CO: Mid-continent Research for Education and Learning. Retrieved from http://teachersity.org/files/PDF/Classroom%20Strategies.pdf

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

Barseghian, T. (2011, January 26). *A day in the life of the iPad classroom.* Retrieved from http://mindshift.kqed.org/2011/01/a-day-in-the-life-of-the-ipad-classroom/

Bebell, D. (2005). *Technology promoting student excellence: An investigation of the first year of 1:1 computing in New Hampshire middle schools.* Retrieved from http://www.bc.edu/research/intasc/researchprojects/nhLaptop/nhtpse.shtml.

Becker, H. J. (1998). Running to catch a moving train: Schools and information technologies. *Theory into Practice, 37,* 20-30.

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer technology. *Children and Computer Technology*, *10*(2), 44-71.

Berliner, D. C. & Calfee, R. C. (Eds.). (1996). Looking at technology in context: A framework for understanding technology and education research. *Handbook of educational psychology* (pp. 807-829). Retrieved from http://mkoehler.educ.msu.edu/OtherPages/Courses/CEP_901B_SP03/Readings/Bransford.pdf

Bielefeldt, T. (2005). Computers and student learning: Interpreting the multivariate analysis of PISA 2000. *Journal of Research on Technology in Education, 37*(4), 339-347.

Blair, N. (2012). Technology Integration for the new 21st century learner. *Principal, 91*(3), 8-13. Retrieved from http://www.naesp.org/principal-januaryfebruary-2012

Boss, S. (2011, September 11). *Technology integration: A short history.* Retrieved from http://www.edutopia.org/technnology-integration-historyo

Boster, F. J., Meyer, G. S., Roberto, A. J., & Inge, C. C. (2002). *A report of the effect of united streaming application on educational performance*. Retrieved from http://static.discoveryeducation.com/feeds/www/media/pdf/DE_streaming_VA%20and%20LA%20Research%20Summary.pdf

Brabec, K., Fisher, K., & Pitler, H. (2004). Building better instruction: How technology supports nine research-proven instructional strategies. *Learning and leading with technology, 31*(5). Retrieved from http://files.eric.ed.gov/fulltext/EJ695741.pdf

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain, mind, experience, and schools* (Expanded edition). Washington, DC: National Academy Press.

Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of Research on Technology in Education, 39*(1), 22-43.

Bus, A. G., & Neuman, S. B. (Eds.). (2009). *Multimedia and literacy development: Improving achievement for young learners.* New York, NY: Routledge Taylor and Francis Group.

Byrom, E., & Bingham, M. (2001). Factors influencing the effective use of technology for teaching and learning: Lessons learned from the SEIR-TEC intensive site schools. Greensboro, NC: Southeastern Regional Educational Development Laboratory. Retrieved from ERIC database. (EC471140)

CEO Forum of Education and Technology. (2001). *Key building blocks for student achievement in the 21st century* [PowerPoint slides]. Retrieved from http://www.ceoforum.org/downloads/report4.pdf

Christensen, R. (2002). Effect of technology integration education on the attitudes of teachers and students. *Journal of Research on Technology in Education, 34*(4), 411-433.

Coley, R., Cradler, J., & Engel, P. (1999). *Computers and classrooms: The status of technology in U.S. schools.* Princeton, NJ: ETS Policy Information Center.

Collins, A., & Halverson, R. (2009). *Rethinking education in the age of technology: The digital revolution and schooling in America.* New York: Teachers College Press.

Common Core State Standards Initiative. (2012). *Students who are college and career ready in reading, writing, speaking, listening, & language.* Retrieved from http://www.corestandards.org/ELA-Literacy/introduction/students-who-are-college-and-career-ready-in-reading-writing-speaking-listening-language

Consecutive. (n.d.). In *Merriam-Webster's online dictionary*. Retrieved from http://www.merriam-webster.com/dictionary/consecutive

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, CA: SAGE Publications, Inc.

Cuban, L. (1986). Teachers and machines: The classroom use of technology since 1920. New York, NY: Teachers College Press.

Cuban, L. (2001). Oversold and underused: Computers in the classroom. Cambridge, MA: Harvard University Press.

Cuban, L. (2006). 1:1 laptops transforming classrooms: Yeah, sure. *Teachers College Record*, October 31.

Cuban, L., & Kirkpatrick, H. (1998). Computers make kids smarter - right? *Technos, 7*(2), 26-31.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834. doi: 10.3102/00028312038004813

Darling-Hammond, L., Zielezinski, M. & Goldman, S. (2014, September). *Using technology to support at-risk students' learning*. Retrieved from https://edpolicy.stanford.edu/sites/default/files/scope-pub-using-technology-report.pdf

District X. (2014). *District Information.* Copies in possession of the author.

District X. (2014). *Technology Immersion Overview*. Copies in possession of the author.

Dorris, S. (2014). *The effect of computer-assisted instruction on the reading achievement of elementary school students* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3629279)

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2006). *Learning by doing: A handbook for building professional learning communities*. Bloomington, IN: Solution Tree Press.

Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990). The evolution of teachers' instructional beliefs and practices in high-access-to-technology classrooms: First-fourth year findings. Cupertino, CA: Apple Computers Inc.

Educational Broadcasting Corporation (2004). *Computer-assisted instruction.* Retrieved from http://www.britannica.com/topic/computer-assisted-instruction

Encyclopedia Brittanica, Inc. (2016). *Glossary of Educational Terms.* Retrieved from http://pub.schoolwisepress.com/smart/dic

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4). Retrieved from http://highlandsgoldenrams.wikispaces.com/file/view/ertmer.pdf

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4). Retrieved from http://marianrosenberg.wiki.westga.edu/file/view/ErtmerPTeacherPedagogical.pdf

Fadel, C., & Lemke, C. (2006). *Technology in schools: What the research says.* Retrieved from http://www.cisco.com/web/strategy/docs/education/TechnologyinSchoolsReport.pdf

Ferending, K. A. (2003). *Questioning technology: Electronic technologies and educational reform*. New York: Peter Lang Publishing, Inc.

Fuchs, T. & Woessmann, L., (2004). *Computers and student learning: Bivariate and multivariate evidence on the availability and use of computers at home and at school.* Retrieved from http://www.cesifo-group.de/portal/pls/portal/docs/1/1188938.PDF

Fullan, M. (2001). *Leading in a culture of change.* San Francisco, CA: John Wiley & Sons, Inc.

Gahala, J. (2001). Critical issue: Promoting technology use in schools. *North Central Regional Educational Laboratory.* Retrieved from http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te200.htm

Glossary of Educational Terms. (n.d.). *Glossary of Educational Terms.* Retrieved from http://pub.schoolwisepress.com/smart/dic

Goldberg, A., Russell, M., & Cook, A. (2003). The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *Journal of Technology, Learning, and Assessment, 2*(1), 3-19. Retrieved from http://ejournals.bc.edu/ojs/index.php/jtla/article/view/1661/1503

Grant, M. M., Ross, S. M., Wang, W., & Potter, A. (2005). Computers on wheels: An alternative to 'each one has one'. *British Journal of Educational Technology 36*(6), 1017-1034.

Great Schools Partnership (2014). In *The Glossary of Education Reform*. Retrieved from http://edglossary.org/

Groff, J. (2013). *Technology-rich innovative learning environments*. Retrieved from http://www.oecd.org/edu/ceri/Technology-Rich%20Innovative%20Learning %20Environments%20by%20Jennifer%20Groff.pdf

Gulek, J. C., & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *Journal of Technology, Learning, and Assessment, 3*(2), Retrieved from http://ejournals.bc.edu/ojs/index.php/jtla/article/view/1655/1501

Harasim, L. (2012). *Learning Theory and Online Technologies.* New York, NY: Taylor & Francis Group.

Hart Research Associates. (2012). *Parents' and teachers' attitudes and opinions on technology in education.* [PowerPoint slides]. Retrieved from www.leadcommission.org/sites/default/files/LEAD%20Poll%20Deck.pdf

Hartley, A. J. (2014). *A mixed methods study exploring the perceived barriers to technology integration among elementary teachers in four elementary schools within a northern Genesee County school district.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3713813)

Heffernan, R. M. (2012). *Motivators of classroom technology use and types of technology being used in public elementary schools in an urban school district* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3505910)

Holcomb, L. G. (2009). Results and lessons learned from 1:1 laptop initiatives: A collective review. *TechTrends, 53*(6), 49-55.

ISTE. (2016). *ISTE Standards.* Retrieved from http://www.iste.org/standards

Jamison, D. Suppes, P. & Wells, S. (1974). The effectiveness of alternative instructional media: A survey. *Review of Educational Research, 44,* 1-67.

Jeroski, S. (2005, September). *Research Report: The wireless writing* program 2004-2005. Retrieved from http://www.prn.bc.ca/documents/WWP/wwp2005.pdf

Johnston, T. (2014, December 9). *Technology and student achievement: The right question to ask.* Retrieved from https://www.clarity-innovations.com/blog/tjohnston/technology-and-student-achievement-right-question-ask

Jonassen, K. R., Peck, K., & Wilson, B. (1999). Learning with technology: A constructivist perspective. *Special Education Technology, 16*(1), 46.

Kansas State Department of Education (2015). *Kansas College and Career Ready Standards.* Retrieved from http://community.ksde.org/Default.aspx?tabid=4754

Kansas State Department of Education (2015). Kansas K-12 reports [Data file]. Copies in possession of the author.

Kansas State Department of Education. (2015). Kansas building report card [Data file]. Retrieved from Copies in possession of the author.

Kao, L. L. (2009). *Adding it up: Is computer use associated with higher achievement in public elementary mathematics classrooms?* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3401750)

Kaumbulu, B. M. (2011). *Effective technology integration for digital literacy development in kindergarten through second grade* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3449931)

Keengwe, L. (2007). Faculty integration of technology into instruction and students' perception of computer technology to improve student learning. *Journal of Information Technology Education,* 6, 169-180.

Kemker, K., Barron, A. E., & Harmes, J. C. (2007). Laptop computers in the elementary classroom: Authentic instruction with at-risk students. *Educational Media International*, *44*(4), 323-339.

Knight, U. L. (2008). *The relationship between capacity, usage, and access of technology and student achievement* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3340443)

Kulik, J. A. (1994). Meta-analytic studies of findings on computer-based instruction. In E. L. Baker & H. F. O'Neil, Jr. (Eds.), *Technology Assessment in Education and Training* (pp. 9-34). Hillsdale, NJ: Lawrence Erlbaum.

Kulik, J. A. (2003). *Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say.* Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.207.3105&rep=rep1&type=pdf

Leu, D. J., Jr., Kinzer, C. K., Coiro, J., & Cammack, D. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R. B. Ruddell & N. Unrau (Eds.), *Theoretical models and processing of reading* (5th ed., pp. 1570-1613). Retrieved from https://www.researchgate.net/publication/265628542_Toward_a_Theory_of_New_Literacies_Emerging_From_the_Internet_and_Other_Information_and_Communication_Technologies

Leu, D., O'Byrne, W. I., Zawilinski, L., McVerry, J. G., & Everett-Cacopardo, H. (2009). Comments on Greenhow, Robella, and Hughes: Expanding the new literacies conversation. *Educational Researcher, 38*, 264-269. doi: 10.3102/0013189X09336676

Light, D., McDermott, M. & Honey, M. (2002). *The impact of ubiquitous portable technology on an urban school project hiller* (Report No. 9815026). New York, NY: Education Development Center, Inc.

Lowther, D. L., Inan, F. A., Strahl, D. J. & Ross, S. M. (April, 2009). *Do one-to-one initiatives bridge the way to 21st century knowledge and skills?* Paper presented at the 2009 America Educational Association Educational Research Association National Conference, San Diego, CA.

Lowther, D. L., Ross, S. M., & Morrison, G. M. (2003). When each one has one: The influences on teaching strategies and student achievement of using laptops in classrooms. *Educational Technology Research & Development, 51*(3), 23-44.

Lunenburg, F. C., & Irby, B. J. (2008). *Writing a successful thesis or dissertation: Tips and strategies for students in social and behavioral sciences.* Thousand Oaks, CA: Corwin Press.

Mann, D., Shakesshaft, C., Becker, J., & Kottkamp, R. (1999). *The West Virginia story: Achievement gains from a statewide technology initiative.* Santa Monica, CA: Milken Family Foundation.

Marsh, J. (2005). *Digital beginnings: Young children's use of popular culture, media and new technologies.* Retrieved from University of Sheffield, Literacy Research Centre, http://www.digitalbeginnings.shef.ac.uk/DigitalBeginningsReport.pdf

Moeller, B. & Reitzes, T. (2011, July). *Integrating technology with student-centered learning*. Retrieved from http://www.nmefoundation.org/getmedia/befa9751-d8ad-47e9-949d-bd649f7c0044/Integrating-Technology-with-Student-Centered-Learning?ext=.pdf

Mouza, C. (2008). Learning with laptops: Implementation and outcomes in an urban, under-privileged school. *Journal of Research on Technology in Education, 40*(4), 447-472.

Means, B. (2010). Technology and education change: Focus on student learning. *Journal of Research on Technology in Education, 42*(3), 285-307.

Myers, K. (1996). *School improvement in practice: Schools make a difference project.* Retrieved from ERIC database. (ED394170)

National Assessment Governing Board (2014). *Technology and engineering literacy framework for the 2014 national assessment of educational progress*. Retrieved from https://www.nagb.org/content/nagb/assets/documents/publications/ frameworks/technology/2014-technology-framework-abridged.pdf

National Center for Education Evaluation and Regional Assistance. (2007). *Effectiveness of reading and mathematics software products: Findings from the first student cohort.* Retrieved from http://ies.ed.gov/ncee/pdf/20074005.pdf

Noeth, R. & Volkov, B. (2004). *Evaluating the effectiveness of technology in our schools.* Retrieved from https://www.act.org/research/policymakers/school_tech.pdf

North Central Regional Education Laboratory. (2005). *Critical issue: Using technology to improve student achievement.* Retrieved from http://www.ncrel.org/sdrs/areas/ issues/methods/technology/te800.htm#researchresult

Northwest Evaluation Association (2004). *Reliability and validity estimates: NWEA achievement level tests and measures of academic progress.* Retrieved from http://images.pcmac.org/Uploads/Jacksonville117/Jacksonville117/Sites/Docume ntsCategories/Documents/Reliability_and_Validity_Estimates.pdf

Northwest Evaluation Association. (2012). *Get to know NWEA*. Retrieved from http://www.nwea.org/

November, A. (1998). *Critical Issue: Developing a school or district technology plan.* Retrieved from http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te300.htm

November, A. (2010). *Empowering students with technology.* Thousand Oaks, CA: Corwin.

One-to-One Institute. (2010). *Project RED: Revolutionizing Education.* Retrieved from http://one-to-oneinstitute.org/research-overview

Papert, S. (1980). *Paper for the president's commission for a national agenda for the 80s.* Retrieved from http://www/papert.org/articles/president_paper.html

Papert, S. (1996, October 27). Computers in the classroom: Agents of change. *The Washington Post Education Review.* Retrieved from www.papert.org/articles/ComputersInClassroom.html

Parr, J. M. & Fung, I. Y. (2000). *A review of the literature on computer-assisted learning, particularly integrated learning systems, and outcomes with respect to literacy and numeracy.* New Zealand: University of Auckland. Ministry of Education.

Partnership for 21st Century Skills. (2007a). *The intellectual and policy foundations of the 21st century skills framework.* Retrieved from http://www.p21.org/storage/documents/docs/Intellectual_and_Policy_Foundations.pdf

Partnership for 21st Century Skills. (2007b). *Maximizing the impact: The pivotal role of technology in a 21st century education system.* Retrieved from http://www.p21.org/storage/documents/p21setdaistepaper.pdf

Penuel, W. (2006). Implementation and effects of on-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Pitler, H., Hubbell, E. R., Kuhn, M., & Malenoski, K. (2007). *Using technology with classroom instruction that works.* Alexandria, VA: Association for Supervision and Curriculum Development.

Prensky, M. (2006). *Don't bother me, Mom, I'm learning: How computer and video games are preparing your kids for 21st century success and how you can help!* St. Paul, MN: Paragon House.

Reiser, R. A. (2001). A history of instructional design and technology, Part II: A history of instructional media. *Educational Technology Research & Development, 49*, 57-67.

Revington, S. (2015). *Authentic learning.* Retrieved from http://authenticlearning.weebly.com

Richey, R. C. (2008). Reflections on the 2008 AECT definitions of the field. *Tech Trends*, *52*(1), 24-25.

Ringstaff, C. & Kelley, L. (2002). *The learning return on our educational technology investment: A review of the findings from research.* Retrieved from http://www.wested.org/online_pubs/learning_return.pdf

Roberts, C. (2011, May 16). ISTE NETS – International technology standards. *Digital Learning World.* Retrieved from http://digitallearningworld.com/iste-nets-international-technology-standards

Roberts, C. M. (2004). *The dissertation journey.* Thousand Oaks, CA: Corwin Press.

Rockman, S., Chessler, M., & Walker, L. (1998). *Powerful tools for schooling: Second year study of the laptop program.* Retrieved from http://www.rockman.com/projects/126.micro.aal/yr2_report.pdf

Roschelle, J., Pea, R., Hoadley, C., Gordin, D. & Means, B. (2000). Changing how and what children learn in school with computer-based technologies. *The Future of Children, Children and Computer Technology, 10*(2), 76-101.

Ross, S. M., Morrison, G. R., & Lowther, D. L. (2010). Educational technology research past and present: Balancing rigor and relevance to impact school learning. *Contemporary Educational Technology, 1*(1), 17-35.

Russell, M., Bebell, D., & Higgins, J. (2004). Laptop learning: A comparison of teaching and learning in upper elementary equipped with shared carts of laptops and permanent 1:1 laptops. *Journals of Educational Computing Research. 30*(3), 313-330.

Saxena, S. (2013, December 30). How technology can support authentic learning [Web log post]. Retrieved from http://edtechreview.in/news/865-how-technology-can-support-authentic-learning

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge-building communities. *The Journal of the Learning Sciences, 3*(3), 265-283.

Schacter, J., & Fagnano, C. (1999). Does computer technology improve student learning and achievement? How, when, and under what conditions? *Journal of Educational Computing Research, 20*(4), 329-343.

Seeley, C. (2014). *Smarter than we think: More messages about math, teaching and learning in the 21st century.* Sausalito, CA: Math Solutions.

Shattuck, G. (n.d.). *The historical development of instructional technology integration in K-12 education.* Retrieved from http://www.nowhereroad.com/technology_integration/readings/shattuck.pdf

Shields, M. K. & Behrman, R. E. (2000). Children and computer technology: Analysis and recommendations. *Children and computer technology, 10*(2), 4-30. Retrieved from https://www.princeton.edu/futureofchildren/publications/journals/article/index.xml?journalid=45&articleid=200&sectionid=1304

Sivin-Kachala, J. (1998). *Report on the effectiveness of technology in schools, 1990-1997.* Washington, DC: Software Publishers Association.

Sivin-Kachala, J. & Bialo, E. R. (1999). *1999 research report on the effectiveness of technology in schools* (6th ed.). Washington, D.C.: Software Information Industry Association.

Suhr, K. A., Hernandez, D. A., Grimes, D., & Warschauer, M. (2010). Laptops and fourth grade literacy: Assisting the jump over the fourth grade slump. *Journal of Technology, Learning, and Assessment, 9*(5), 1-45. Retrieved from http://ejournals.bc.edu/ojs/index.php/jtla/article/view/1610/1459

Sun Associates. (2013, July 27). *Best practices in technology integration: What the research says.* Retrieved from http://www.sun-associates.com/tlresources.html

Talley, G. K. (2012). *Testing the digital divide: Does access to high-quality use of technology in schools affect student achievement?* Retrieved from http://drum.lib.umd.edu/handle/1903/12561

Toy, C. (2014). *Leadership and effectively integrating educational technology: Ten lessons for principals and other educational leaders*. Retrieved from http://www.nassp.org/Content.aspx?topic=58730

Trotter, A. (1998, October 1). A question of effectiveness. *Education Week, Technology Counts, 18*(5), 6-9.

Trucano, M. (2005). *Knowledge map: Impact of ICTs on learning and achievement.* Retrieved from https://www.infodev.org/infodev-files/resource/InfodevDocuments_8.pdf

U.S. Department of Education. (1983). *A nation at risk: An imperative for educational reform.* Retrieved from http://www2.ed.gov/pubs/NatAtRisk/index.html

U.S. Department of Education. (1996). *Technology literacy challenge fund.* Retrieved from http://clinton4.nara.gov/WH/New/edtech/2pager.html

U.S. Department of Education. (2005). *EdNational education technology plan*. Retrieved from http://www.ed.gov/about/offices/list/os/technology/plan/2004/site/edlite-default.html

U.S. Department of Education. (2014). *Learning technology effectiveness.* Retrieved from https://tech.ed.gov/wp-content/uploads/2014/11/Learning-Technology-Effectiveness-Brief.pdf

Vega, V. (2013). *Technology integration research review: Additional tools and programs.* Retrieved from http://www.edutopia.org/technology-integration-research-tools-programs

Wagner, T. (2012, February 11). "Creating Innovators" - as seen through the eyes of a 14-year old Thai student… Tony Wagner. Retrieved from http://www.tonywagner.com/917

Warschauer, M. (2006). *Laptops and literacy: Learning in the wireless classroom.* New York: Teachers College Press.

Wells, D. (2012). What if all the computers were broken? *Principal*, *91*(3), 12-13. Retrieved from http://www.naesp.org/sites/default/files/Wells_JF12.pdf

Wenglinsky, H. (1998). *Does it compute? The relationship between educational technology and student achievement in mathematics*. Retrieved from https://www.ets.org/Media/Research/pdf/PICTECHNOLOG.pdf

Wenglinsky, H. (2005). *Using technology wisely: The keys to success in schools.* New York, NY: Teachers College Press

Appendices

Appendix A: Letter to District X Regarding the Study

Request to Conduct Research in the [redacted] School District
Principle Investigator:

Desiree Rios
15406 Reeds Street, Overland Park, Kansas 66223
816-863-5835 (personal)
913-239-7215 (office)
drios@[redacted]k12.org

Major Advisor:
Dr. Russ Kokoruda
Baker University
913-491-4432
Russ.Kokoruda@bakeru.edu

District Staff Consulted:

[redacted], Director of Assessment and Research, has been contacted regarding this study. We have discussed the proposed research and the possible data collection options. To maintain confidentiality and anonymity of students and teachers, [redacted] will be a contact for data collection, utilizing her specialization in the areas of elementary assessment and data analysis. Data would be extracted from the NWEA database for students in all schools, including those participating in the Technology Immersion Program.

Description of the Research Study:

The proposed research involves an analysis of the Technology Immersion program for technology integration by reviewing the impact on participating students related to their growth in reading and mathematics achievement as measured by the results of the MAP assessments. Specifically, the research involves looking at student data for students who are in a Technology Immersion classroom as compared to those who are not in a Technology Immersion classroom. The data to be reviewed will be the percentage of students who achieve the growth target between their fall and spring MAP assessments during each year of participation in a Technology Immersion classroom. Student data will be organized by grade levels, including Kindergarten through grade five. Data from the initial three years of the Technology Immersion program will be utilized within the research. For 2012-2013, five elementary schools participated in the program, so the data from those five schools will be reviewed. For 2013-2014, data from the eight participating schools will be reviewed. Then, in 2014-2015, twelve schools will be included in the data analysis.

Data Collection Process:

Data will be collected using the NWEA reports following the spring assessments. [redacted] is willing to provide selected data with all school, teacher and student identifiers removed. Reports used for the data analysis will be the Projected Performance and Growth Distribution report, the Achievement Growth Status Report and the Class Breakdown Reports. Overall percentages of growth achieved in both reading and mathematics will be reviewed for each grade level, Kindergarten through grade five, for each year included in the study. The percentages for Technology Immersion classes will be compared the overall percentages of growth achieved for classes not participating in Technology Immersion. An additional component of the study will be to review the growth for students who complete additional, consecutive years within classes in the Technology Immersion program. The percentage of students who achieve their growth targets after one, two, and/or three years in Technology Immersion classrooms will be reviewed.

Involvement of subjects of the study:

The subjects of the study will not be involved in the treatment as the data collected will occur through electronic access to the MAP assessment results. District personnel will provide the data and information in a manner which does not identify the school, teachers, or students. Data will be collected following the 2014-2015 spring MAP test administration. Reports will be accessed electronically when they are available for review. Following the data collection, results will be compiled and analyzed throughout the remainder of 2015. Completion of the study is intended to be December of 2015.

University Approval:

IRB approval has not yet been received. I understand that any approval to complete this research will be contingent upon receipt of the IRB approval. If such approval is granted, please identify any requirements of the [redacted] school district related to the use of the name of the school district, the name of the program and/or any individuals that supported this research project.

I am available for additional questions at your convenience and may be contacted at the phone/email listed above. Thank you for your consideration to this request to conduct research using data from the [redacted] school district.

Sincerely,

Desiree Rios

Appendix B: District X Authorization for Research Study

From: [redacted]
To: Rios, Desiree C.
Subject: RE: Data permission
Date: Monday, June 15, 2015 7:37:09 AM

Desiree,

I am sorry I didn't send this last week.

You have been granted permission to use the MAP data from [redacted] provided no students are identifiable in your analysis. In addition, please refer to the district in a manner that does not name it directly identify it as [redacted]. We would love to see a copy of your final results.

Please let me know if you need me to pull data for you or if you have worked with [redacted] on that portion.

Take care,

[redacted]
Director of Assessment and Research
[redacted] School District
[redacted]

Appendix C: Proposal for Research to Baker University

Date:

SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

IRB PROTOCOL NUMBER _______________
(IRB USE ONLY)

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

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

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

Name	Signature	
1. Dr. Russ Kokoruda	_____________________,	Major Advisor
2. Dr. Katie Hole	_____________________,	Research Analyst
3. Dr. Susan Rogers	______________________,	University Committee Member
4. Dr. Tonya Merrigan	______________________,	External Committee Member

Principal Investigator:	Desiree Rios
Phone:	816-863-5835
Email:	drios@bluevalleyk12.org
Mailing address:	15406 Reeds Street Overland Park, KS 66223

Faculty sponsor:	Dr. Russ Kokoruda
Phone:	913-491-4432
Email:	Russ.Kokoruda@bakeru.edu

Expected Category of Review: ___Exempt ___ Expedited _ __Full

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

The Effects of Elementary Student Participation in Technology Immersion Classrooms on Meeting Growth Targets

Summary

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

The proposed research involves an analysis of a district's Technology Immersion program for technology integration and its impact on participating students related to their growth in reading and mathematics achievement as measured by the results of the MAP assessments.

The purpose of this quantitative study is to investigate the relationship between access to technology and student achievement as measured by the MAP assessments. The hypothesis is that student achievement in reading and mathematics increases with the integration of technology resources.

Four research questions guided the research design. First, questions established the extent to which students in Technology Immersion classrooms reached their growth targets on the MAP assessments, in reading and mathematics achievement. Second, questions compared the percentage of targeted learning growth in reading and mathematics for students who participated in the Technology Immersion classrooms consecutively for the full three years of the study as compared to students who did not participate in the Technology Immersion classrooms.

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

There will be no manipulation or condition included in this study.

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

Student assessment data will be utilized in this study from the biannual administration of the Measures of Academic Performance (MAP) assessments. Data will be anonymously accessed from archival data records.

Subjects will encounter no psychological, social, physical, or legal risk.

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

Subjects will not be subjected to any stress in the study.

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

Subjects will not be deceived or misled in any way.

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

There will be no request for information that subjects might consider to be personal or sensitive. Student test scores will be disaggregated to only groupings that will not identify individual information.

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

Subjects will not be presented with materials which might be considered to be offensive, threatening, or degrading. There will be no interactions with the subjects.

Approximately how much time will be demanded of each subject?

No additional time will be demanded of the subjects for this study.

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

The subjects of this study are elementary students (grades K-5) in attendance in the school district during the three year time period of this study. The three years include the 12-13, 13-14, and 14-15 academic school years. Data will be collected anonymously from district personnel with no individual identification. Data will be disaggregated by grade level only.

The subjects will not be solicited or contacted due to the anonymity of the data collection within the study. Data used will not be based on individual students. Thus, no individual student would be identifiable within the research.

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

N/A

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

N/A

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

No aspect of the data used in this study will identify individual students, thus no permanent record will be created.

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

N/A

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

The data for this study will be collected from a representative within the school district, referred to as District X, from the MAP assessment reports website. This data is stored on the secure servers of the test company, with accessibility only to district personnel. No personally identifiable information, i.e., student names, will be requested in order to maintain anonymity of subjects. Selected data secured for this study will be stored by the researcher on a secure server for five years following completion of the study. The data will be deleted after five years.

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

There will be no risks involved in this study that would offset benefits that may accrue from the findings of the research and potential contributions to the profession.

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

The results of MAP assessments for all elementary students (not identifiable to the researcher) in the district will be used in this study. Data will be accessed from MAP assessment archives for this research study. The data will be accessed by and provided to the researcher in an anonymous form from a representative of the school district. The data will be sorted and analyzed to determine the results of the research questions.

Appendix D: IRB Letter of Approval

Baker University Institutional Review Board

February 4, 2016

Dear Desiree Rios and Dr. Kokoruda,

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

Please be aware of the following:

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

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at CTodden@BakerU.edu or 785.594.8440.

Sincerely,
Chris Todden EdD
Chair, Baker University IRB

Baker University IRB Committee
Verneda Edwards EdD
Sara Crump PhD
Erin Morris PhD
Scott Crenshaw