# THE EFFECTIVENESS OF ONE-TO-ONE TECHNOLOGY INTEGRATION PROGRAMS IN K-12 EDUCATION AND ITS IMPACT ON STUDENT READING ACHIEVEMENT

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by:

BRANDON CLARK

Dr. Cynthia MacGregor, Dissertation Supervisor

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

THE EFFECTIVENESS OF ONE-TO-ONE TECHNOLOGY INTEGRATION PROGRAMS IN K-12 EDUCATION AND ITS IMPACT ON STUDENT READING ACHIEVEMENT

presented by Brandon Clark,

a candidate for the degree of doctor of education,

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

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Dr. Cynthia MacGregor

_____

Dr. Kim Finch

_____

Dr. Denise Baumann

_____

Dr. William Agnew

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The Effectiveness of One-to-One Technology Integration Programs in K-12 Education and its Impact on the Student Reading Achievement

Brandon T. Clark

Dr. Cynthia MacGregor, Dissertation Supervisor

ABSTRACT

As school districts implement technology in the classrooms to increase student engagement, improve student test scores, and combat the ever-increasing need for distance learning, it is imperative to identify practices that justify the cost (Chanlin, 2007; Keengwe Schnellert, & Mills, 2012; Lei & Zhao, 2008). The minimal amount of existing research on this topic has produced no significant correlations between student achievement and technology use in the classroom (Claro, Nussbaum, López, & Díaz, 2013). This mixed methods case study identified one school district, who had implemented a one-to-one technology program, targeting the Missouri Assessment Program (MAP) English Language Arts (ELA) assessment scores for students in grades three through six. A Pearson's chi-square test for homogeneity was conducted for all 2016 (pre-implementation) and 2018 (post-implementation) MAP ELA test scores. Additionally, the same chi-square test for homogeneity was conducted for the student subgroups of free and reduced lunch, special education (IEP status), and ethnic minority students. Qualitative data were collected of teacher's perceptions using Ruben Puentedura's (2012) technology integration model with the six components of reading

instruction. Of the 20 chi-square tests, 16 indicated a significant difference in distribution between the 2016 and 2018 sets of data. However, the data indicated a negative relationship between the use of one-to-one technology and student reading achievement. The teacher survey revealed that a majority of teachers were inconsistently integrating technology into the reading curriculum and also indicated that lack of teacher buy-in and untargeted professional development as the causes for lack of implementation.

*Keywords*: bring your own device technology (BYOD), critical social theory. cultural hegemony, equity gaps, one-to-one (1:1), SAMR, student achievement, technology integration

# SECTION ONE:

# INTRODUCTION TO DISSERTATION

# The Effectiveness of One-to-One Technology Integration Programs in K-12 Education and its Impact on the Student Reading Achievement

As technology has become more pervasive within society, schools are beginning to look at the relevance and impact of technology on student achievement. With the addition of smart phones and tablets, students have a tremendous amount of power and potential for learning at their fingertips. Li and Pow (2011) stated, "Ubiquitous knowledge construction empowers students to function effectively in the twenty-first century, an era marked increasingly with change, information explosion and evolving technologies" (p. 320). Schools over the past decade have committed a significant amount of resources to provide students with computers and Internet access (Keengwe, Schnellert, & Mills, 2012; Lei & Zhao, 2008). As schools see the initial impact of technology on student engagement and achievement, plans to implement one-to-one technology into the classroom have become increasingly important to stakeholders, like school boards, parents, teachers, and administrators.

The implementation of one-to-one technology in K-12 schools had a positive impact on student achievement, but only when certain conditions were satisfied (Claro, Nussbaum, López, & Díaz, 2013). As Claro, Nussbaum, López, and Díaz (2013) discussed, many attempts to implement technology in the classroom have failed because "teachers cannot be left alone during the process of adoption and implementation of a new technological resource" (p. 325). Collaboration between administration, teachers, students, and parents were essential for teachers to be successful in satisfying the pedagogical processes and objectives of integrating technology into the classroom. Unfortunately, many school districts rushed plans to implement technology in the

classroom to keep up with the increasing demands from parents and employers to create highly skilled students who are prepared for a growing and complex technological society (Chanlin, 2007). Therefore, the impact and benefit of technology integration were severely restricted and limited without the proper structures to build administrator and teacher capacity for technology, infrastructures to support the technology, and avenues to build stakeholder buy-in, especially as it related to the initial and continued cost of implementing one-to-one technology in the classrooms.

Unfortunately, many school districts do not have the tax base or support to implement a very costly one-to-one integration plan for classrooms and have looked for alternate ways to integrate technology into the school's curriculum. Many early attempts at this process to integrate technology started with schools creating computer labs or mobile computer carts, while others school districts allowed students to bring their own technology to the classroom or *Bring Your Own Device* (BYOD). The main issue with computer labs and mobile carts was the lack of immersion or one-to-one use that was needed to build 21st century students (Li & Pow, 2011). Burns and Polman (2006) and Tan, Lin, Chu, and Liu (2012) asserted that one-to-one technology use provided students with unrestricted access to knowledge, allowing students to immediately expand learning opportunities beyond what non-technological teaching strategies or intermediate classroom uses of technology could ever provide. Even though one-to-one and BYOD programs provide a ubiquitous approach to technology integration in the classroom, it potentially created an inequity among various student subgroups who do not have adequate technology in their homes (Bruder, 2014). Sangani (2013) claimed that even though student access to personal technological devices had increased and will continue

to increase over the next several years, there would always be a subset of a school's population who will not be able to afford adequate technology for personal or school use. There will always be a subset of students within a school who will not have the opportunity for immersion of technology through personal use, and therefore, these students will come into classrooms lacking basic technological skills and knowledge (Sangani, 2013).

## Statement of the Problem

While there was evidence to show that integrating technology into classrooms has had a positive impact on student performance and attitudes about learning (Claro et al., 2013; Inserra & Short, 2012; Keengwe, Schnellert, & Mills, 2012; Lei, & Zhao, 2008; Li & Pow, 2011; Tan et al., 2012), few studies have analyzed the impact on student discipline and classroom management issues brought about because of one-to-one and BYOD programs. A major gap in this research topic was the lack of research studies comparing and analyzing the impact of such technology integration programs on the student subgroups of special education (IEP status), minority, and low socioeconomic status. Especially in the case of one-to-one and BYOD programs, some students were significantly disadvantaged due to classroom management issues and student discipline that arose due to the implementation of such programs.

As school districts move forward to give their students an academic edge through technology integration, the cost of one-to-one technology and the potential inequities of BYOD programs are at the forefront of education decision makers. Lei and Zhao (2008) reported in the early 2000s, states like Maine and Michigan spent in the upwards of 30 to 40 million dollars to increase technology use in classrooms. In 2006-07, the state of

Pennsylvania spent 200 million dollars to provide a laptop for all high school students. Not all school districts can afford this type of investment in one-to-one technology, which makes BYOD programs more viable, since the burden of providing student technology falls to the families. Even with the potential for BYOD programs to provide ubiquitous use of technology in the classroom, BYOD programs have the potential to widen the already significant equity gap that exists for underprivileged students in K-12 education (Watters, 2012).

In either ubiquitous technology program choice, the concern for how these types of programs affect underprivileged students must be a point of discussion for any school district looking at providing technology in the classroom. Some major concerns that must be addressed are the preparation and training provided to teachers, such as how to effectively integrate technology into instruction, technology problem solving, and how to successfully implement technology with underprivileged student groups. Few research studies have provided adequate evidence regarding the impact that ubiquitous programs, such as one-to-one technology programs, have on student achievement of underprivileged student groups, and this research study looked to provide evidence of impact that one-to-one technology programs have on elementary reading assessment scores for underprivileged students.

## Purpose of the Study

The purpose of this study was to provide research to scholars and practitioners that would contribute to the topic of technology integration in K-12 education. The scholarly purpose of this research study was to fill a knowledge gap that existed regarding the impact of technology integration strategies on at-risk student achievement.

More specifically, this study attempted to observe the student reading achievement impact on underprivileged students in a one-to-one school district. The knowledge gained from this study would add to the growing base of research in the topic for K-12 technology and education and also add a much-needed critical theory lens and perspective to guide future research on the impact of educational reform, policy, and decisions for underrepresented populations.

For the practitioner, this study aimed to provide pertinent information to guide school districts in making technology integration decisions. To justify the cost of one-to-one technology integration programs, school personnel must demonstrate to tax payers the high cost for investment will not only increase student achievement, but also shrink the inequities that exist in the achievement gap for underprivileged students. Similarly, solid research needs to reveal the impact that BYOD programs have on the equity gaps for underprivileged students and not use the need for ubiquitous technology use in the classroom and lack of school district resources to unintentionally widen an already large chasm that exists for underprivileged students. For the purposes of this study, the researcher sought to examine the impact of a one-to-one technology program on student reading achievement for underprivileged students.

## Research Questions

The research questions guiding this study are as follows:

1. What is the impact of a one-to-one technology integration program on student reading achievement?

2. What is the impact of a one-to-one technology integration program on the student reading achievement of student sub-groups, as defined by free and reduced lunch, Special Education (IEP status), and ethnic minority students?
3. What is the primary factor, as perceived by teachers, for determining the effectiveness of a one-to-one technology program on student reading achievement?

## Theoretical Framework

The theoretical framework for this research study was critical theory. Critical theory is the process of learning how to identify "how unjust dominant ideologies are embedded in the everyday situations and practices" (Merriam & Bierema, 2014, p. 215). Furthermore, Vaandering (2010) asserted that critical theory was more than just recognition of hidden oppression in a dominant, cultural hegemony, but also a call to action that sought to prevent further injustice to oppressed groups. Freire (2000) agreed with this notion and stated, "A mere perception of reality not followed by this critical intervention will not lead to a transformation of objective reality" (p. 51). The end goal of this theory was to motivate social change through reflective practices that improved the status of oppressed groups, and in the case of this study, educationally oppressed student groups (Freire, 2000).

Critical theory was grounded in the works of Max Horkheimer, who was a member of the Frankfurt School of Social Research and was displeased with capitalist society and its oppressive structures (Tar, 1975). Horkheimer developed three tenets of critical theory in his 1936 essays, and Brookfield (2014) summarized those foundational elements and stated that:

> Western democracies are highly unequal societies in which economic inequity, racism, and class discrimination are critical realties; that the way this state of affairs is reproduced as seeming to be normal, natural, and inevitable…is through the dissemination of dominant ideology; and that critical theory attempts to understand this state of affairs as a prelude to changing it. (p. 418)

Educational systems are another form of a cultural hegemony, which further work to oppress students through educational structures, similar to the assembly line construction of the 19th century industrial revolution (hooks, 1994).

Freire (2000) asserted that educational structures are one-way streets where teachers are the sole source of knowledge, center of the learning process, and responsible for the selection of curriculum and pedagogy. This school of thought was summarized as the teacher acts and the students respond, which only further marginalized oppressed student groups. Education, as a whole, is a process in which educators are teaching students to adopt the dominant ideology (Freire, 2000).

Scholars, like bell hooks (1994), made a call for action by asking educators to change teaching practices by creating dialogue that promoted reflective thinking. Many of the oppressive structures, such as language and dominant class beliefs, work to ostracize oppressed groups – many of them unknowingly. One of those common, dominant beliefs was that educators and students are equal and the structures of race, class, and gender are often ignored in the creation and implementation of curriculum. Critical theory looked to challenge those beliefs and create progressive classroom structures that deemphasized dominant ideological beliefs (hooks, 2003).

The basic underpinning of technology integration was to prepare students for today's society using relevant 21st learning skills. One-to-one technology programs are one attempt to decrease the inequities that exist with low socioeconomic students and other underrepresented student groups by providing each student with technology for learning. This attempt at equalization would be supported by critical theorists, as it would acknowledge and potentially address the inequities created through economic class structures by providing technology for all, but pedagogical and curriculum issues of the dominant class would still need to be addressed (hooks, 2003). Nevertheless, BYOD programs would only further strain the inequities of the underprivileged students. These sincere attempts to create one-to-one, technological environments, entrenched in a desire to increase student achievement, may save taxpayer dollars, but only further ignore the realities created by dominant ideologies.

The overarching questions guiding the formation of this study, through a critical lens, was whether or not a one-to-one technology integration program increased the inequities of underprivileged students or leveled the playing field. The critical theory lens was used as the foundation for this study by studying the impact of one-to-one technology integration programs and the impact on underprivileged or oppressed student groups. Education should be a process by which students are liberated and transformed (Freire, 2000); however, attempts to use technology integration programs to liberate and decrease inequities in student groups may be stifled by how teachers are trained and programs are fully implemented.

## Design of the Study

For this research study, a mixed methods methodology was used, since it embodied the strengths of both quantitative and qualitative research. This tactic would help the researcher gain greater insight into the complex issues surrounding technology implementation plans and equity gaps for students, which is a common approach for complicated social issues (Creswell, 2009). The design of this study was a time-bounded, case study of one public school district, which had implemented a one-to-one technology program for at least three years (Creswell, 2009; Merriam, 2009).

### Setting

The setting for this research study was a large, Midwestern public school with at least 50 students in each underrepresented student group, including special education (IEP status), minorities, and low socioeconomic status, as defined by free/reduced lunch status. Exact percentages of these minority student groups for the study had not been determined prior to selecting the school district and may be a limitation of the study, due to the availability of schools implementing these particular technology programs.

For this study, a school district with larger student populations was preferred for the quantitative portion of the study, in order to provide a large enough sample for the Pearson's chi-square test for homogeneity; however, for the qualitative portions of the study, large populations of student groups will not be as necessary, as data can be mined from teacher surveys. Additionally, the researcher searched for a school, who started a technology integration program within the last eight years and had a perception of successful implementation. The perception of success in these technology programs would provide an avenue to explore whether or not the same level of success was

achieved within the underrepresented student groups, seen by increased academic performance.

**Participants and Sample**

The number of participants for this study were based on the available historical student data, as it related to the Missouri Assessment Program (MAP) English Language Arts (ELA) state assessments. Also, the number of teachers surveyed were approximately 60 for all elementary school teachers in grades three through six. For the quantitative portion of the study, all available student participants in grades three through six were utilized through historical state assessment data. Additionally, students in each grade were disaggregated into the demographic categories of special education (IEP status), ethnicity, and free and reduced lunch. These student categories were significant, as many schools define success by whether or not these student subgroups demonstrate a high enough level of proficiency on the state's common assessment. Convenience sampling was the primary method employed to select participants from the teacher group, as all teachers currently teaching grades three through six were utilized for the questionnaire. If convenience sampling was not easily obtained, then simple random sampling would be utilized to ensure that every teacher participant had an equal chance of contributing to the study (Fink, 2013).

For the purposes of this study, the teacher participants were contacted by email to complete an online questionnaire. For necessary circumstances, paper and pencil copies of the survey were distributed as needed. For the qualitative and quantitative portions of the teacher questionnaire, the researcher provided all necessary disclosures and requests for permission within the questionnaire.

**Data Collection Tools**

For this study, historical student achievement data and teacher questionnaires were utilized to address the research questions. The historical data were used to determine the student academic impact of a one-to-one technology program. Third through six grade Missouri Assessment Program (MAP) English Language Arts (ELA) assessments, prior to the COVID pandemic, were utilized one year prior to the implementation of the one-to-one technology program and the second year of implementation of the technology program for the school district. Using the second year of implementation allowed for the teachers to adjust to the new technology in the classroom and to finish one year of professional development and support related to the technology initiative. This type of data collection was necessary to perform a Pearson's chi-square test for homogeneity with pre and post data to determine the impact and significance of the technology integration program. The independent variable was the year prior to implementation and two years after implementation. In addition, the chi-square analysis was used to determine if the two variables, pre and post years of implementation, were independent or had any significant relationship. For each chi square analysis, frequency of each category was compared to the one year prior and two years after implementing the one-to-one technology program. The chi square test would not necessarily help determine a cause and effect relationship, but rather whether or not the variables of pre and post implementation were related in a statistically significant way (Field, 2012).

A mixed methods survey was an effective tool for this study since it enabled the researcher to gather perceptions and feedback from a large number of sources without the

need for personal contact. This qualitative tool was essential since the researcher was studying a program or event where descriptive analysis of participant responses were necessary to uncover the phenomenon, which was equity gaps in technology education programs (Merriam, 2009). Quantitative data would not be enough to truly uncover whether or not an equity gap was being affected, but with the combination of rich, qualitative data, the researcher hoped to gain insight into this problem of practice.

**Teacher Questionnaire**

The questionnaire initially started with an item that determined the teacher's years of teaching experience in the school district. This item was necessary to determine whether or not the participant was teaching with the school district prior the implementation of the one-to-one technology initiative. Any teacher response of less than six years ended the questionnaire for that participant. The remainder of the questionnaire consisted of a Likert scale utilizing Ruben Puentedura's (2012) SAMR model as table categories, measuring the frequency of use of the SAMR categories, (a) substitution, (b) augmentation, (c) modification, and (d) redefinition, compared with the six major components of reading. Each SAMR category was listed as its own table to gauge frequency of use with Likert scale categories (a) never, (b) rarely, (c) sometimes, (d) often, and (e) always. The categories of reading included (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary, (e) comprehension, and (f) spelling (Mehta, Foorman, Branum-Martin, & Taylor, 2005). Additionally, open ended items asked each teacher about their perceptions on the effect of one-to-one technology and professional development related to reading instruction and achievement for students, including underrepresented student populations.

## Human Subjects Protection

All participants for this study were given an option to participate and would receive a written summary of the intended purpose of the study and a statement declaring the voluntary nature of the research study. All participants were allowed to opt out of involvement at any time and were asked to sign release forms. In the case of students, no release forms were needed, since only historical, non-identifying data were collected. Release forms explained the voluntary nature of the research project and also emphasized the confidential nature of the data reporting and ethical treatment of participants. To avoid any unnecessary conflicts of interest, the researcher selected a school district where the researcher has no direct influence or prior relationships with the teachers in grades three through six. This ensured the research contained little to no bias on the part of the researcher or the participants involved, and enabled the researcher to raise important questions and issues throughout the study and avoid potentially compromising political obstacles (Creswell, 2009).

## Data Analysis

For the data analysis portion of the study, the researcher used the historical data of the Missouri Assessment Program (MAP) English Language Arts (ELA) test for grades three through six, and ran a Pearson's Chi Square test for homogeneity. Data were gathered one year prior to the one-to-one technology initiative (2015-16 school year) and the second year of implementation (2017-18 school year). The chi square analysis took the data and defined the success and failure frequency for each grade level using the defined categories by the Missouri Department of Elementary and Secondary Education (MDESE) which included (a) below basic, (b) basic, (c) proficient, and (d) advanced.

The two variables were compared by grade level pre and post the technology initiative. The reasoning for utilizing this statistical test was to determine whether or not there was a significant relationship between the pre and post-assessment data of the technology program (Field, 2012). This data determined what impact, if any, existed in the state assessment scores of the various student groups in this study.

The qualitative data obtained from the teacher surveys were coded and analyzed with the purpose of identifying categories and themes in the data within the SAMR/reading Likert scale and open response portion of the survey. The open coding process for the free response questions allowed natural categories to emerge from the data, where more general themes were created and reported in the findings section (Emerson, Fritz, & Shaw, 2011; Merriam, 2009). These findings were coupled with the quantitative data from the survey to answer research question number three.

## Limitations

Due to the newness of this research topic, there were not many school districts who were implementing either BYOD or one-to-one technology integration programs. Similarly, the few school districts who were currently implementing these programs had been doing so for five or less years, and obtaining a cooperative site for this study was difficult. Due to the use of a critical lens theory, finding a school with a combination of either a high Caucasian or minority population, coupled with a significant number of free or reduced lunch, at least 30% or more, significantly limited the opportunities for research. Many of the school districts in the Midwest incorporating technology integration programs tended to be more affluent school districts. Additionally, an independent samples t-test was proposed as another measure to answer questions one and

two, but due to the State of Missouri's shifting numerical ranges for the four levels of achievement, an independent t-test was not able to be ran without determining a common ratio between the two different scales.

## Definition of Key Terms

### Bring your own technology (BYOD)

This is a technology integration program which allows students to bring their own personal electronic device for school use. The advantage of this type of program is the cost saving measures for the school district, and the ability for students to be familiar with the operation of their own device. Concerns of this type of program involve the potential to widen an already significant achievement and social gap for underrepresented student population who cannot afford the most current or popular technology (Bruder, 2014).

### Critical Social Theory

Critical Social Theory i**s** the process of reflecting on societal processes to reduce the impact of dominant processes and ways of thinking on underrepresented groups in society (Brookfield, 2014).

### Cultural Hegemony

Cultural hegemony is the societal domination of a diverse class of people by one majority or dominant, ruling class. The dominant class sets the rules, expectations, norms, beliefs, and values and attempts to impose these rules as the cultural norm to the minority classes (Lears, 1985). In the world of education, it has been commonly accepted that the dominant powers or privileges of being a male, white, upper-class, and non-disabled have set the tone for educational policy and implementation in American

schools. This type of dominant class rule has marginalized underrepresented groups of students, and the effects of educational policy decisions on minority groups have not always been considered and how these decisions may considerably widen an already significant gap in student achievement and equality (hooks, 2003).

**One-to-one (1:1)**

This is a technology integration program which provides each student their own personal, technological device. The main differences between 1:1 and BYOD programs is in a 1:1 program, the school district purchases the equipment and all equipment is exactly the same across grade levels. Critical theorists state that this type of integration program eliminates the inequities that can be created with BYOD programs (Sangani, 2013; Watters, 2012).

**SAMR Model**

Ruben Puentedura (2012) developed a hierarchy for assessing the levels at which technology is successfully integrated into various student lessons. The model resembles the Bloom's Taxonomy model, as higher levels of the SAMR technology integration model require higher forms of critical thinking and formations of new concepts involving technology for learning. The four levels in low to high integration order include (a) substitution, (b) augmentation, (c) modification, and (d) redefinition.

**Technology integration**

Technology integration is the attempts of schools to seamlessly incorporate the use of technology into the school's curriculum and pedagogy. The key to technology is not to use it as a stand-alone tool, but integrate it into curriculum to enrich the learning process. This type of integration increases the chances of students retaining the newly

acquired information. Similarly, teachers must shift from a dominant source of the information to a facilitator, who guides students to information and helps them process and apply the new information (Baylor & Ritchie, 2002). Current technology integration programs include one-to-one (1:1) and bring your own device (BYOD). Barriers to successful implementation of the technology integration programs include teacher training, teacher and student attitudes towards technology, improper administration, poor infrastructure, lack of technical support, and curriculum integration (Keengwe, Schnellert, & Mills, 2011).

**Ubiquitous use of technology**

In educational situations, ubiquitous use of technology is an active, continuous use of technology, which is seamlessly integrated in a subject's curriculum. This concept is in contrast to the use of technology as a stand-alone lesson or class. Ubiquitous use of technology affords students the opportunity to have complete immersion and the opportunity to use technology for all learning related tasks (Tan, Lin, Chu, Lui, 2012).

## Significance of the Study

With one-to-one technology integration programs being relatively new in K-12 education, the gap in research on the impact of such programs alone was significant. Additionally, the equity gaps that were potentially created by technology integration programs will be necessary knowledge for school districts to have in order to make and justify decisions regarding one-to-one and BYOD programs to taxpayers, teachers, and parents. As unfunded, federal mandates, such as *No Child Left Behind* and Common Core standards, have pushed aggressively for reform, educators have felt the pressure to adopt technology integration programs, as the savior for the American education system's

achievement gaps, when compared to other nations (Devlin, Feldhaus, & Bentrem (2013). The knowledge gained from this study will enable educators to approach the integration of technology in classrooms with a clear understanding of the impact of such programs on the achievement of the aforementioned student subgroups. This understanding will balance the pressure being applied by parents, society, and the federal government for fast implementation and also give educators a reason to slow down and investigate which type of technology integration program will fit for their students, teachers, and community.

Additionally, the knowledge gained from this research study will serve to fill a gap in the scholarly knowledge for K-12 education, as well as another caveat for critical theory supporters. The knowledge generated will also serve as a platform for future research into other educational ventures that will seek to either widen or eliminate the equity gap, in regards to student achievement, for underprivileged student groups. Critical theory supporters would argue that much of what happens in K-12 education, in terms of initiatives and policies, tends to objectify those groups of students that the initiatives or policies are intended to help (Brookefield, 2014). The research provided by this study should become an avenue or system through which educators and policy makers funnel decisions to determine its impact on underrepresented student groups.

## Summary

The overarching question this research study hoped to answer was whether or not technology integration programs had a positive or negative impact on underprivileged student groups. This question was grounded in the critical theory lens that hoped to uncover the dominant ideologies of our K-12 educational system and promote social

change that would have a positive impact on underrepresented student groups. To assist in uncovering this impact on student achievement, this study employed a mixed methods approach to answer the research questions, due to the complicated phenomenon being studied. The study used historical, state achievement data to show any significance in student achievement gains, as well as teacher surveys to reveal the perceptions and impact of one-to-one integration programs on underrepresented students.

The purpose of this study was to fill a gap in research on one-to-one technology programs in K-12 education and to provide school administrators with pertinent data to justify the existence of one-to-one technology programs. The significance of this research stemmed from a lack of classroom technology integration research for K-12 educators, but more importantly it would help researchers, policy makers, and educators couple a well-known critical theory lens, applied to a new trend in education. This marriage of theory and innovative strategies for student achievement will provide decision-makers a systematic process to ensure the plan to increase state test scores does not negatively impact the achievement of underrepresented students.

# SECTION TWO:

# LEADERSHIP AND PRACTITIONER CONTEXT FOR STUDY

## Introduction

The U.S. Department of Education (2017) stated in the national plan for technology in the classroom, "The conversation has shifted from whether technology should be used in learning to how it can improve learning to ensure that all students have access to high-quality educational experiences" (p. 7). The access to technology differed from student to student, especially when talking about rural versus urban internet access, poverty, and other student related factors that affected how students access technology in the homes of underrepresented populations (McClure & Pilgrim, 2021). As our society has moved more into a digital and technology-based society, Lindsay (2016) asserted that "education needs to respond to the rapid global uptake of mobile technology in order for learning to remain authentic and meaningful" (p. 1). The Missouri Department of Elementary and Secondary Education (MDESE) supported this notion through its mission and vision, identifying priority areas for technology within their plan with a focus on early literacy and success-ready students (MDESE, 2/17/22, 2022). However, MDESE does not necessarily dictate how schools would meet each of these goals, and with the current federal and state mandates and policies, schools are looking for alternative methods of instruction to meet the ever-increasing standards.

As schools look to stay relevant in a digital society, many school districts are looking to technology as a way to increase student engagement and state test scores and reduce the achievement gap, specifically as it relates to underrepresented student populations. As school districts rush to implement technology-based instruction, including one-to-one technology, they can overlook critical factors of culture, leadership, student access to technology infrastructure, and how to integrate the technology into

educational pedagogy (Stephens, 2017). McClure and Pilgrim (2021) stated "successfully implementing a new technology program, such as 1:1 technology initiative, is a significant undertaking and represents a shift in basic pedagogical approach away from the paper pencil mentality. The implementation process takes time and includes long-range plans for implementation and professional development" (p. 2).

Even as many school districts had already started down the path of one-to-one technology integration, the COVID-19 world-wide pandemic that started in 2019 forced schools, teachers, and students, who may have not been fully ready, to rely on technology even more due to school closures, quarantines, and new social distancing guidelines. The change from face-to-face learning, even with technology integration, into a fully or hybrid online format had the potential to significantly affect student achievement. The aforementioned factors for successful implementation only become exacerbated, as schools are now forced to deal with technology not only in their physical classroom, but now in a virtual environment (Kim, Yu, Park, Ha, & Baek, 2021).

## Organization Overview

For the purposes of this research project, the school district used in this case study will be referred to as Midwest Public Schools (MWPS). Midwest Public Schools was a large district consisting of an overall enrollment of more than 6,000 students with only one high school. MWPS had a primarily Caucasian student population of 80% with close to 2,000 students classified as free/reduced lunch students. Just under 40 % of the households made less than $30,000 per year, and despite some of these factors, the school district was annually rated as one of the top school districts in Missouri, typically in the top 25 of all schools in Missouri. On state assessments, over 50% of the students

demonstrated advanced/proficient on the English/Language Arts section and nearly 40% of its students demonstrated advanced/proficient on the state mathematics exam. The school district's combined average ACT score was slightly over 22.

The school district did have a significant rural population that stretched over multiple counties, making access to technology infrastructure, such as internet access, a challenge to many rural students (School web site, 2022). Despite this limiting factor, the school district began virtual and hybrid classes for its high school classes, starting in 2012. The school district offered many of these classes to its high academic performing students as a way to offer a flexible schedule.

MWPS has been in existence over 100 years and has been a leader in the region for college and vocational student preparation (School web site, 2022). The school prides itself in placing over 90% of its students either in college or vocational training (school web site). This type of success has inspired the leadership within the school district to adopt a one-to-one technology initiative in the 2016-17 school year, where every student in the school district had been given a personal electronic device for school use at school and home. The school district committed to provide the students with the most relevant and up-to-date technology to give their students every opportunity to be prepared for the workforce (School web site).

## Leadership Context of Organization

Leadership, in the context of educational change, challenges school administrators to influence groups through a process of achieving common goals. These goals can create culture problems, as they can challenge entrenched beliefs, not only within a person, but the organization as a whole (Northouse, 2013). Kotter (2011) stated, "since

change is the function of leadership, being able to generate highly energized behavior is important for coping with the inevitable barriers to change" (p. 48). Strong leaders must inspire their followers to dream of the impossible, but make the impossible achievable through satisfying the human needs of achievement, belonging, and self-esteem (Northouse, 2013).

Servant leadership is one strategy used to break the barriers related to inspiring followers to push for change, even when success has been achieved currently and in the past. Many successful organizations struggle to push past this initial barrier for change because they do not understand the essential role of analysis for how change can continue the trend of success. In the context of organizational change, servant leadership poses a challenge as the crux of this leadership strategy puts people first and seeks their input even when the people are not seeking change for an already successful organization (Northouse, 2013).

MWPS had shown a strong tradition of servant leadership that started with the superintendent and flowed through the leadership at all levels as a fundamental core to its success. This leadership, coupled with a large growth in the community and history of success over last 20 years, had made MWPS an attractive school district for new and veteran teachers and administrators, as well new families (School web site, 2022). MWPS regularly sought to empower each of its employees, enabling them to take risks for academic gain, while putting the needs of students first.

Wong and Page (2003) defined servant leadership as a paradox that combined the best of putting people first and strong, decisive leadership. Servant leadership looks to coerce people to change through relationships, wielding strong, unilateral power over

those people who are unreliable, and ultimately empowering others to find their path of success. The main characteristic of servant leadership is a leader's willingness to relinquish power and control, increasing vulnerability and humbleness, and eventually allowing the leader to become relatable. Wong and Page (2003) developed a framework for servant leadership which included character-orientation, people-orientation, task-orientation, and process-orientation.

**Character-orientation.** This part of servant leadership focuses on the leader's characteristics, specifically integrity, humility, and servanthood (Wong & Page 2003). Servant leaders must be ethical, not only in decision making but in demonstrating a genuineness to the greater good of the organization and care of its people (Northouse, 2013). MWPS had seen that demonstrated when its superintendent and cabinet appeared to be approachable and being careful listeners. MWPS had taken a strong position to gather input from its employees and allow them to shape decisions, and in many cases, unilaterally make decisions based on teacher input. This willingness to give up power through decision making, helped MWPS employees to see the leadership as servanthood focused.

**People-orientation.** Wong and Page (2013) defined the second aspect of servant leadership as people-oriented, which focuses on the care and well-being of the people being led. A servant leader can demonstrate a person-centered orientation by caring for, empowering, and developing others. MWPS, as described earlier, showed a strong commitment to caring and empowering their employees through a decentralized decision-making structure, which could be seen in how professional development days were created and designed through teacher input (School web site, 2022). MWPS had also

created multiple opportunities for teacher and future leadership growth through academies that help teachers get their master's degrees in teaching or leadership.

**Task-orientation.** This part of the servant leadership structure focused on how the leader set the tone for the organization through vision and goal setting (Wong & Page, 2003). Both of these processes fell back to the people-oriented characteristic, as MWPS allowed teachers to help set the vision and direction for the school district through the use of committees. Similarly, the goal-setting phase at MWPS also involved many teachers and administrators who served on strategic plan committees every four years. The purpose of these committees were to establish needs, goals, and steps for accomplishing the goals within the given timeframe (School web site).

**Process-orientation.** The last part of Wong and Page's (2003) servant leadership model was the leader's ability to impact the processes of the organization. Leaders who can model the use of teams and involve people in the decision-making process will create a sense of control and ownership with its employees. As described earlier, involving people in the task-orientation of the organization will not only increase an employee's self-efficiency, but provide a flexible model for leadership, decision-making, vision-casting (Kotter, 2011). For MWPS, this flexible model for organizational processes was key to the structure that makes MWPS successful. Bolman and Deal (2008) stated "If structure is overlooked, an organization often misdirects energy and resources" (p. 68).

## Organizational Analysis

Bolman and Deal (2008) stated "organizations are complex, surprising, deceptive, and ambiguous, they are formidably difficult to comprehend and manage… the world of most managers and administrators is a world of messes: complexity, ambiguity, value

dilemmas, political pressures, and multiple constituencies" (p. 41). For educational institutions to create change within their organization, they have to shed the narrow-minded approach to understanding organizational structures and politics, which can cause leaders to make short-sighted decisions for a much more complicated problem. Bolman and Deal (2008) offered four frameworks for understanding how decisions are made within a complex organization: (a) structural, (b) human resource, (c) political, and (d) symbolic. For the purposes of this study, MWPS was analyzed through each of Bolman and Deal's frames.

## Structural Analysis

Bolman and Deal's (2008) structural frame looks at the hierarchy of an organization and focused on getting employees into the right jobs. The structural frame defined specific roles, provided a hierarchy for leadership and offices, and in many cases, provided security to it employees. As an organization's structure is well-defined, employees find job security and are more productive, due to the lack of ambiguity.

MWPS had a clearly defined structure for its hierarchy, with one superintendent, two assistant superintendents, a cabinet comprised of various district leaders, a seven-member school board, building leaders, and representation from the Missouri School Teachers Association (MSTA). The school district established several committees that provided input on various topics to inform district decisions. The school district also utilized a school improvement team that was comprised of several teachers and administrators, who helped define the needs and goals for the district, as well the steps to accomplish the goals (School web site). MWPS had clearly defined roles for leadership and management, which helped leaders navigate the complexities and change within the

organization. All leaders were encouraged to be managers, but each department was structured so there was at least one leader with multiple managers at each level. This intentional hierarchy allowed the leaders to shape and influence change, but also have the task-oriented managers there to accomplish the goals and change needed for success (Kotter, 2011).

## Human Resource Analysis

Organizations, if viewed only through a structural view, could have the tendency to use and abuse people, as one view of the organization centers solely on the employee providing a service for the organization. Bolman and Deal (2008) introduced the Human Resource frame, which looked at how organizations and people could work together for mutual benefit. Bolman and Deal (2008) stated "high performing companies do a better job of understanding and responding to the needs of both employees and customers. As a result, they attract better people who are motivated to do a superior job" (p. 136). Through the servant leadership lens, listening and caring about the growth of people inspires people to be successful, change whenever needed, and take ownership of their work. This intentional building of community joins people through common values, helps focus people towards common goals, and seeks to meet the needs of the individual employee (Northouse, 2013).

MWPS had developed several human resource principals that centered on finding the right people, retaining employees, empowering employees, and investing in the employees' futures (Bolman & Deal, 2008). MWPS put a priority in hiring the right people by using a variety of screening tools and references to not just find a person, but to find people who fit into the school district's mission and vision. The school district

invested significant money over the last 20 years to increase teacher starting pay, re-write policies that limit newly hired, veteran teachers' salaries, and promote leadership from within the district. All of these aforementioned approaches helped develop the culture that attracts and retains employees. Due to the shared values and assumptions created through this process, MWPS was able to navigate change into a digital classroom without significant barriers. MWPS took a several year approach to developing the roll out plan, which involved a lot of teacher and administrator input. Many lead teachers were promoted into leadership positions to support the rollout of one-to-one technology, and a comprehensive professional development plan was tailored around the needs of teachers, as defined by the teachers.

## Political Analysis

To better understand an organization, one must set aside the traditional views of top-down power and decision making, and instead look at the many competing individuals and groups fighting over scarce resources (Bolman & Deal, 2008). Mintzberg (2005) defined organizational politics as the ability "to convince those to whom have access, to use one's resources, information, and technical skills to their fullest in bargaining, to exercise formal power with a sensitivity to others" (p. 336). The key phrase was access and use power, while recognizing how that affects other stakeholders within your organization. To create changes in policies and practice, great leadership understands the players within the organization, what resources they bring to the table, and how a shared collection of assumptions and goals can create organizational harmony.

MWPS, as described in many instances, recognized that its greatest resource was people, investing in their growth, listening, and sharing the decision making. As MWPS

looked to create change in its digital classroom practices and policies, its largest challenge revolved around working with veteran teachers who had been a part of the success of MWPS over the last several years. Many of these teachers were entrenched in their current practices and could see no reason why they would need to change their pedagogy. MWPS worked directly with MSTA representation to establish the need and common goal for one-to-one technology implementation. After harnessing the support and power from this teacher organization, MWPS still looked to build teacher buy-in through its traditional structures, including a strategic plan committee and various department heads throughout the district. Through these processes, the district leaders used reason and support from the U.S. Department of Education and MDESE, but heavily relied on already established relationships to work through the coming change (Bolman & Deal, 2008). The end result was a majority of district stakeholders buying into the one-to-one curriculum. For those remaining stakeholders who resisted the change, the human resources frame was applied, where people were shifted into positions that better suited their skill set, or naturally these stakeholders chose to the leave the district.

## Symbolic Analysis

The symbols of an organization are the vision and values of the organization. These can be seen in the traditions and stories of an organization. Bolman and Deal (2008) stated "facing uncertainty and ambiguity, people create symbols to resolve confusion, find direction, and anchor hope and faith" (p. 253). MWPS has been in existence for over 100 years and consistently tells the stories of its past successes, celebrates the heroes and heroines of its past, and continues to promote long standing traditions that honor the successes of past graduates. The school's mascot stands as a

symbol for excellence, which was modeled in the school's mission and vision and being a leader for educational success.

One of the general mottos for the school district was "MWPS leads schools around the curve and never chases." Many inspirational quotes that are put on buildings around the district and on various literature reflect the belief that MWPS was not a follower but a leader in the region. During the stakeholder buy-in portion of the one-to-one technology initiative, MWPS used this call to leadership as a way to rally the troops. In many ways, this symbolic approach moved nervous, scared, or hesitant teachers to look to the future and prepare a way for new technological pedagogy in the classrooms.

## Implications for Research

The purpose of this study was to evaluate the impact of how one-to-one technology was impacting student achievement, specifically in the area of reading comprehension. Understanding the lenses that shaped and influenced an organization's leadership theory, decision making, and culture can better explain the results that would come from a study involving this much complexity. The idea of implementing technology in a classroom was not as simple as a school district providing the funds necessary to buy each student a piece of technology, but instead was a multi-faceted, intertwined set of issues that could affect the student achievement results.

The implications of completing this research with this school district posed significant challenges as the researcher worked as an administrator, but in a department not connected to one-to-one technology in any way. The researcher believed the research results would be well received at the school board and district administrator level, due to the relationships with each stakeholder and by gaining stakeholder buy-in from each

group prior to beginning the research. However, the results of the research would have significantly different interpretations and future steps based on the stakeholder group.

At the district administrator level, it is generally believed the one-to-one initiative was having a positive impact on student achievement and attitudes towards learning. This general belief was based on the district's state assessment data, rankings with similar schools, and overall ranking in its state. State assessment data gathered before and after the implementation of the one-to-one technology program showed either consistent or increased state assessment scores as compared to other schools in the same state. Any data from the research study that did not show any significant connection of the technology program to student reading scores would most likely be processed as an application error, in terms of teachers not fully utilizing the technology to maximize student achievement. The qualitative data would help the district administrators to better gain insight into the level of the SAMR integration into reading instruction and perceptions on technology and reading achievement, district-provided professional development, and impact on underrepresented student population.

At the school board level, the results of the research study could have a negative impact, as the school board makes decisions for how future tax dollars will be spent toward technology integration. Any results that show little-to-no significance in the relationship between technology integration and student reading achievement could be used as an opportunity to explain the need for further research and explain the multitude of factors that also influence this relationship, including but not limited to professional development, teacher buy-in, and family/home factors. This research study could be used as a starting point for the school district to be more accountable for key achievement

factors as they relate to technology integration and present that as a yearly report to the school board.

Harper and Milman (2016) suggested that more research should be dedicated to these issues of implementation to better understand the full effect of technology in the classroom, which included "planning, design, development, implementation, and evaluation of 1:1 programs" (p. 140). The intent in mentioning these influential factors would help to better decipher the data and pose the possibility that the results could be seen as non-transferrable. The specific circumstances and organizational structures, politics, and symbols that created the environment for which MWPS was able to implement one-to-one technology in classroom may lead to future research in similar school districts with varying results.

## Summary

All school districts are looking for a secret to being successful. Bolman and Deal (2008) stated that "all great groups believe that they are on a mission from God, that they could change the world, make a dent in the universe" (p. 289). MWPS had created a culture that believed they were doing God's work and making a difference in the lives of their students. The entire symbolic structure of this organization centered around the belief that MWPS produced the best academic students, the most successful students in life after high school, and was a leader and model for all other schools. All of these beliefs led directly to why the school district looked to adopt various forms of technology in the classroom over the last 20 years and eventually a one-to-one laptop initiative. Even with the noble cause to lead our students into the future, MWPS had to look at how

this change, even when it may affect the majority of its student population in a positive way, would affect marginalized and underrepresented student groups within the district.

# SECTION THREE:

# SCHOLARLY CONTEXT FOR THE STUDY

## Introduction

As federal and state policies and mandates continue to change the landscape of American education, school districts are constantly morphing their educational practices to meet high expectations for state and national assessments. As accountability measures to meet achievement goals were implemented, school districts were looking towards technology as a tool to increase student engagement and achievement in the classroom. Over the last couple of decades, technology within schools started with computer labs where teachers could sporadically teach learning with technology. More recently, the technology had moved more into the classroom with the addition of Smart Boards and mobile computer carts. These more recent technological innovations had made it more convenient to engage students with technology in the classroom more frequently. However, with the increase in educational standards for student technology skills, coupled with mandates to integrate all subject areas cohesively with technology, a one-to-one approach to technology was seemingly the next logical path for student success.

The approach many schools have utilized had been a one-to-one technology adoption or one laptop or piece of technology per student. The main problem most school districts had faced was the cost associated with integrating this type of technology plan into the classroom. Many states were spending more than 40 million dollars to bring one-to-one technology plans into the classroom (Lei & Zhao, 2008). To counteract the cost of a one-to-one technology approach, schools had allowed students to bring their own device/technology, or BYOD, into the school for learning purposes. Even though this solved the cost issues associated with expensive technology integration plans, it potentially created an inequity for students who could not afford adequate technology for

school (Bruder, 2014). However, there was little to no research studies that verified the impact of BYOD technology programs on student achievement gaps or perceptions of an increasing student equity gap.

The purpose of this research study was to look at technology programs through a critical theory lens and determine the impact that one-tone technology programs have on student achievement in the area of standardized reading assessments of at-risk populations, as defined by free/reduced lunch student populations. Furthermore, the researcher's purpose was to add to the small amount of literature on technology integration programs, and for scholarly purposes, increase the knowledge related to technology and its potentially marginalizing effects on at-risk student reading achievement. This research study would also become a tool for school administrators to use to evaluate their organization and determine what effects a one-to-one technology program may have on their at-risk student populations and what inequities may be created for at-risk student populations within their own school district.

## Technology in the Classroom

The purpose and need for most schools to integrate technology in the classroom has been to increase student achievement in an ever-growing age of educational accountability. This accountability stemmed from a 1985 report *A Nation at* Risk (U.S. Department of Education, 2022), as well as new policies, like the *No Child Left Behind Act* (*NCLB*). The *NCLB* Act pushed educators to adopt a more scientific approach to measuring student achievement, which has spawned accountability for student achievement in the form of standardized testing (Devlin, Feldhaus, & Bentrem, 2013). New standards of education have called for students to apply higher levels of technology

competency, but schools generally limit technological integration to isolated lessons within the curriculum due to the overall lack of technological resources (ChanLin, 2007; Keengwe, Schnellert, & Mills, 2012). Furthermore, as student engagement, differentiated instruction, and student achievement have become the new focus for 21st century learning, one-to-one technology education seemed to be the answer to provide high levels of engagement, instruction, and achievement (Keengwe et al., 2012).

However, with many school districts looking to invest millions of dollars to bring technology to the fingertips of every student, the impact of one-to-one programs needed to be investigated. A study conducted by Keengwe, Schnellert, and Mills (2012) investigated the perceptions of students and faculty of a one-to-one laptop program in a Midwestern high school. The study showed that students and faculty perceptions of the program were positive, and student engagement and learning were positively impacted. However, the study only looked at the qualitative perceptions and did not necessarily gather any quantitative data to support an increase in student achievement. This study also made a call for a deeper investigation into the teaching practices of one-to-one programs since many of the instructional strategies observed only used technology as a substitute to book, paper, and pencil. A study conducted by Lei and Zhao (2008) revealed similar findings that student perceptions were positive, and students exhibited increased levels of engagement and desire to learn with the one-to-one technology program.

The cognitive impact that one-to-one technology had on students through the formal learning structures showed increased desires to learn, better communication and expression, and the ability to be self-directed and explore new learnings. The research by

Lei and Zhao (2008) showed that the study also noted an increase in the students' technology proficiency, but it lacked any quantitative data to support an impact on student achievement. This lack of quantitative data were the main critique of all the technology integration research. Even though qualitative perceptions are extremely valuable in the research to reveal complex findings, compared to its quantitative counterpart, the lack of quantitative data demonstrated a significant gap in the literature.

Another limitation in the research revolved around the new technology program of bring your own device or BYOD. Many school districts allowed students to bring cell phones, tablets, and laptops to school for learning purposes, since the schools saw a benefit in a one-to-one technology plan, but could not afford to buy the technology for all students. Similar to the one-to-one technology research, the BYOD programs had no significant research to show they had any impact on student achievement. However, the literature did begin to talk about the potential student inequities that surround a BYOD program since students were forced to provide their own technology (Sangani, 2013). Watters (2012) took a strong stance against BYOD, insinuating it was one of the worst ideas in education because it only widened a large chasm for student equity. Even though these arguments against BYOD have merit, in terms of their potential to create inequities, there were no studies that directly looked at a BYOD program and its impact on student achievement or student perceptions about learning.

## Barriers to Implementation

Even with the potential positive attributes of one-to-one technology programs for students, many of the research studies noticed significant barriers to implementing the technology in the classroom successfully. Factors that inhibited successful technology

integration lied in the teachers' and administrators' abilities to adapt to the new technology, the overall technology infrastructure, and the lack of buy-in from key stakeholders. Kamal, Weerakkody, and Irani (2011) studied the effects of technology integration programs in a local United Kingdom government. Their study uncovered the perceptions of vital stakeholders and was crucial to not only developing the buy-in necessary for implementation, but the stakeholder knowledge was key to creating a successful plan.

Similarly, teacher and administrator buy-in was key in any educational setting where policies, practices, and new technology were needed to be integrated into the system's everyday practices. Inan and Lowther (2010) conducted a study to research the link between teachers' perceptions about new technology and their ability to successfully integrate it into the classroom. Their study revealed the teachers' beliefs about integrating technology in the classroom had a direct impact on how well they effectively integrated the laptops into their everyday curriculum. The lack of teacher buy-in permeated the attitudes toward the technology program, the methods employed to engage students with the technology, and whether or not teachers engaged in professional development to increase their technology skills (Chanlin, 2007; Claro et al., 2013; Donovan, Green, & Hansen, 2012; Inan & Lowther, 2010; Inserra & Short, 2012; Li, 2010).

An administrator's lack of buy-in had a significant impact on the teachers' attitudes toward the adoption. Schrum, Galizio, and Ledesma (2011) studied the impact of an administrator's attitude toward technology and discovered that the administrator's education and preparation, as well as leadership skills, were the determining factors for

their support of the technology program. Many of the administrators lacked the necessary skills to lead others in adopting technology, as they lacked the prerequisite knowledge of how a plan of this magnitude should unfold.

School budgets were one of the major factors in dictating whether a BYOD or a school-district issued piece of technology would be used to help integrate technology into the classroom. Regardless of the specific technology implementation strategy adopted by school districts, the foundation for successful implementation started with the attitude, knowledge, and willingness of teachers and administrators to alter their culture and belief system, as it related to technology integration. Administrators must establish a culture of technology integration, which directly influences the attitude and role of the teacher using technology, professional development for effective technology strategies, and the belief in a repetitive exposure of technology into the teachers' everyday lesson plans (Cheung & Slavin, 2013).

## SAMR Framework for Evaluating Technology Effectiveness

In addition to lack of buy-in from key stakeholders, many teachers have struggled with how to implement and measure the use of technology in their lessons. Caukin and Trail (2019) indicated that properly using technology and defining its purpose was key for successful implementation. Caukin and Trail (2019) stated, "Technology should never be considered the classroom babysitter or the busy workstation. Rather, technology is used intentionally and strategically as a tool to allow students to engage meaningfully in authentic learning experiences" (p. 47). Ruben Puentedura (n.d.) created an evaluation tool to measure the level of implementation of technology in teacher lessons. The model could be viewed like a ladder or hierarchy for how technology was specifically used in

each lesson and its effect on student learning. The model ranged from substitution of technology for paper and pencil tasks to transformational learning and provided educators with a way to measure not only the quantity of technology used in each lesson, but also the level of integration (Jacobs-Israel & Moorefield-Lang, 2013; Lacruz, 2018). The SAMR model's acronym stands for (a) substitution, (b) augmentation, (c) modification, and (d) redefinition. Teachers could measure the level of technology integration by asking simple questions which included what was gained by replacing a paper and pencil task with technology, could technology improve the task, did the lesson or task change significantly due to the use of the technology, and did the technology create a brand new task that could not have been previously accomplished (Puentedura, 2012.)?

Romrell, Kidder, and Wood (2014) further defined the basic tenants of one-to-one technology integration or mobile learning (mLearning), separating mLearning characteristics from basic technology use in the classroom with no purpose or objective. Mobile learning (mLearning) was defined as learning that was personalized, situated, and connected. Learning devices that are considered personalized are those that students own or are allowed to customize to better fit their personality and learning style. This is significantly different from mobile devices that schools allow students to check out for a day or simply use for a lesson and return to the teacher. mLearning devices are also defined as situated, as they are able to be used in and out of the classroom. The portability of the mobile device redefined the learning situation, allowing students to not be confined by school buildings and time. Finally, mLearning devices are connected to people and information across multiple platforms through the use of the Internet and applications (Romrell, Kidder, & Wood, 2014).

Sung, Chang, and Lui (2016) concluded that the mLearning through mobile and personalized technology extends into how the technology is incorporated not only in the classroom but outside of the classroom. Students with mobile technology tend to develop an inquisitive, research-based approach, which can enhance a student's self-efficacy for learning. The mLearning characteristics combined with the SAMR model provided, educators with a common formative assessment to evaluate the effectiveness and level of technology integration in the classroom (Romrell, Kidder, & Wood, 2014). The SAMR model parallels Bloom's Taxonomy Model, in that it looked to define and measure the cognitive function needed for a given task or lesson. Furthermore, the SAMR model provided educators with a strategy for combining traditional lesson structure and technology skills with a better framework for understanding the cognitive requirement of each technological task (Suryani, Setiawan, & Sulaiman, 2019).

**Substitution**

In the SAMR model, substitution was the lowest level in the hierarchy of technology implementation. For many teachers, this would be the most logical starting place when first introducing technology to students, especially for those teachers who may not be trained in technology lesson planning or have technology competency. Romrell, Kidder, and Wood (2014) described the substitution level as replacing a simple task that could be accomplished with paper and pencil with some type of mobile learning tool but provided no functional change to the actual lesson.

Gromik (2012) conducted a study of English Language Learners and the effects of having students create conversational videos using their cell phones. Students were required to make a series of 30 second videos talking about a topic in the English

language, and then they were asked to share with the class. Students appreciated the ability to use the cell phones and the freedom outside of the classroom to complete the task. This lesson qualified as substitution since students could have accomplished the same objective through in-class speeches or group conversations. Lan, Tsai, Yang, and Hung (2012) found similar results of increased student participation and satisfaction when asking students to participate in online discussion groups. The researchers used one control group with no technology and one group using an online discussion board. The results of the study showed the students, utilizing the online discussion board, were more active and engaged in the learning assignment compared to the control group.

For the substitution category, teachers must ask themselves what was gained by replacing a common task with technology. In the studies mentioned above, substitution provided a personalized learning environment where assignments could be completed outside of the classroom, a differentiated approach to instruction and learning, choice, and unique forms of feedback from teacher and student (Caukin & Trail, 2019). Simple substitution alone does not provide an educator with any measure of effectiveness or higher student achievement, but coupled with mLearning characteristics, it provided teachers and students with a purpose, direction, and qualitative measure for technology integration.

**Augmentation**

The next level of the SAMR technology integration model is Augmentation, which challenged educators to add one functional, technology feature to the lesson design that previously could not be done (Puentedura, 2012). Romrell et al. (2014) stated, "Examples of mLearning activities at the augmentation level of the SAMR Model go

beyond the substitution level in that they provide some type of functional improvement over what could have been achieved with traditional tools" (p. 7). An example may include an elementary teacher using a digital reading program, which allowed students to listen and read at an independent rate to multiple stories of the student's choosing. This change augmented the traditional lesson in that it substituted digital stories for a teacher-led story time, but also added a functional improvement by allowing students to choose their own stories and work at their own pace (Hamilton, Rosenberg, & Akcaoglu, 2016).

In addition to adding technology to a traditional lesson design, mobile applications had been designed for educator and student use that would also fall into the category of augmentation. Caukin and Trail (2019) analyzed multiple mobile applications that educators could use to either add functionality to a lesson, or in some cases, a platform for providing feedback to parents and students. Seesaw was a mobile application that allowed teachers and students to take pictures of student work to display for parents, provided feedback, and created a school years' worth of work in a portfolio. Besides the feedback it provided to all stakeholders, it also enabled teachers to track the learning progress of each student. Another example of a mobile application was the game, Kahoot, where teachers created quizzes, tests, and study reviews for students for the purpose of providing instant feedback of right and wrong answers. Teachers could implement this game as a class, small group, or as individuals. Once the game was set up, students were able to work through the module independently or with a teacher.

In both mobile application examples, the applications added functional features to the original model. Where students would normally take work home to parents, Seesaw provided instant feedback to parents and students. Similarly, Kahoot provided a self-

paced, instant feedback model for learning or reviewing new material (Caukin & Trail, 2019). One common expectation of teachers was to assess the learning of an objective, which could be accomplished in a number of ways. One example was an exit slip, which consisted of a simple quiz or set of questions at the end of a class period. The exit slip provided feedback to the teacher on whether or not the students learned the objective for the day. This exit slip required a certain amount of time to grade and analyze to determine the effectiveness of the lesson and the student learning. With Kahoot, a teacher could provide a few questions at the end of the lesson through the mobile application and receive instant feedback to know whether the learning objective was met for that class. Similarly, due to the efficiency of the feedback, a teacher could integrate this throughout the lesson and more quickly obtain feedback on learning with smaller, chunked objectives.

Additional examples of augmentation lessons in research studies were conducted by Pfeiffer, Gemballa, Jarodza, Scheiter, and Gerjets (2009), who studied a group of students in a marine biology course. The researchers set up a learning activity with a control group, who used a printed field guide of marine biology, while the other group used an interactive DVD in place of the field guide. The DVD showed the marine biology in their natural habit using video, audio, and pictures of the same information in the field guide. These enhancements provided a functional change to the lesson through the interactive nature of the DVD. Students who used the DVD demonstrated a stronger mastery of the material and scored higher on the post assessment compared to the control group.

In each of the previous examples, mLearning characteristics were observed and each case created personalized, authentic learning, as seen in the example of the marine biology class, through the attempt to bridge the formal and informal nature of identifying marine life in the sea. In addition, the mobile app, Seesaw, met the connected definition of mLearning through its ability to create a learning community for the teacher, students, and parents. This level of the SAMR technology integration model allowed teachers to take their first true step toward the transformation of student learning by providing one functional change through the use of technology.

The prior two levels of the SAMR model were classified as enhancements, since the use of technology was provided as a simple replacement of ordinary tasks or as a functional improvement to the lesson or structure (Hilton, 2016; Puentedura, 2012). Even though some of the cases showed evidence of increased student learning and engagement, these levels still fell short of the potential of how technology could impact lesson design. The next two levels in the hierarchy of the SAMR model attempted to create brand new learning opportunities that would not be possible without technology. These levels also required the educator to significantly modify the lesson to incorporate technology, compared to the substitution needed in the prior two levels (Hilton, 2016). Romrell et al. (2014) claimed that only at these higher two levels of the SAMR model do educators truly reach the pinnacle of mLearning.

**Modification**

Modification was the third level and the beginning of the transformation category of the SAMR technology integration model. For this level, Puentedura (2012) asked questions related to how the technology modification added to the overall lesson design

and whether or not the change was highly dependent upon the use of that technology. One example of a lesson that qualified for the modification level was a flood disaster simulation in a geomorphology course. Students were given flood scenarios via text messages and asked whether or not to initiate the flood alert procedures.

Based on the previous response provided by the student helped determine the next prompt provided by the program through the text message. Students were put in a situation where they needed to respond quickly, similar to a real flood disaster situation. Even though the study did not measure learning outcomes, the perceptions of students were favorable, as it created a real-life learning experience, both in the timing and responses, but it also allowed each student to personalize the learning, as they were in control of their responses and justified their own approach to the flood simulation. Hamilton et al. (2016) provided another example of modification, as it related to how light travels through the use of an interactive program that allowed students to adjust and change the different variables of light travel. In the prior examples, all technology integrated into the lesson not only provided a functional improvement, but it created a new way to learn a lesson objective that was not previously present with standard education tools.

**Redefinition**

At highest level of the SAMR model was the redefinition stage, which challenged educators to not only create new, functional technology driven caveats within a lesson, but to create entirely new learning experiences that would not happen without the integration of technology. Along the same lines, the expectation for this level of the SAMR model was to access the higher levels of Bloom's Taxonomy, where students

could analyze, evaluate, and justify their new learning, as well as create original products or demonstrations of learning (Caukin & Trail, 2019). Liu and Tsai (2013) conducted a research study with English as a Foreign Language (EFL) learners who were attempting to learn English through an augmented-reality cell phone application that utilized GPS to find the student on the campus of the university. The mobile application utilized the camera of the student's cell phone and provided English words or word descriptions of the objects all around the university campus. The study revealed a higher level of student engagement and a stronger feeling for EFL students to persist in learning English and not quit, which was a common struggle for most EFL learners.

Even though the redefinition stage should be the highest stage of technology implementation, according to the SAMR model, it did not necessarily guarantee that the highest levels of Bloom's Taxonomy awerere being utilized effectively (Caukin & Trail, 2019). However, at first glance, this may seem to be a criticism of the SAMR model, but in reality, it was important to utilize a wide range of cognitive levels at all levels of the SAMR model. The SAMR model did an excellent job of providing educators with an evaluation tool for how technology had been integrated into student lessons, but Hilton (2016) encouraged educators not to view the model as a hierarchy, but more as a guide to creating meaningful learning experiences. The key was to focus on how educators could make new learning that did not previously exist under the paper and pencil model. Romrell et al. (2014) furthered the discussion by connecting the mLearning characteristics of personalized, situated, and connected to the SAMR model, and noted that of the ten studies they examined, all of the studies that qualified for the redefinition stage of the SAMR model demonstrated all three characteristics of mLearning, where the

lower levels of the SAMR model connected with only one or two of the mLearning characteristics.

Hamilton, Rosenburg, and Akcaolu (2016) stated, "With the ubiquity of technology in today's interconnected world, it is imperative for teachers to understand how to use technology to promote student learning and achievement" (p. 439). The SAMR model provided teachers with a starting place for understanding the connection between teaching and technology, and its effect on academic achievement. The SAMR model's strong parallel to Bloom's Taxonomy provided educators with a familiar framework to assist in integrating technology in lessons at various cognitive levels (Suryani, Setiawan, & Sulaiman, 2019).

## Digital Inequity Research

Additional discussion was needed regarding the impact of whether or not technology integration, through either BYOD learning or one-to-one use, truly created better learning experiences and achievement for underprivileged student populations. With disadvantaged student populations, Shank and Cotton (2014) indicated there are two levels of digital divide that were created for disadvantaged student populations, as it related to technology. The first level of digital divide discussed the disadvantaged student population's access to technology. This divide widened as the researchers noticed, specifically in urban youth, the ability of low-income families to purchase a personal electronic device. Additional concerns were the age at which these students began using technology, at school and in the home, and accessibility and connectivity to the Internet.

The second part of the digital divide related to how students use the technology and the Internet. Four major categories were formed when discussing the effects of technology on underprivileged students. The first two are more significant and center on communication and social networking. Communication was defined as the ability for students to communicate across simple platforms, like texting and email. Social networking was similar, but required students to navigate much more complex, social applications, like Facebook and Instagram. Even though these forms of communication were similar, the differences are in the complexities and structures of how students navigate to communicate and create culture and community (Shank & Cotton, 2014).

Warschauer, Cotton, and Ames (2012) investigated schools in the Birmingham, Alabama area and their attempt to create a one-to-one technology approach to learning and its effects on the students' use of technology, especially as it related to underprivileged students. Each student was given their own laptop, but the findings showed that 47% of the students did not have Internet connectivity at home, making it difficult to use the technology for enrichment or remediation (Warschauer, Cotton, & Ames, 2012). Even with one-to-one technology implementation, the study showed teachers struggled to create any purposeful use for the technology, and students were not able to harness the enriching power of the technology, due to lack of access and modeling of how to properly use it for educational purposes.

The Organization for Economic Cooperation and Development (OECD, 2016) provided a study that looked at 42 different countries, and even when disadvantaged student groups had access to the Internet at home, the majority of the low- and middle-income families utilized the technology in mostly non-educational situations, as

compared to more affluent students. OECD (2016) further implied this problem was linked to a lack of proficiency in reading, stating, "students with good reading skills, regardless of their background, have a much easier time finding their way around – and mining the considerable assets of – the Internet" (p. 4). To be able to use educational technology for student gains, students must possess a proficient level of reading, in order to properly navigate, search, and evaluate information provided by the Internet and educational applications and programs. This research provided a common infinite loop that educators fight when integrating technology with disadvantaged student groups and reading and comprehension skills.

The two major factors of access and type of use have to be considered when integrating technology and analyzing its effects on underprivileged student achievement. Access to technology, whether through BYOD or one-to-one programs, will carry significance in how students use technology outside the classroom. Lack of appropriate technology for BYOD programs or unfamiliar pieces of provided technology coupled with lack of resources or Internet access in the home stand as major obstacles for school districts with disadvantaged students. Similarly, the parent support and scaffolding at home, along with the student's ability to read and problem solve, will further complicate the application of technology into the lesson design. To further exacerbate the digital divide, even with more technology access for underprivileged students, these students tend to be consumers of technology versus producers of technology, which was a key aspect of learning through technology integration (Roswell, Morell, & Alvermann, 2017).

## Critical Theory

A critical theory lens was used to frame and analyze key concepts and findings for this research study. The goal was to use this framework to identify dominant ideologies of the American education system, especially as they related to technology and student achievement. Furthermore, critical theory and its foundational elements have been used to form the purpose and research questions to help ensure that technology integration plans do not marginalize underrepresented student groups.

Critical theory originated in the early twentieth century as a reaction to the ideals of dominant groups in society and their traditions which oppressed underrepresented populations (Brookefield, 2014; Tar, 1975). The works of Max Horkheimer, who was a member of the Frankfurt School of social research, was dissatisfied with the capitalist society and its oppressive structures (Tar, 1975). Brookfield (2014) stated, "Western democracies are highly unequal societies in which economic inequity, racism, and class discrimination are critical realties; that the way this state of affairs is reproduced as seeming to be normal, natural, and inevitable" (p. 418). Especially for those people in positions of power and privilege, little thought was given to why certain traditions and systems exist, especially when they still primarily serve the needs of the privileged. These systems become the status quo and rarely are challenged or noticed as minority groups are marginalized by their oppressive structures. Merriam and Bierema (2009) stated, "Critical theory acknowledges that the social world creates structures that confer privilege to some and marginalizes others based on attributes such as race, ethnicity, gender, age, sexual orientation, religion, class, physical ability, and so on" (p. 215). One

of the major goals of critical theorists has been to uncover the traditional, dominant systems that are entrenched in any society.

Other critical theorists are not merely satisfied with the recognition of hidden oppression within society, but their aim has been to create a plan or call to action to prevent future incidents of oppression (Freire, 2000;). Freire (2000) confirmed the necessity for a call to action, and stated "A mere perception of reality not followed by this critical intervention will not lead to a transformation of objective reality" (p. 51). The end result for any critical theorist is to affect change within the system and create an environment that reduced equity gaps and improved the standard of living for all (Freire, 2000).

Another concept of critical theory was the idea of cultural hegemony, which was developed by Antonio Gramsci, an Italian Communist, who attempted to address the relationship between power and culture in a capitalistic society (Lears, 1985). Cultural hegemony can be defined as an act of a privileged, dominant, governing body within a diverse society who established the norms, values, and beliefs of that society as the dominant and accepted view (Vaandering, 2010). hooks (1994) expanded this definition of cultural hegemony into the educational system, and asserted many of the current structures and policies worked to increase the inequities of minority students. Students in today's educational system are packaged and educated with a "one size fits all" approach to learning, where a student's age is the determining factor for what was educational and developmentally appropriate. This lack of a differentiated approach to education has created a system that marginalizes students who are not developmentally ready,

regardless of the reason, and promoted those students who are a part of the dominant social group (hooks, 1994).

Educational structures, policies, and practices are the attempts of the dominant social group to communicate and assimilate students to its values, morals, and beliefs (Freire, 2000; hooks, 2003; Mitchell, Crowson, & Shipps, 2011). Freire (2000) further insinuated that educational systems are one-way streets that establish the teacher as the source of knowledge and students as a depository, thus stifling creativity and true knowledge construction. Friere (2000) stated, "Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other" (p. 72). By severely limiting the opportunity for learning to one type of structure, students struggle to demonstrate learning, as defined by the source/deposit method of education. Keeson (2011) further explored the marginalization this type of educational system had on underrepresented students in how it unnecessarily labeled and stereotyped students by a limited number of success indicators. The belief that students could utilize their diverse experiences to create and express new learning was negated by many of the oppressive, dominant educational structures.

bell hooks (1994) expressed her disgust with her fellow teachers as many of them failed to view their students as whole human beings, and instead only as a process in which to disseminate their own knowledge, beliefs, and ideologies. Many of the accepted processes and ideologies of education act as oppressive structures, which work to marginalize oppressed groups. A common, dominant belief in education has been the belief that education was blind to the structures of race, class, and gender, and are often

ignored in the curriculum and educational pedagogy. Critical theory looked to challenge these beliefs and create progressive classroom structures that deemphasized dominant ideological beliefs (hook, 2003). Freire (2000) stated:

> This seeming lack of distinction is conveniently adopted by those educators who believe that education is neutral as they engage in a social construction of not seeing. That is, they willfully refuse to understand that the very term "pedagogy" mean(s) "to lead a child." (p. 25)

Critical theory looked to challenge this seemingly neutral point of view, and instead adopted a more complex system of thinking that incorporated the diversity that students bring, physically, emotionally, and mentally (hooks, 2003).

A one-to-one approach to technology integration would more closely align to the critical theorists' beliefs of challenging the assembly line education that obviously oppresses certain student populations. Specifically, the one-to-one technology plan attempted to decrease the equity gap for underprivileged students by ensuring all students, regardless of ethnicity, disability, or socioeconomic status, have the exact same technology. However, pedagogical and curriculum issues would still need to be addressed, as old ideologies coupled with new technology would still tend to marginalize underrepresented student groups, especially as it related to technology integration in traditional lesson design (hooks, 2003).

As previously stated, the SAMR model would help educators better align, assess, and integrate technology into the classroom. However, the SAMR model alone may not reach the underprivileged student populations and ensure greater student achievement, as measured by standardized tests at the national and state level. Greater attention to the

underlying problems related to being a disadvantaged student, like access to technology outside of the school, home environment and attitudes regarding technology and education, and reading ability, must be researched to better understand how to implement technology to increase overall student achievement.

## Reading Literacy and Technology

One major area of student learning and achievement, where educators look to increase student success, has been in the area of reading and reading comprehension. Tindall and Nisbet (2010) asserted that "Researchers and practitioners alike attest to the critical role of vocabulary in reading comprehension in both native speakers and second language learners. Without sufficient vocabulary, it is impossible to successfully read for meaning" (p. 5). Furthermore, all learning was dependent on a student's ability to decode words, make meaning, and apply that meaning to the learning objective (Tindall & Nisbet, 2010). Even in the context of a mathematics curriculum, whether in solving algebraic equations or word problems, many students who struggle with mathematics are not necessarily lacking in math related skills, but in reading and comprehending what the objective was targeting in that problem.

Daniel, Walsh, Goldston, and Arnold (2006) stressed the strong relationship between students with subpar reading abilities and dropout and suicide. Hernandez (2011) showed similar findings relating the strong correlation between basic reading skills and the ability to graduate on time. The researcher's data showed that one in six students, who are not reading at a proficient level by the third grade, would not graduate on time. This drop out percentage was four times higher compared to those students who were reading on grade level by the end of the third grade. For educators, reading was a

complex task that required not only detailed attention for lesson planning and implementation, but in addition, educators must account for the numerous non-educational factors that influence learning, like poverty, race, and learning disabilities.

The U.S. Department of Education Office of Career, Technical, and Adult Education (2014) described the five essential components of reading as (a) phonemic awareness, (b) phonics, (c) vocabulary, (d) reading fluency, and (e) reading comprehension. Furthermore, each essential reading component was not a stand-alone skill that could be mastered independently of the other four. Reading assessments should be used to identify the weaknesses of each individual student, and based on those results, a specific, differentiated plan should be developed to adequately meet the need of each unique student.

**Phonemic Awareness**

Phonemic or phonological awareness was described as the ability of a reader to understand the patterns and sounds of language. Berg and Stegelman (2003) provided a basic timeline for phonological skill development, starting at the age of three with rhyming and rhyming patterns. Ages four and five looked primarily at counting syllables and phonemes or distinct units of sound. Ages six and seven looked for students to blend two and three phonemes, while at age eight, students should demonstrate consonant cluster segmentation or the ability to separate consonants sounds in a word. Without these essential phonological skills, researchers claimed students would never benefit from reading instruction (Berg & Stegelman, 2003; Tindall & Nisbet, 2010). Lai, Tsai, and Yu (2010) designed a study involving third grade students learning English as a foreign language and a technology program aimed at increasing phonological skills. The

students were able to hear words in English, then were able to audio record those same words into the program. The program measured four key areas of the student's response, pronunciation, intonation, tempo, and the volume of the student's pronunciation of key words. Students were given immediate feedback and were allowed to repeat for mastery. The results of the study indicated the experimental group showed greater gains, as compared to the control group, and furthermore, the pre-classified, low ability group of students showed significant gains and mastery of the phonological skills.

**Phonics**

Phonics was the second essential reading skill, and was defined as the ability to decode and associate sounds of letters and groups of letters in words. Even though many experts asserted that phonics was an essential skill of reading, many reading researchers implied that word recognition and the ability to compute meaning were just as important (Castles, Rastle, & Nation, 2018; Double, McGrane, Stiff, & Hopfenbeck, 2019). Similarly, Castles et al. (2018) promoted not only the sounds of letters, phonics, but the written units of the letters, graphemes, and how students connected the written and spoken words. Double et al. (2019) further researched the importance of phonetic development using phonic checks for students six years of age. The researchers' study showed a strong, predictive indication of future success in reading when early tests identified struggling readers, as it pertained to phonics. The study noticed a strong correlation of continued reading success for students who were struggling with phonics during the first check and became proficient by the second phonics check. These students showed phonics proficiency four years after the initial check, compared to those students who did not make proficient strides between the first and second phonics check.

## Vocabulary Development

Bulut and Karasakaloglu (2017) stated, "Vocabulary is defined as all the words that people acquire in proportion to their age, gender, natural and social environment" (p. 100). There are many factors that contribute to a child's intentional or incidental vocabulary development, as well as which approaches were used for building an in-depth vocabulary. Teepe, Molenaar, Oostdam, and Fukkink (2019) looked at the effects of the parent/child interaction on vocabulary development and the programs that could assist in this process. The researchers developed a study that divided pre-school aged children into three categories (a) control group, (b) active learning parent meetings, and (c) learning through technology. The study demonstrated that children, not in the control group, benefited and developed better vocabulary development as compared to those in the control group. The highest level of gains were noted in the active learning parent group with the next lower level of gains in the technology group. The researchers asserted the lower level of gains in the technology group could be attributed to the inherent difficulties surrounding implementing technology in educational settings. With such an emphasis on parent/child interaction, this study spoke directly to underprivileged students and the challenges they face to obtain better vocabulary development. Especially for pre-school aged children, the linguistic level of conversation and frequency of those conversations between the parent and child dictated to what level children obtain their vocabulary. Basically, parents with more in-depth vocabularies would tend to stimulate better conversations, more frequently challenge their children with newer words, and adjust the conversations to meet the current needs of their child (Teepe et al., 2019). However, Dongjing (2020) showed no one method of vocabulary development

met all needs for all students. This researcher's study noticed the age of the students and developmental level would better determine which type of vocabulary development strategy was needed for best gains. Regardless of method, vocabulary development played an important role in the overall development of student achievement, as it pertained to reading ability.

**Reading Fluency and Comprehension**

Reading fluency was defined as the rate, ease, and tonal expression of a reader, which was heavily influenced by a combination of reading skills, including grammar and phonics. Reading fluency was significant in the overall reading process, as it showed a mastery of other reading skills, like grammar and phonics, but also freed up the mental capacity of the brain to focus more on reading comprehension. Reading fluency also had a significant influence on positive feelings of self-confidence and motivation to read various texts (Nevo, Vaknin-Nusbaum, Brande, & Gambrell, 2020).

Increased reading comprehension ability of students showed similar signs of increasing self-confidence and motivation to persist in reading difficult texts. Even though all components of reading were essential, reading comprehension was considered to be the greatest of the essential reading skills. Even with the mastery of the other four reading components, no meaning, analyzation, or evaluation could take place without the ability to comprehend a written text (Kusdemir & Bulut, 2018).

Many studies have been conducted showing the use of programs and technology to increase fluency and comprehension. Kloos, Sliemers, Cartwright, Mano, and Stage (2019) showed evidence of a technology-based intervention program and the strong correlated effect on improved reading fluency and comprehension for students in grades

two through six. Similarly, Bilgi (2019) demonstrated the overall importance and significance of parent reading programs for underprivileged students on fluency and comprehension. Bilgi's (2019) research placed the parent/family at the forefront of the reading intervention, which was supported by Teepe's et al. (2019) research of parent/child conversations and development of vocabulary proficiency. The connection was so significant it created questions for how disadvantaged students develop these essential reading skills without support from parents. Furthermore, if these essential interactions are not taking place at home to increase a child's essential reading skills, it put even more pressure on educators to take a more efficient, systematic approach to not only teach reading skills, but how they integrate technology into those reading lessons.

Bilgi (2019) stated, "The ability to read is an integral part of school life and is one of the basic skills for academic achievement" (p. 218). As educators navigate the landscape of teaching reading skills and strategies for student success, it would be essential to understand how reading affects not just students in general, but those students who are underprivileged. Similarly, when introducing new technology within lessons, especially those centered on reading instruction, teachers must account for the limitations that were inherent with disadvantaged students as it related to the personal use of technology, access to the Internet, and support from parent and guardians. The SAMR model, coupled with the mLearning characteristics, could provide educators with a structured path to implement technology with meaning as it related to increasing a student's reading level and overall comprehension. Couple this technology integration model with solid research and understanding of digital inequity would empower educators to give disadvantaged students the confidence they need to master the essential

components of reading and subsequent academic achievement in other areas of academia and life.

## Summary

Even though there was significant political pressure due to unfunded federal mandates, as well as societal pressure to integrate technology in the classroom, the literature demonstrated a lack of concrete evidence that any one-to-one or BYOD technology plan would have a significant, positive impact on student achievement as a single qualifier. With high costs being associated with one-to-one technology plans, school administrators need to be able to approach stakeholders with a high level of confidence that a significant investment of this nature can and will pay dividends. Similarly, school administrators need to approach one-to-one technology programs with the knowledge necessary to combat potential student inequities associated with one-to-one technology or mLearning programs. As demonstrated in the related literature, even once a technology plan was chosen based on research, significant work was needed to create the necessary capacity and buy-in to ensure the program was implemented correctly and effectively. Furthermore, models and structures, like mLearning and the SAMR model, were needed to guide educators in the development of lessons with technology and how to assess the effectiveness of implementing the technology and its impact on student reading achievement, especially for underprivileged students.

# SECTION FOUR:

# CONTRIBUTION TO PRACTICE

**The Effectiveness of One-to-One Technology Integration Programs in K-12 Education and its Impact on Student Reading Achievement**

**By Brandon Clark**

Presented to the Directors of Technology Services and Curriculum

## Executive Summary

### *Introduction*

With an ever-increasing trend for school districts to invest significant funds into student-related technology and the increased demand on state testing and student engagement and achievement (Keengwe, Schnellert, & Mills, 2012; Lei & Zhao, 2008), it is essential for schools to analyze the impact of such technology on student achievement. Many school districts are blindly implementing technology with little to no support, expecting increases in student achievement, and have little to no systems in place to measure either implementation or impact of technology in the classroom. In addition to the trend of one-to-one technology in the classroom, the COVID-19 pandemic forced many school districts, who were not prepared, to fully implement distance learning or technology as a learning device (Kaloostian, McCall, & Chhetri, 2020).

### *Purpose*

During the initial research process, many attempts were made to find studies that measured technology and its impact on student achievement. Most of the studies in this arena focused on implementation strategies and struggles, teacher and administrator buy-in, professional development, student engagement, and equity gaps between one-to-one technology and bring your own device (BYOD) programs. Very few studies have attempted to measure the statistical impact of how the use of technology could impact student achievement, especially in the area of reading achievement (Claro, Nussbaum, López, & Díaz, 2013). The purpose of this study was to investigate any impact of implementing technology in the classroom through empirical data, as well as looking at the student sub-groups of free and reduced lunch, students with disabilities (IEP), and ethnic minority students. Additionally, the study looked to help school districts who were implementing technology in the classroom and help inform decisions about how to implement technology with teachers and students, while providing data for its impact on underrepresented student groups.

### *Research Questions*

1. What is the impact of a one-to-one technology integration program on student reading achievement?
2. What is the impact of a one-to-one technology integration program on the student reading achievement of student sub-groups, as defined by free and reduced lunch, Special Education (IEP status), and ethnic minority students?
3. What is the primary factor, as perceived by teachers, for determining the effectiveness of a one-to-one technology program on student reading achievement?

### *Methods of Investigation*

In this project, a mixed methods case study was implemented to research the statistical impact of a one-to-one technology program in one school district. Data included in this project included student reading achievement, as measured by the Missouri Assessment Program (MAP) English Language Arts (ELA) exam and a survey of teacher perceptions on levels of technology integration, professional development, and impact on student

achievement. Statistical data were gathered from the spring of 2016 and 2018 MAP ELA exams for students in grades three through six, which correlated to the school district's technology adoption year of 2016-17. The 2017 data were not collected, as the data may have contained an implementation dip in the very first year of the one-to-one technology being used in the classroom.

Attempts to gather this information proved to be challenging, as the State of Missouri changed it reporting location, format, and the overall scoring scale. Due to the changing scale score from 2016 to 2018, a chi-square test for homogeneity was deemed most appropriate for the quantitative data, as the categories of student achievement from the MAP assessment had not changed. The categories included (a) below basic, (b) basic, (c) proficient, and (d) advanced. A mixed methods survey was also administered to all elementary teachers in grades three through six, which focused on determining level of technology integration, teacher perceptions about technology and its impact on instruction and assessment, district professional development, and technology impact on the student sub-groups of free and reduced lunch, IEP, and ethnic minority students.

For the quantitative portion of the survey, the SAMR model was used as a frame to categorize the different levels of technology integration within the classroom. Ruben Puentedura (2012) created a four-tier system that categorized technology use from enhancement to transformational.

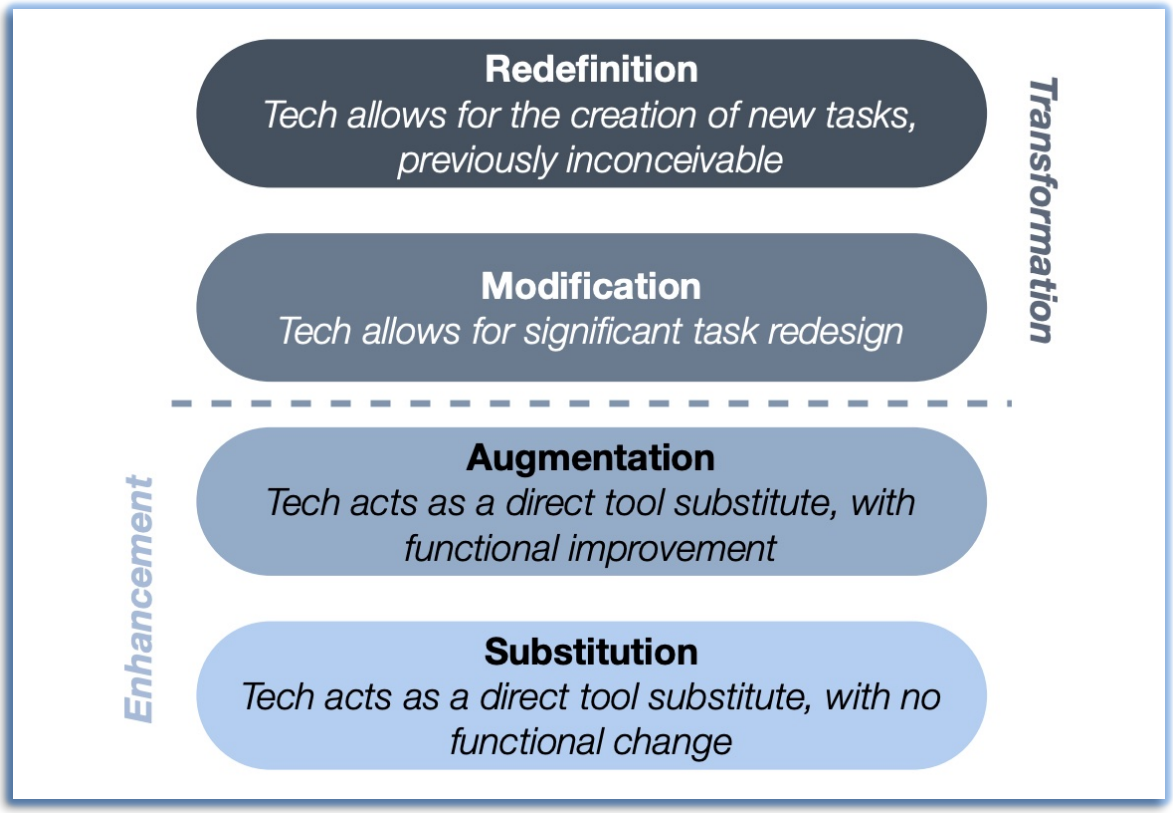



**Fig. 1** Puentedura, R. (2012). Substitution, Augmentation, Modification, and Redefinition (SAMR) model (retrieved from http://www.hippasus.com/rrpweblog)

Teachers were asked to rate their level of technology integration on the six categories of reading instruction: (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary, (e) text comprehension, and (f) spelling. Teachers were given the Likert scale of Never, Rarely, Sometimes, Often, and Always to rate their personal technology integration into their reading lessons and activities.

### *Participants*

*Number of Student Participants*

| 2016 | | 2018 | |
|---|---|---|---|
| Student Group | *n* | Student Group | *n* |
| 3rd-6th | 1841 | 3rd-6th | 1877 |
| 3rd | 480 | 3rd | 474 |
| 4th | 426 | 4th | 444 |
| 5th | 478 | 5th | 522 |
| 6th | 457 | 6th | 437 |
| Minority | 244 | Minority | 271 |
| IEP | 240 | IEP | 262 |
| Free/Reduced Lunch | 715 | Free/Reduced Lunch | 653 |

*Teacher Questionnaire Participants*

| SAMR Levels of Technology Integration | *n* |
|---|---|
| Q2 - Substitution | 42 |
| Q3 - Augmentation | 35 |
| Q4 - Modification | 34 |
| Q5 - Redefinition | 31 |
| Qualitative Feedback | |
| Q6 - Instruction & Assessment | 16 |
| Q7 - Professional Development | 15 |
| Q8 - Minority Subgroups | 15 |

*Note.* 66 teachers responded to the survey with an average of 11.1 years of experience.

***Analysis***

Pearson's chi-square test for homogeneity was used to compare data from 2016 and 2018 for the following groups:

- ◊ 3rd-6th Grade
- ◊ 3rd Grade
- ◊ 4th Grade
- ◊ 5th Grade
- ◊ 6th Grade
- ◊ 3rd-6th Grade Minorities
- ◊ 3rd Grade Minorities
- ◊ 4th Grade Minorities
- ◊ 5th Grade Minorities
- ◊ 6th Grade Minorities
- ◊ 3rd-6th Grade IEP
- ◊ 3rd Grade IEP
- ◊ 4th Grade IEP
- ◊ 5th Grade IEP
- ◊ 6th Grade IEP
- ◊ 3rd-6th Grade Free/Reduced
- ◊ 3rd Grade Free/Reduced
- ◊ 4th Grade Free/Reduced
- ◊ 5th Grade Free/Reduced
- ◊ 6th Grade Free/Reduced

For SAMR teacher survey questions 2-5, a Likert scale was used to tabulate the frequency in which each teacher utilized the different tiers of the SAMR model compared to the six components of reading instruction.

For questions 6-8, open coding was used to determine main categories and themes and frequencies were tabulated for each category.

***Findings***

Of the 20 chi-square tests, all but four data sets showed a significant difference in the distribution of MAP ELA tests score categories between 2016 and 2018 tests with a $p<.05$. The only tests to not show a significant difference in the distribution were the 4th grade minority student groups and the 6th grade minority, free/reduced lunch, and IEP student groups. The data showed the number of students scoring Advanced and Proficient compared to Basic and Below Basic significantly decreased from 2016 to 2018 by an average of 19.6%. Even with the dramatic decrease in advanced and proficient students for the ELA assessment, the state saw a similar shift of scores in the basic and below basic categories. The only subgroup to see an increase in advanced and proficient students were the 6th grade IEP students with an increase of 4.9%.

*Proficient and Advanced Student Percentages*

| | % of Proficient/Advanced | | |
|---|---|---|---|
| Grade | 2016 | 2018 | Difference |
| 3rd | 80% | 63.1% | -16.9% |
| 4th | 84.7% | 65.1% | -19.7% |
| 5th | 79.9% | 55.2% | -24.7% |
| 6th | 71.8% | 66.1% | -5.6% |

*Note*. Average drop in scores was -16.73%

| Question 2 – How frequently do you use ***Substitution*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
|---|---|---|---|---|---|
| *n* = 42 | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 30.95% | 19.05% | 28.57% | 16.67% | 4.76% |
| Spelling | 30.95% | 35.71% | 26.19% | 7.14% | 0.00% |
| Vocabulary | 33.33% | 23.81% | 26.19% | 16.67% | 0.00% |
| Phonics | 35.71% | 30.95% | 21.43% | 11.90% | 0.00% |
| Fluency | 38.10% | 26.19% | 19.05% | 16.67% | 0.00% |
| Phonemic Awareness | 38.10% | 28.57% | 21.43% | 9.52% | 2.38% |

| Question 3 – How frequently do you use ***Augmentation*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
|---|---|---|---|---|---|
| *n* = 35 | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 28.57% | 20.00% | 37.14% | 11.43% | 2.86% |
| Vocabulary | 37.14% | 20.00% | 28.57% | 14.29% | 0.00% |
| Spelling | 42.86% | 31.43% | 20.00% | 5.71% | 0.00% |
| Phonics | 42.86% | 17.14% | 37.14% | 2.86% | 0.00% |
| Fluency | 45.71% | 11.43% | 34.29% | 8.57% | 0.00% |
| Phonemic Awareness | 45.71% | 22.86% | 25.71% | 5.71% | 0.00% |

| Question 4 – How frequently do you use ***Modification*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
|---|---|---|---|---|---|
| *n = 34* | Never | Rarely | Sometimes | Often | Always |
| Vocabulary | 29.41% | 38.24% | 11.76% | 20.59% | 0.00% |
| Text Comprehension | 32.35% | 17.65% | 26.47% | 20.59% | 2.94% |
| Phonics | 38.24% | 35.29% | 17.65% | 8.82% | 0.00% |
| Spelling | 38.24% | 32.35% | 14.71% | 14.71% | 0.00% |
| Fluency | 41.18% | 23.53% | 14.71% | 20.59% | 0.00% |
| Phonemic Awareness | 41.18% | 32.35% | 17.65% | 8.82% | 0.00% |

| Question 5 – How frequently do you use ***Redefinition*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
|---|---|---|---|---|---|
| *n = 31* | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 32.26% | 16.13% | 16.13% | 32.26% | 3.23% |
| Vocabulary | 38.71% | 19.35% | 19.35% | 22.58% | 0.00% |
| Spelling | 38.71% | 29.03% | 19.35% | 12.90% | 0.00% |
| Phonemic Awareness | 41.94% | 29.03% | 16.13% | 12.90% | 0.00% |
| Phonics | 41.94% | 29.03% | 19.35% | 9.68% | 0.00% |
| Fluency | 45.16% | 29.03% | 16.13% | 9.68% | 0.00% |

The previous table represented the quantitative data collected from the 3rd through 6th grade teacher survey, asking teachers their perception of technology integration with the six components of reading instruction. It was noteworthy to observe that anywhere from 50% to 75% of the teachers reported they never or rarely used technology for any of the SAMR levels of technology integration. These findings were further supported by the qualitative data in the open-ended responses. Regardless of whether the teachers provided perceptions on the one-to-one technology, professional development, or the technology effects for minority subgroup student achievement, a common theme noted was a consistent non-use of the technology for reading instruction. This was noted in the comments stating the new technology was rarely or never used or only used to enrich instruction, as opposed to primary instruction. Similarly, teachers reported the professional development offered by the school district was either ineffective or not targeted specifically for how to integrate into reading instruction or instruction in general.

The last question asked of teachers was their perception of how the one-to-one integration had affected the achievement of minority student populations. Over half of the teachers responded felt as if the technology was a significant reason for higher student engagement. Additionally, teachers perceived technology was a great tool for providing differentiated lessons and opportunities for remediation, but based on the quantitative data, were still not implementing the technology with students on any consistent level.

*Teacher Qualitative Survey Open-Ended Responses*

| How has reading instruction and assessment changed, if at all, since implementing the one-to-one technology initiative? | |
|---|---|
| *n = 16* | Frequency |
| Rarely used/no change | 4 |
| Student engagement/differentiated student learning opportunities | 4 |
| Technology used as enrichment, no instruction | 3 |
| Acclimatization to online reading assessments | 3 |
| More access to technology | 2 |
| Students losing motivation for reading literature | 1 |
| In what ways, if any, has the professional development provided by the school district influenced your implementation of one-to-one technology for reading instruction. | |
| *n = 15* | Frequency |
| No change/not effective | 8 |
| More emphasis on collaboration and evaluating data | 3 |
| Better insight on how to use technology in the classroom | 3 |
| PD provided for enrichment, no instruction | 1 |
| In what ways, if any, has the one-to-one technology initiative affected the engagement, learning, and reading achievement of minority student populations, specifically free and reduced lunch, IEP, and ethnic minority students? | |
| *n = 15* | Frequency |
| Higher student engagement and opportunities for differentiated instruction and remediation | 8 |
| No change/no use | 4 |
| Created behavior issues when transitioning away from technology | 2 |
| More access to grade level and minority literature | 2 |
| Immediate feedback for students | 1 |
| Strengthen student skills | 1 |

***Conclusion***

The following conclusions can be drawn from this study:

- ◊ Research Question 1
  - o From the statistical data, no observation could be made to show any positive effect of the school district's one-to-one technology initiative on reading scores, as defined by the MAP ELA exam.
  - o Teachers' use of technology as an instructional tool in the classroom, as categorized by the SAMR model, rated on average in the low "Rarely" to "Sometimes" utilized categories for the six components of reading instruction.
  - o The Likert scale for all components of reading indicated that teachers "Rarely" used technology as tool for reading instructions, with nearly 50% of teachers never using technology as part of the reading curriculum.
  - o Teachers in this research study had not bought in to the value of one-to-one technology and prefer to teach reading instruction in a more traditional manner with technology used as enrichment.
- ◊ Research Question 2
  - o From the statistical data, similar observations were made for the subgroups of free/reduced lunch, IEP, and ethnic minority student achievement, where no observed positive effect on student achievement can be attributed to the one-to-one technology program.
  - o Even though teachers felt the technology initiative increased minority subgroup student engagement and opportunities for differentiated, grade appropriate instruction and remediation, they also indicated they were ill-prepared as the professional development provided was either ineffective or only geared toward enrichment and not primary instruction.
- ◊ Research Question 3
  - o The majority of the teachers indicated the professional development was either not effective or was not targeted specifically enough to affect day-to-day instruction.
  - o Teachers indicated there were mixed signals from the lack of continued professional development and urged the school district to provide more opportunities for learning.
  - o Due to the lack of teacher professional development focused on reading instruction, teachers indicated the technology initiative was not effective and were choosing to only use the technology for enrichment or not at all.
  - o Several teachers revealed that technology should not be used as the primary form of reading instruction.

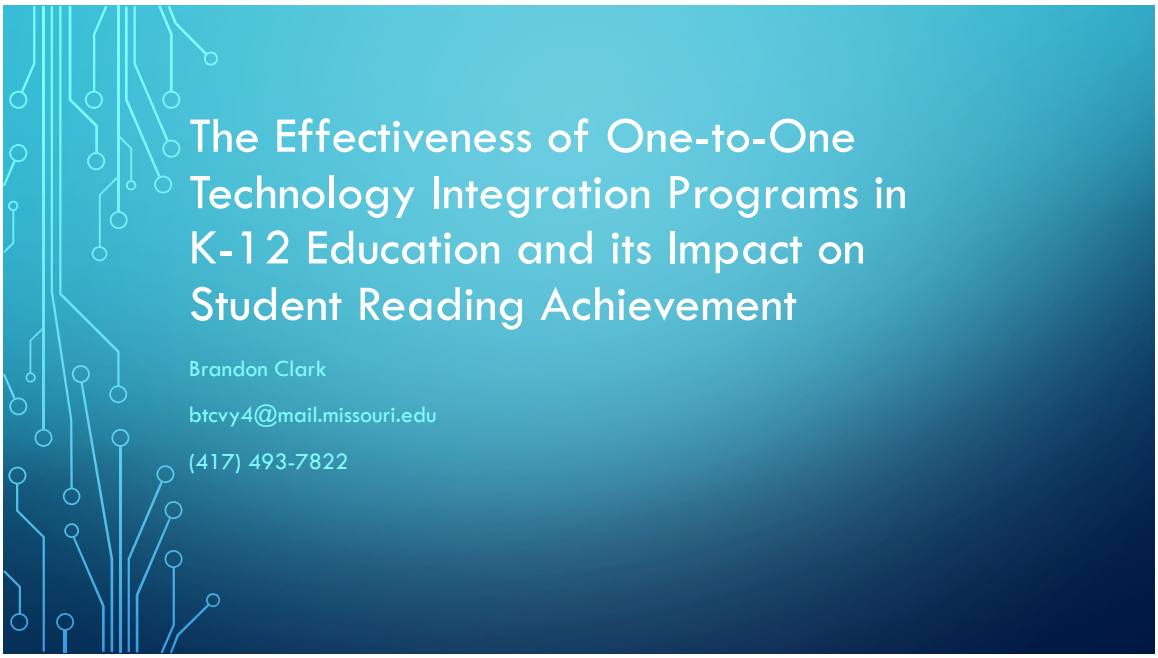
***Recommendations***

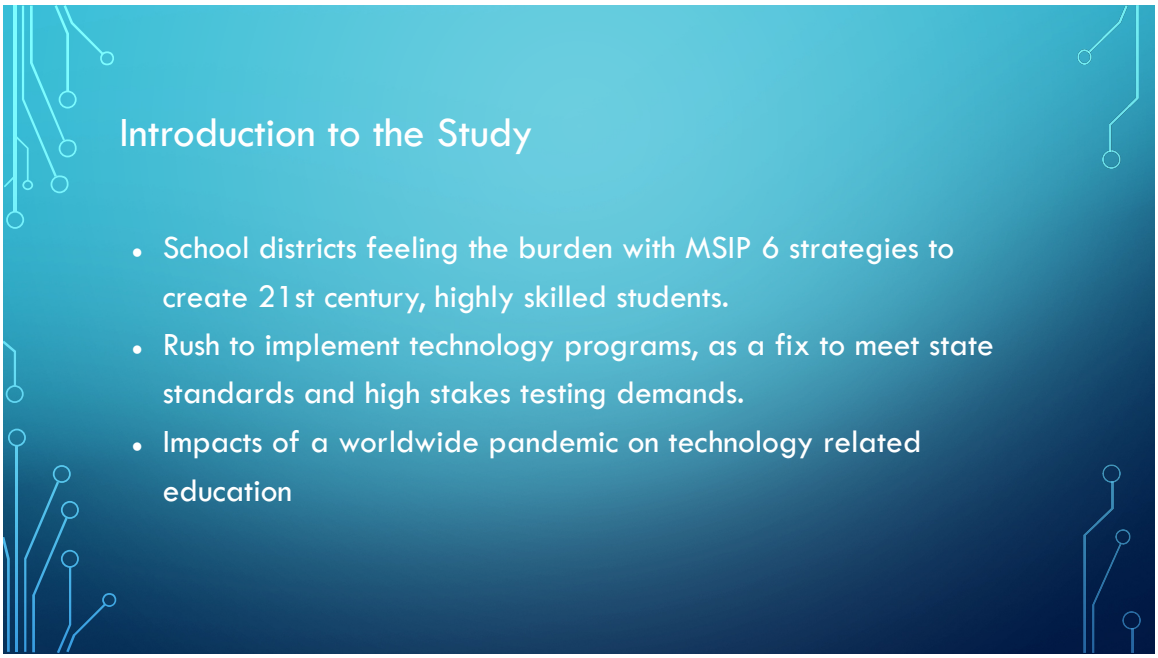
- ◊ Investigate and determine the scale scoring change in the MAP ELA data from 2016 to 2018 and its effects on the overall drop in assessments scores.
- ◊ Obtain Scholastic Reading Inventory (SRI) data of current 3rd-6th grade students and compare classrooms with no use of technology to high use of technology for reading instruction.

- ◊ Utilize the Professional Learning Communities (PLCs) to develop common formative assessments that would specifically measure the six components of reading instruction with and without technology instruction.
- ◊ Conduct additional qualitative research to uncover whether the lack of technology use was solely related to lack of professional development or routed in either traditional teaching beliefs or stress from high-stakes standardized tests.
- ◊ Develop professional development opportunities for reading instruction that cover the following topics:
    - o Technology integration as an effective instructional tool
    - o SAMR model for technology integration
    - o Helping minority subgroups with the use of technology in the classroom
    - o Technology as a remedial tool for increasing student reading achievement
    - o Cultural hegemony and its effects on minority student groups

Li (2010) captured the challenges that administrators will face when attempting to implement a significant pedagogical change such as a one-to-one technology integration. As the research study uncovered, teacher buy-in and professional development are key elements to successful implementation, but as the previous research also suggested, a clear path with targeted goals must be developed, along with examples of proven practice to help teachers overcome the entrenched, traditional views on teaching reading curriculum. Li stated, "With a clear vision, curriculum goals, innovative pedagogies and professional development, teachers will develop their awareness and change their practices accordingly when exposed to or confronted with the success demonstrated by exemplary practices" (p. 285).

**Presentation**




As an instructional leader, it is imperative when looking at new and innovative programs and ideas to fully vet the processes, especially when millions of dollars are being invested as a strategy to create twenty-first century learners and increase student

achievement scores. Since this school district invested millions of the tax payer dollars on a one-to-one technology initiative, it was necessary to make a concerted effort to the look at the effects of this adoption on student achievement. Claro, Nussbaum, López, and Diaz (2013) indicated these types of technology adoptions only positively impact student achievement under very specific circumstances. This was especially important when it came to the professional development provided to equip teachers on how to incorporate such technology into the curriculum and everyday lessons. Due to the global COVID-19 pandemic, this technology preparedness issue was shoved violently to the forefront for all school districts and most school districts were ill-prepared to incorporate this technology in a meaningful way to keep students persisting toward graduation (Kaloostian, McCall, & Chhertri, 2020).

States across the nation were spending millions of dollars to implement one-to-one technology programs, but there was minimal research showing any positive, significant correlation between technology use and student achievement (Claro et. al.,

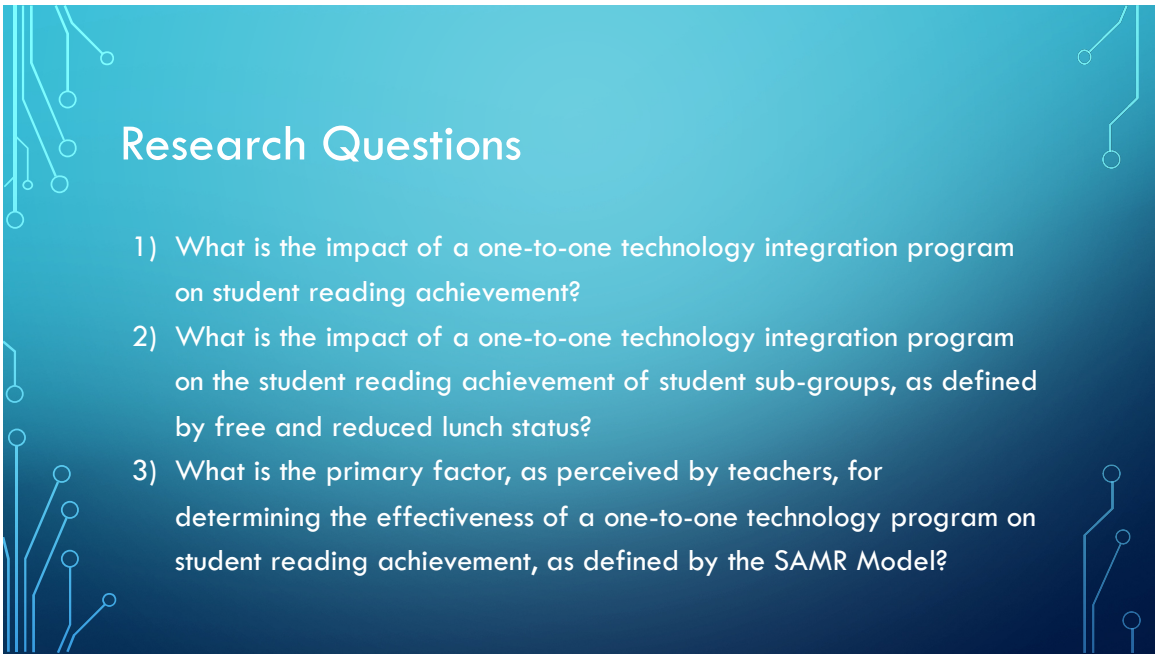
2013; Inserra & Short, 2012; Keengwe, Schnellert, & Mills, 2012; Lei & Zhao, 2008). To further complicate the issue, school districts were struggling to properly implement these technology initiatives, especially once COVID-19 shut down seated classes, rushing school districts to get the technology in the students' hands without proper teacher and administrator buy-in or providing adequate professional development for how to integrate the technology into the curriculum (Chanlin, 2007).

As our nation moved into what could be a potential recession, administrators, school boards, and tax payers were looking for ways to save money in school budgets. Even though it could be assumed that no one in the community would fight for less technology in classroom, there may be a need to reallocate how technology money was being spent, as budget cuts were looming. As schools looked to pass future bond and tax levies, many of which will involve classroom technology, this study was imperative to give this school district a guide for technology purchasing, teacher PD, and revision of curriculum.

Very little research had been conducted to show the statistically significant impact of integrating technology into the classroom (Claro, Nussbaum, López, & Díaz, 2013). Claro, et al. (2013) stated "there are very few experimental studies that allow for empirically sound conclusions related to causality between ICT (Information and Communications Technology) and student performance. Where evidence seems to converge is in indicating a non-linear and complex relationship between ICT and learning" (p. 316). As school districts were being forced to integrate technology, either through Bring Your Own Device (BYOD) or one-to-one technology programs, researchers were seeing the impact on minority student subgroups when it came to equity and access, as well as teacher preparation and buy-in to implement such technology into their lessons. Shank and Cotton (2014) emphasized two parts for the potential of disadvantages when implementing technology in the classroom with minority student subgroups. Firstly, with certain student subgroups, access to technology outside of the school could significantly impact how these students could effectively utilize technology,

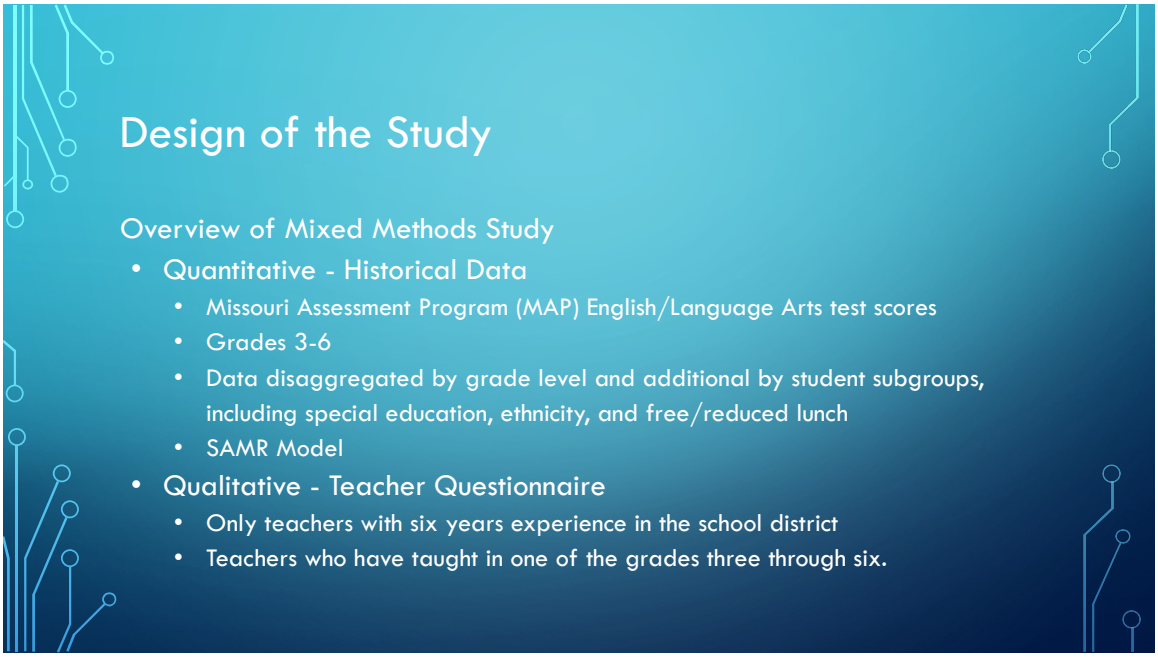
like access to the Internet. Secondly, depending on the student subgroup, there may be a different culture or views on how technology was used in the student's home. The lack of appropriate technology modeling in the home could significantly impact how an underprivileged student would use technology at home and school, regardless if the school was providing the technology.

On top of all of the student concerns with integrating technology, researchers indicated that administrator and teacher buy-in was essential for effective implementation. Li (2010) emphasized "…teachers' conceptions does not necessarily effect change in their practices and student learning" (p. 285). Instead, school districts have to develop a clear vision, goals, and professional development that will help convince teachers to change their instructional practices through clear evidence of success in implementing technology and its effects on student achievement (Li, 2010).

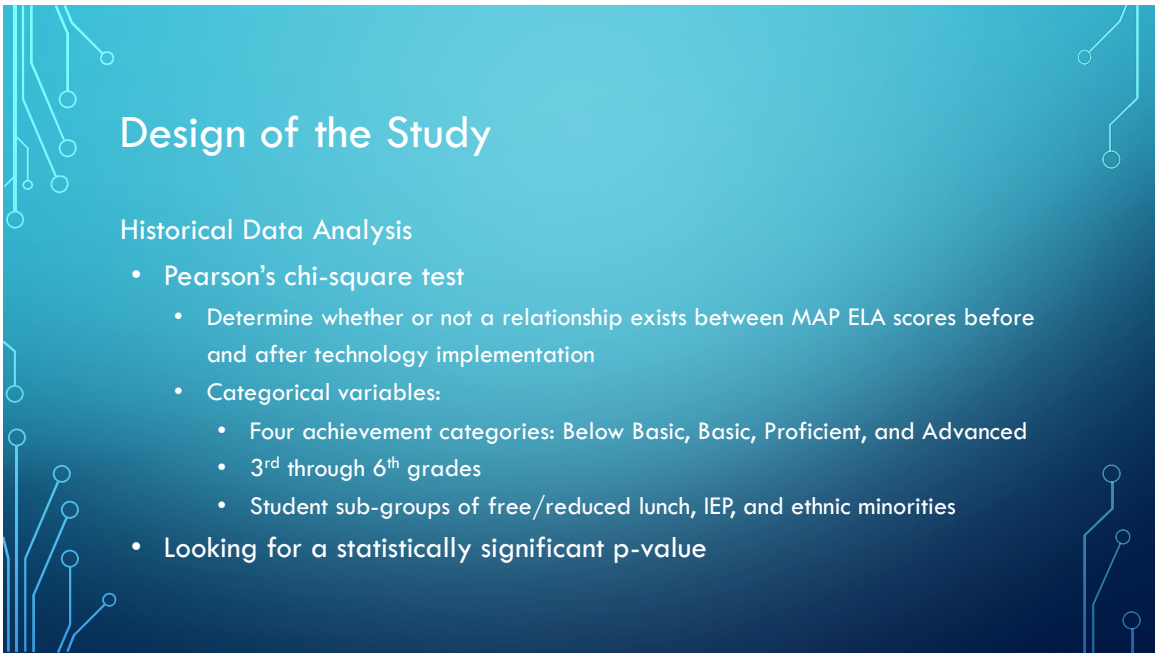



The first and second research questions were addressed through historical MAP ELA data collected from the spring of 2016 and 2018. Since 2016-17 was an

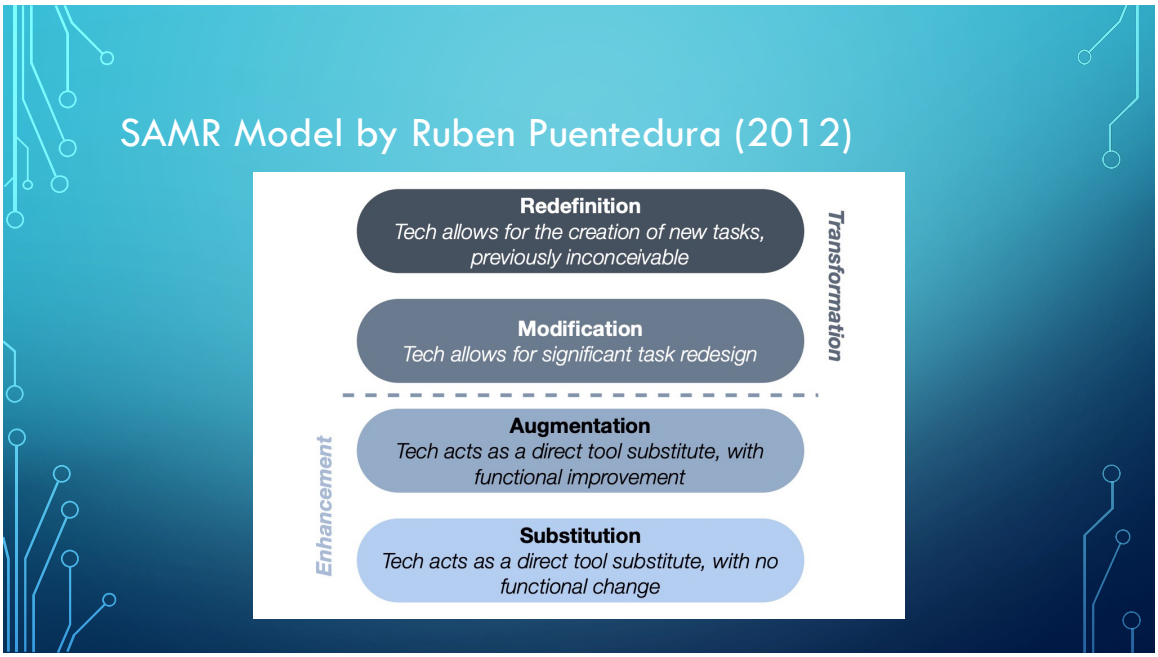
implementation year, this data were excluded to avoid any implementation issues or drops in assessment scores. Additionally, the SAMR level of integration questions would be used to support research questions one and two. The third research question was addressed through an open-ended teacher survey regarding the effects of one-to-one technology on student reading achievement. The additional qualitative data collected would be used to support research questions one and two as well.




Historical MAP ELA data were obtained from 2016 and 2018, excluding 2017 as an implementation year. ELA data were collected as a raw score and a categorical identifier of (a) below basic, (b) basic, (c) proficient, and (d) advanced. Quantitative and qualitative data were collected from elementary teachers who taught with at least six years of experience in grades three through six. The SAMR technology integration model was used as additional quantitative data to indicate at what levels teachers perceived they were integrating technology into the reading curriculum.

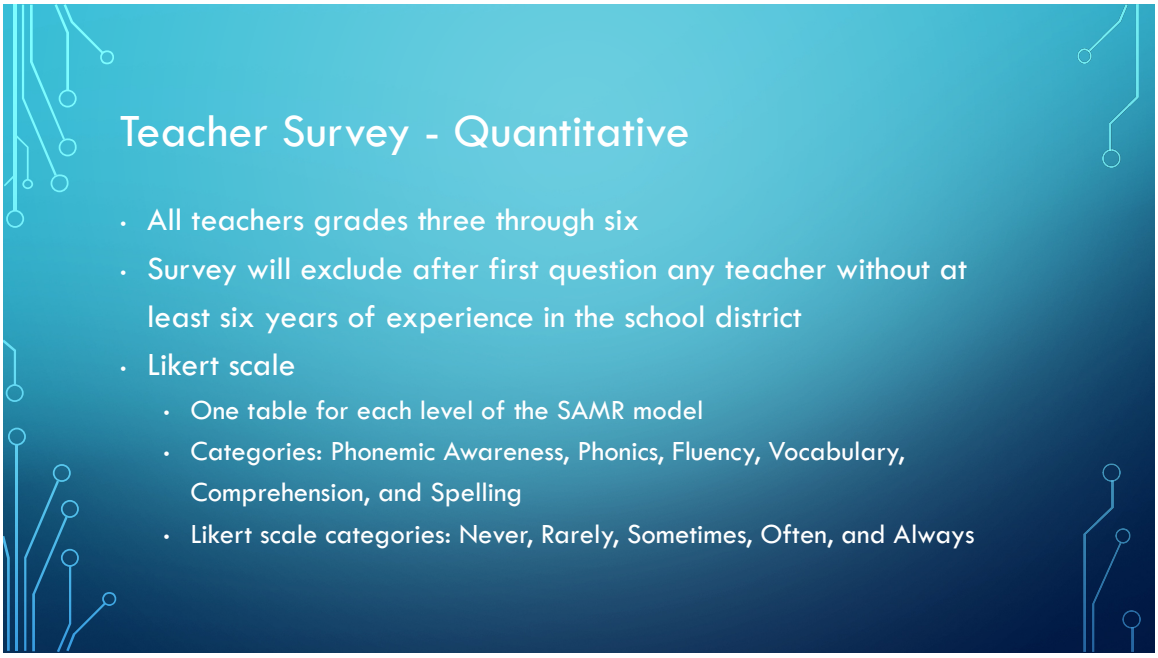



Initially, an independent samples t-test was planned, but due to the State of Missouri's shifting numeric range for reading assessments, it made a cross-tabulation and Pearson's chi-square test for homogeneity the logical choice for testing for significance in the distribution of assessment scores. Assessment data were compared for all grades three through six for 2016 and 2018. Additionally, the minority student subgroups of free/reduced lunch, IEP, and ethnicity were also compared across each grade for the years of 2016 and 2018.

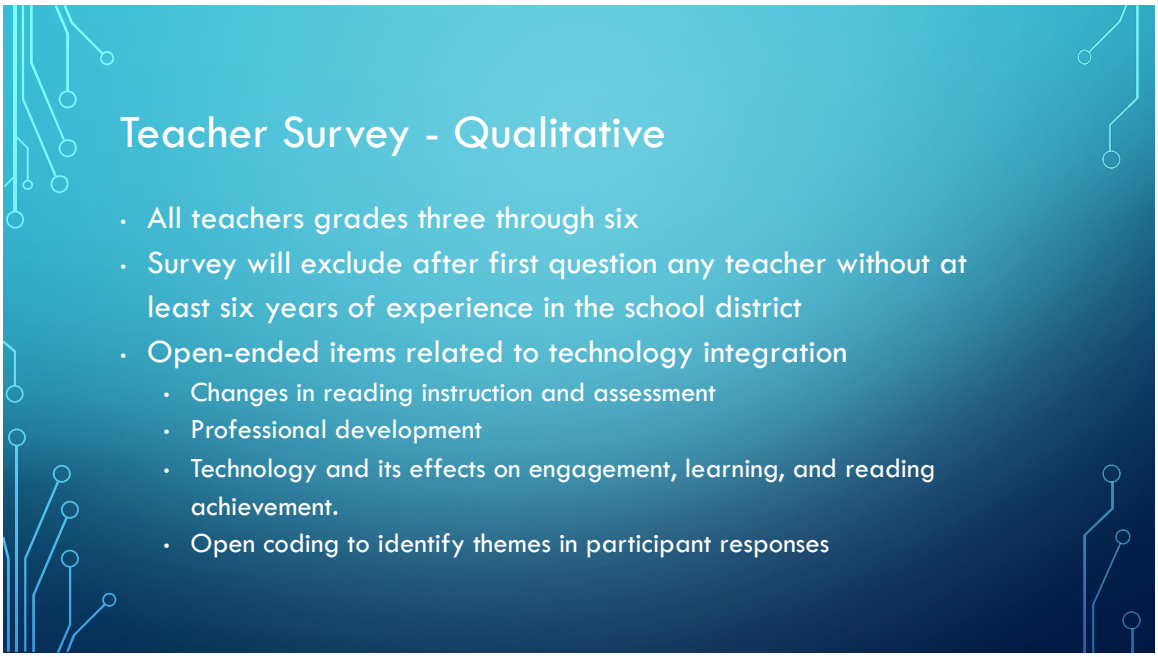



For the quantitative portion of the teacher survey, Ruben Puentedura's (2012) SAMR technology integration model was used to rate the six instructional reading components of (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary, (e) text comprehension, and (f) spelling. The integration model utilized two main parts of technology integration into instruction, (a) enhancement and (b) transformation. The first two levels of the enhancement portion were Substitution and Augmentation, and ranged from simple replacement of paper/pencil tasks for technology to using technology as a functional improvement to the instruction. The transformational portion consisted of the higher two categories of Modification and Redefinition, which required the teacher to redesign the lesson with the technology as a main function of the learning or where the technology allowed students to create new learning, not possible without the use of technology (Puentedura, 2012). Caukin and Trail (2019) broke the SAMR model into student action verbs that separated the lower and higher tiers of technology integration. For the enhancement level, in order, students could remember, understand, and apply new

learning with the help of technology. The transformational level of the SAMR model had students analyzing, evaluating, and creating new learning via technology.




The first portion of the teacher survey asked teachers to rate their frequency of implementing the four levels of the SAMR model compared to the six categories of reading instruction. This part of the survey used a five-tier, Likert scale with descriptors, ranging from Never to Always. The percentage of responses were recorded for each SAMR level and the reading instructional components.




The second portion of the teacher survey asked three open-ended questions about how the one-to-one technology initiative had changed reading instruction, impact of professional development provided by the school district, and how the one-to-one technology initiative had affected the minority student subgroups. Each response was open coded with key words and ideas, then the process of analytical coding was performed to group common key words into larger themes (Merriam, 2009).

## Participants and Survey Overview

| Cross-Tabulation & Chi-square | | | |
|---|---|---|---|
| 2016 Students | | 2018 Students | |
| 3rd-6th Grade | 1841 | 3rd-6th Grade | 1877 |
| 3rd Grade | 480 | 3rd Grade | 474 |
| 4th Grade | 426 | 4th Grade | 444 |
| 5th Grade | 478 | 5th Grade | 522 |
| 6th Grade | 457 | 6th Grade | 437 |
| Minority | 244 | Minority | 271 |
| IEP | 240 | IEP | 262 |
| Free/Reduced Lunch | 715 | Free/Reduced Lunch | 653 |

## Participants and Survey Overview

| Teacher Survey | |
|---|---|
| n = 66 | |
| Average years of experience = 11.1 | |
| Number of Responses by Question | |
| Substitution | 42 |
| Augmentation | 35 |
| Modification | 34 |
| Redefinition | 31 |
| Instruction & Assessment | 16 |
| Professional Development | 15 |
| Free/Reduced Lunch | 15 |

Data from over 1800 students in each of the 2016 and 2018 assessment years were collected, along with 66 teachers with an average teacher tenure of approximately 11 years. Of the 66 teachers who participated in the survey, 42 of them qualified with teaching at least six years in the school district. Of those 42, decreasing participation was noted as the questions became open-ended.

## All Students – ELA Scores & Chi-square

| Grade | Year | Achievement Level | | | |
|---|---|---|---|---|---|
| | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | 4.8% | 15.2% | 49.8% | 30.2% |
| | 2018 | 11.4% | 25.5% | 31.2% | 31.9% |
| 4*** | 2016 | 4.2% | 11.0% | 46.9% | 37.8% |
| | 2018 | 6.8% | 28.2% | 39.6% | 25.5% |
| 5*** | 2016 | 6.5% | 13.6% | 49.0% | 31.0% |
| | 2018 | 7.5% | 37.4% | 32.6% | 22.6% |
| 6** | 2016 | 6.3% | 21.9% | 44.4% | 27.4% |
| | 2018 | 6.2% | 27.7% | 32.0% | 34.1% |
| 3-6*** | 2016 | 5.5% | 15.5% | 47.6% | 31.5% |
| | 2018 | 8.0% | 29.9% | 33.8% | 28.3% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

For each comparison, grades three through six, the Pearson's chi-square test for homogeneity produced a *p* value of less than .05, indicating the null hypothesis could be rejected, showing there was a significance difference in the distribution of the 2016 and 2018 assessment scores. However, when comparing the two years, 2018 showed a significant decrease in the percentage of proficient students in each grade.

## Ethnic Minority Students – ELA Scores & Chi-square

| Grade | Year | Achievement Level | | | |
|---|---|---|---|---|---|
| | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | 3.8% | 15.2% | 59.5% | 21.5% |
| | 2018 | 19.2% | 26.9% | 21.8% | 32.1% |
| 4 | 2016 | 11.1% | 13.0% | 40.7% | 35.2% |
| | 2018 | 7.3% | 32.7% | 38.2% | 21.8% |
| 5** | 2016 | 12.7% | 14.5% | 50.9% | 21.8% |
| | 2018 | 3.9% | 36.4% | 29.9% | 29.9% |
| 6 | 2016 | 5.4% | 32.1% | 35.7% | 26.8% |
| | 2018 | 13.1% | 31.1% | 26.2% | 29.5% |
| 3-6*** | 2016 | 7.8% | 18.4% | 48.0% | 25.8% |
| | 2018 | 11.1% | 31.7% | 28.4% | 28.8% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

When comparing the ethnic minority students ELA MAP scores from 2016 to 2018, all grades, except for grade six, showed a significant difference in the distribution of the scores. The largest drop in proficient performance was noted in the third grade with a decrease of 37.7% with other the fifth grade and all grades combined dropping near 20%.

## Free/Reduced Lunch – ELA Scores & Chi-square

| Grade | Year | Achievement Level | | | |
|---|---|---|---|---|---|
| | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | 6.5% | 17.9% | 54.2% | 21.4% |
| | 2018 | 15.4% | 32.0% | 29.0% | 23.7% |
| 4*** | 2016 | 9.9% | 17.8% | 49.3% | 23.0% |
| | 2018 | 15.4% | 36.9% | 36.9% | 10.8% |
| 5*** | 2016 | 10.7% | 18.3% | 50.3% | 20.8% |
| | 2018 | 13.5% | 44.5% | 26.5% | 15.5% |
| 6 | 2016 | 9.7% | 33.9% | 37.6% | 18.8% |
| | 2018 | 13.0% | 38.3% | 25.3% | 23.4% |
| 3-6*** | 2016 | 9.1% | 21.7% | 48.3% | 21.0% |
| | 2018 | 14.2% | 38.3% | 28.9% | 18.5% |

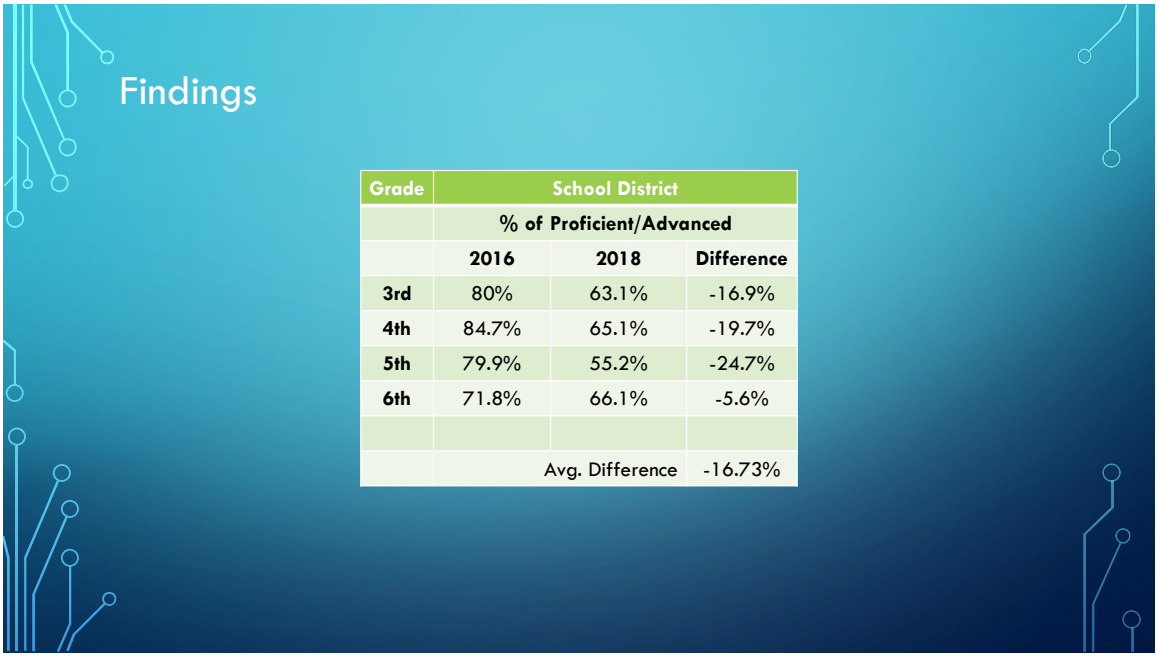
*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

## IEP Students - ELA Scores & Chi-square

| Grade | Year | Achievement Level | | | |
|---|---|---|---|---|---|
| | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | 16.7% | 25.8% | 51.5% | 6.1% |
| | 2018 | 42.6% | 36.8% | 10.3% | 10.3% |
| 4*** | 2016 | 10.9% | 26.1% | 43.5% | 19.6% |
| | 2018 | 29.5% | 47.5% | 18.0% | 4.9% |
| 5*** | 2016 | 26.9% | 31.3% | 37.3% | 4.5% |
| | 2018 | 31.3% | 53.8% | 8.8% | 6.3% |
| 6 | 2016 | 24.6% | 42.6% | 31.1% | 1.6% |
| | 2018 | 22.6% | 39.6% | 30.2% | 7.5% |
| 3-6*** | 2016 | 20.4% | 31.7% | 40.8% | 7.1% |
| | 2018 | 32.1% | 45.0% | 15.6% | 7.3% |

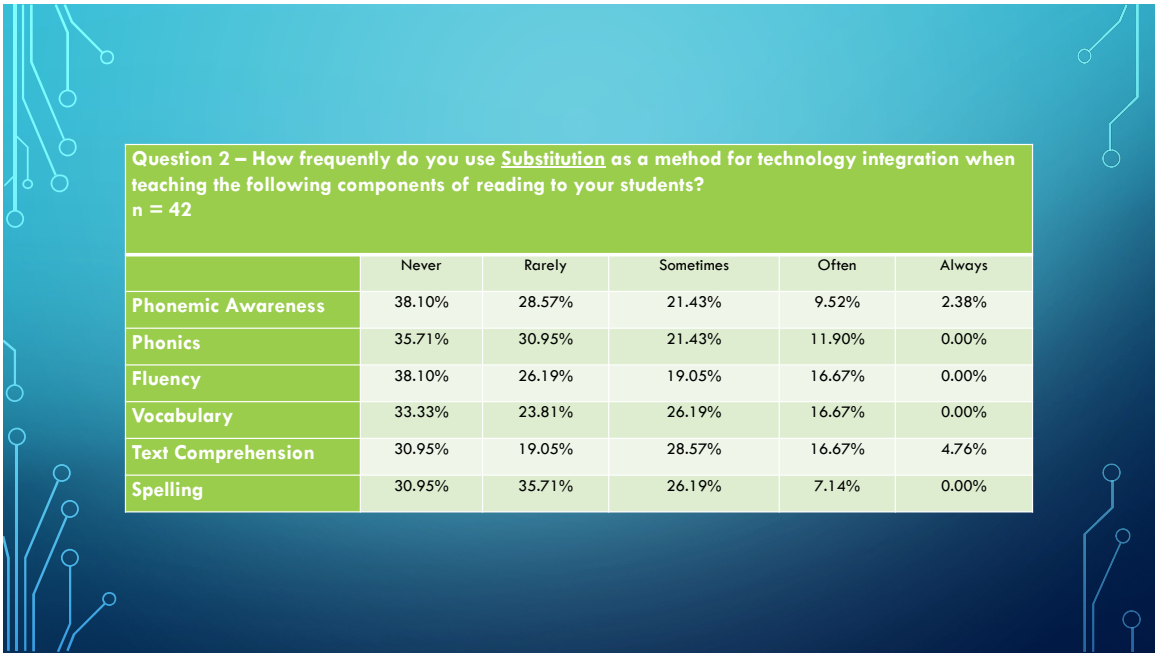
*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

Similar to the ethnic minority student populations, the free/reduced lunch and IEP student assessment scores produced similar *p* values, showing no significant difference in the distribution of scores for the sixth grade group only. The ethnic minority and free/reduced lunch subgroups dropped an average of 18% in the proficient category, while the IEP student subgroup had the highest drop in proficient scores with an average of 24.26%. In all subgroups, the largest shift was noted as student dropped from the proficient to the basic category.




When looking at the cross-tab tables, it was important to note that of the 20 Pearson chi-square tests for homogeneity ran, 16 of the tests indicated a significant difference in the distribution of scores from 2016 to 2018. However, the main significant observation was drastically different from what was originally hypothesized about technology positively affecting reading test scores. All grades and student subgroup populations, except for sixth grade IEP students, saw a decrease in the amount of

proficient and advanced student scores from 2016 to 2018. Sixth grade IEP students increased from 32.7% to 37.7%, increasing by 4.7%.



**Question 2 – How frequently do you use Substitution as a method for technology integration when teaching the following components of reading to your students?**
**n = 42**

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| **Phonemic Awareness** | 38.10% | 28.57% | 21.43% | 9.52% | 2.38% |
| **Phonics** | 35.71% | 30.95% | 21.43% | 11.90% | 0.00% |
| **Fluency** | 38.10% | 26.19% | 19.05% | 16.67% | 0.00% |
| **Vocabulary** | 33.33% | 23.81% | 26.19% | 16.67% | 0.00% |
| **Text Comprehension** | 30.95% | 19.05% | 28.57% | 16.67% | 4.76% |
| **Spelling** | 30.95% | 35.71% | 26.19% | 7.14% | 0.00% |

Question number two of the teacher survey compared the teachers' perceptions of how often they used the SAMR model's lowest level of technology integration, Substitution. Approximately 50% to 65% of the teachers indicated they never or rarely used the lowest form of technology integration for reading instruction.

**Question 3 – How frequently do you use Augmentation as a method for technology integration when teaching the following components of reading to your students?**
**n = 35**

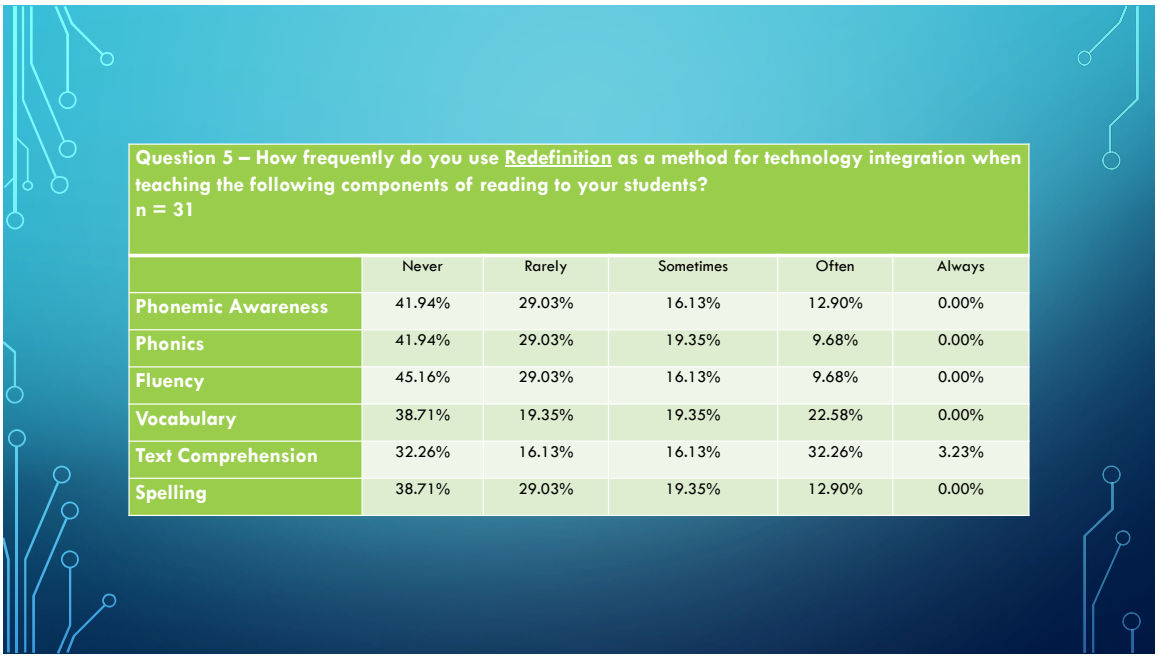
| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| **Phonemic Awareness** | 45.71% | 22.86% | 25.71% | 5.71% | 0.00% |
| **Phonics** | 42.86% | 17.14% | 37.14% | 2.86% | 0.00% |
| **Fluency** | 45.71% | 11.43% | 34.29% | 8.57% | 0.00% |
| **Vocabulary** | 37.14% | 20.00% | 28.57% | 14.29% | 0.00% |
| **Text Comprehension** | 28.57% | 20.00% | 37.14% | 11.43% | 2.86% |
| **Spelling** | 42.86% | 31.43% | 20.00% | 5.71% | 0.00% |

For the second level of the enhancement category of the SAMR model, approximately 48% to 74% of the teachers similarly reported they never or rarely used technology to integrate into reading lessons at the augmentation level.

**Question 4 – How frequently do you use Modification as a method for technology integration when teaching the following components of reading to your students?**
**n = 34**

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| **Phonemic Awareness** | 41.18% | 32.35% | 17.65% | 8.82% | 0.00% |
| **Phonics** | 38.24% | 35.29% | 17.65% | 8.82% | 0.00% |
| **Fluency** | 41.18% | 23.53% | 14.71% | 20.59% | 0.00% |
| **Vocabulary** | 29.41% | 38.24% | 11.76% | 20.59% | 0.00% |
| **Text Comprehension** | 32.35% | 17.65% | 26.47% | 20.59% | 2.94% |
| **Spelling** | 38.24% | 32.35% | 14.71% | 14.71% | 0.00% |

For the first level of the transformative phase of integrating technology into reading curriculum, 50% to 73% of the teachers indicated they never or rarely used technology for any of the six levels of reading instruction.



**Question 5 – How frequently do you use Redefinition as a method for technology integration when teaching the following components of reading to your students?**
**n = 31**

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| **Phonemic Awareness** | 41.94% | 29.03% | 16.13% | 12.90% | 0.00% |
| **Phonics** | 41.94% | 29.03% | 19.35% | 9.68% | 0.00% |
| **Fluency** | 45.16% | 29.03% | 16.13% | 9.68% | 0.00% |
| **Vocabulary** | 38.71% | 19.35% | 19.35% | 22.58% | 0.00% |
| **Text Comprehension** | 32.26% | 16.13% | 16.13% | 32.26% | 3.23% |
| **Spelling** | 38.71% | 29.03% | 19.35% | 12.90% | 0.00% |

Of the 31 teachers who responded to the last level of the SAMR model for technology integration, 48% to 71% of the teachers responded they never or rarely used technology for reading instruction. However, 32.26% of the teachers responded they utilized this level of the SAMR model "Often" for teaching text comprehension. In all four levels of the SAMR model, text comprehension had the highest average percentage for integrating technology into this portion of the reading curriculum.

How has reading instruction and assessment changed, if at all, since implementing the one-to-one technology initiative?

| n = 16 | Frequency |
|---|---|
| Rarely used/no change | 4 |
| Student engagement/differentiated student learning opportunities | 4 |
| Technology used as enrichment, not instruction | 3 |
| Acclimatization to online reading assessments | 3 |
| More access to technology | 2 |
| Students losing motivation for reading literature | 1 |

In what ways, if any, has the professional development provided by the school district influenced your implementation of one-to-one technology for reading instruction.

| n = 15 | Frequency |
|---|---|
| No change/not effective | 8 |
| More emphasis on collaboration and evaluating data | 3 |
| Better insight on how to use technology in the classroom | 3 |
| PD provided for enrichment, no instruction | 1 |

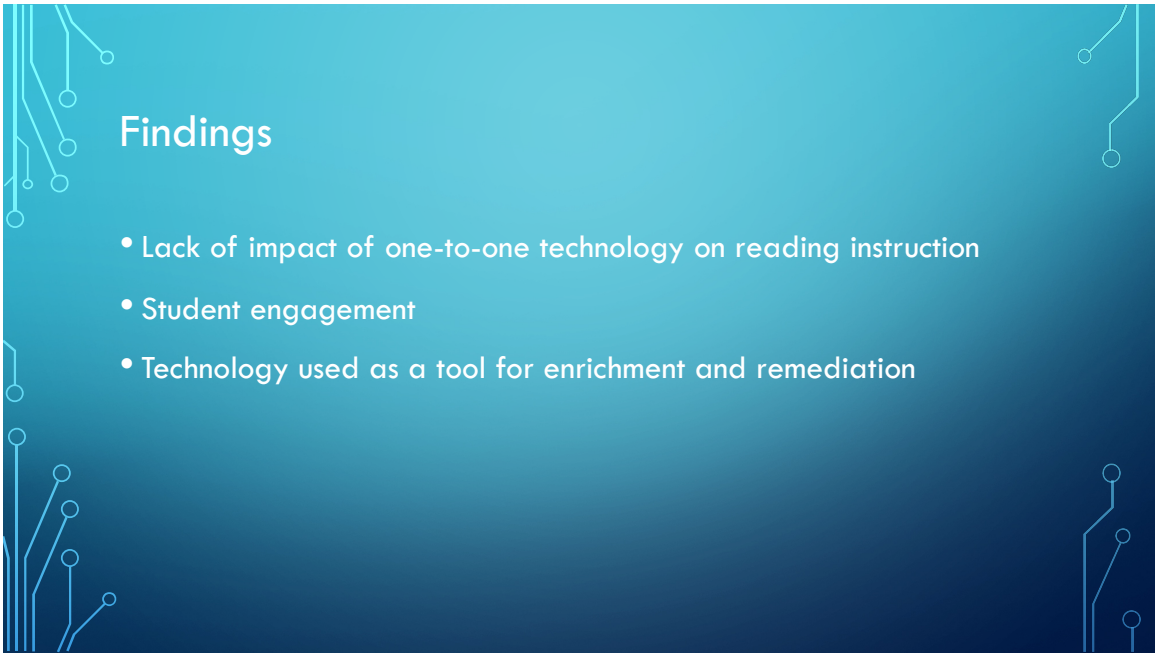
In what ways, if any, has the one-to-one technology initiative affected the engagement, learning, and reading achievement of minority student populations, specifically free and reduced lunch, IEP, and ethnic minority students?

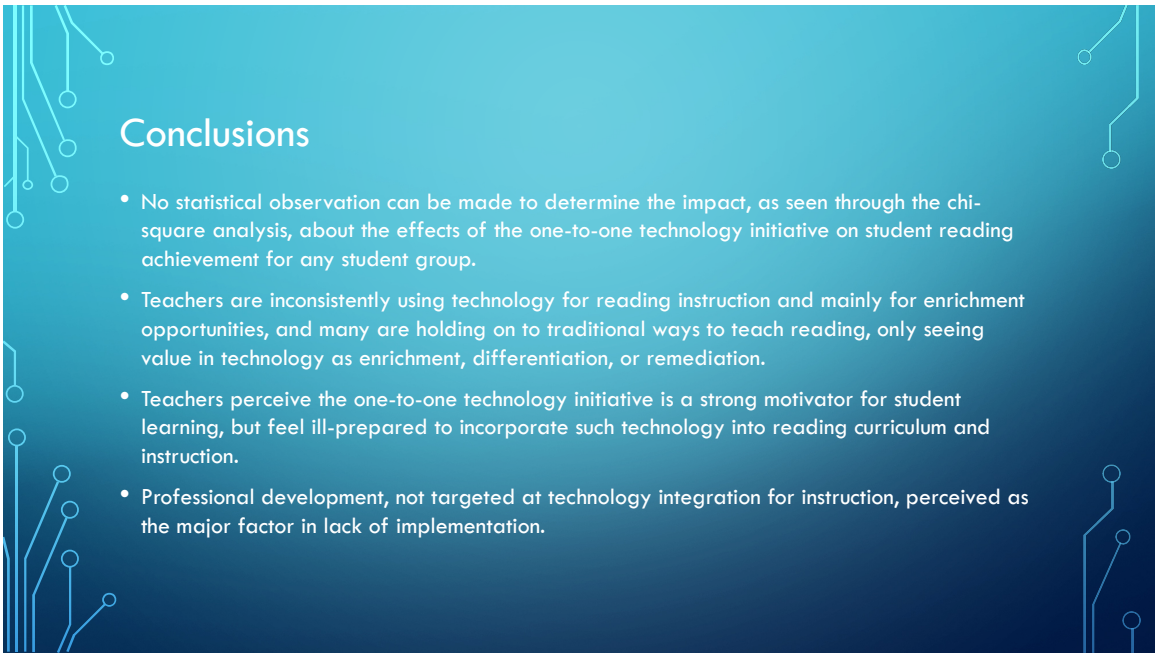
| n = 15 | Frequency |
|---|---|
| Higher student engagement and opportunities for differentiated instruction and remediation | 8 |
| No change/no use | 4 |
| Created behavior issues when transitioning away from technology | 2 |
| More access to grade level and minority literature | 2 |
| Immediate feedback for students | 1 |
| Strengthen student skills | 1 |

For the three open-ended response questions in the teacher survey, 15 to 16 of the 42 qualifying teachers provided responses. The first question asked teachers to give their perceptions of how the technology initiative changed reading instruction and assessment. The most common themes that emerged were "Rarely Used/No Change," "Student Engagement," and "Technology Used as Enrichment, Not Instruction." Of the 16 teachers who responded, 7 of the 16 indicated the technology had little effect on reading instruction and curriculum.

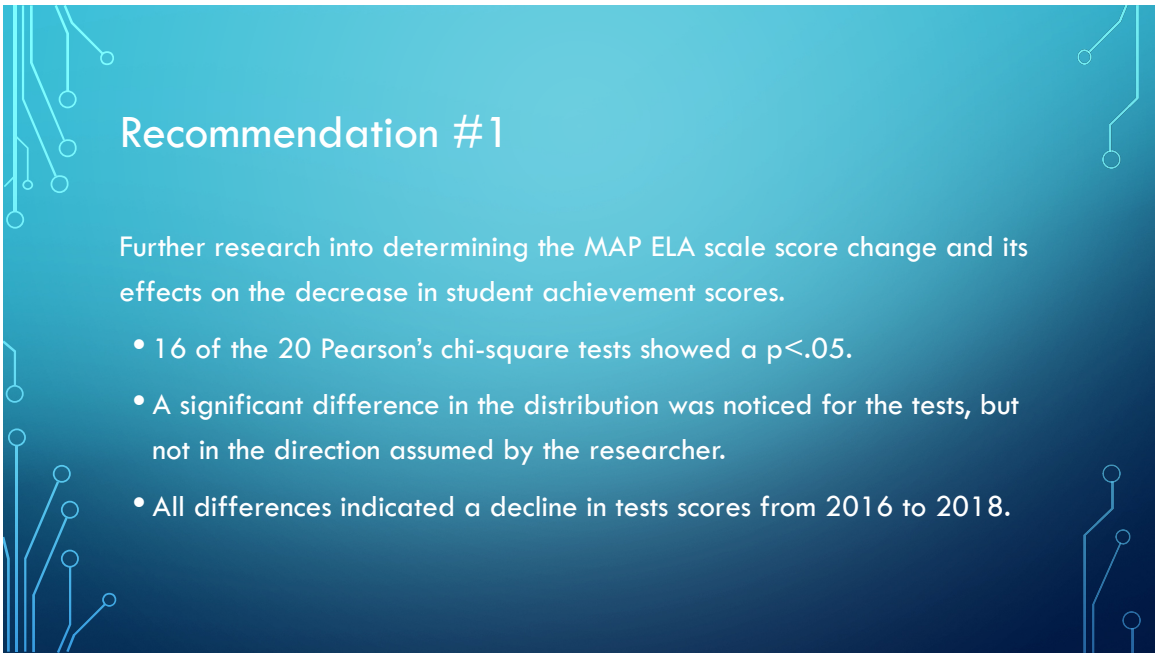
The next question asked teachers to rate the influence of the school district's professional development on reading instruction. The three main themes that emerged were "No Change/Not Effective," More Emphasis on Collaboration/Evaluating Data," and "Better Insight on How to Use Technology in the Classroom." Of the 15 respondents, even though three of them indicated they felt more confident in how to use technology in the classroom, 8 of the 15 teachers felt the professional development was ineffective and provided no impact on the reading instruction.

For the final question, teachers were asked to give their perceptions on how the one-to-one technology initiative affected the previously mentioned minority student subgroups. Two major themes emerged from the 15 responses, "Higher Student Engagement/Opportunities for Differentiated Instruction and Remediation" and "No Change/Not Using." Over half of the teachers strongly felt technology created higher student engagement for minority student subgroups, but also felt it created new challenges and potential discipline when students were asked to transition away from using the technology. However, the second most common response from teachers was the technology was having no impact on minority subgroup student learning.






Even though the Pearson's chi-square analysis showed 16 of the 20 cases to have a significant difference in the distribution of the test scores, no connection between the technology initiative could be attributed to the test scores from 2016 to 2018. From the qualitative portion of the data, teachers showed their inconsistent use and application of technology for reading instruction. Most teachers saw it as an opportunity for enriching the reading curriculum, but the majority of teachers surveyed continued using proven paper/pencil methods for teaching the six components of reading instruction. Lastly, even though teachers perceived integrating technology into the classroom was increasing student motivation and engagement, they felt unprepared to utilize this technology for reading instruction at any level of the SAMR model.

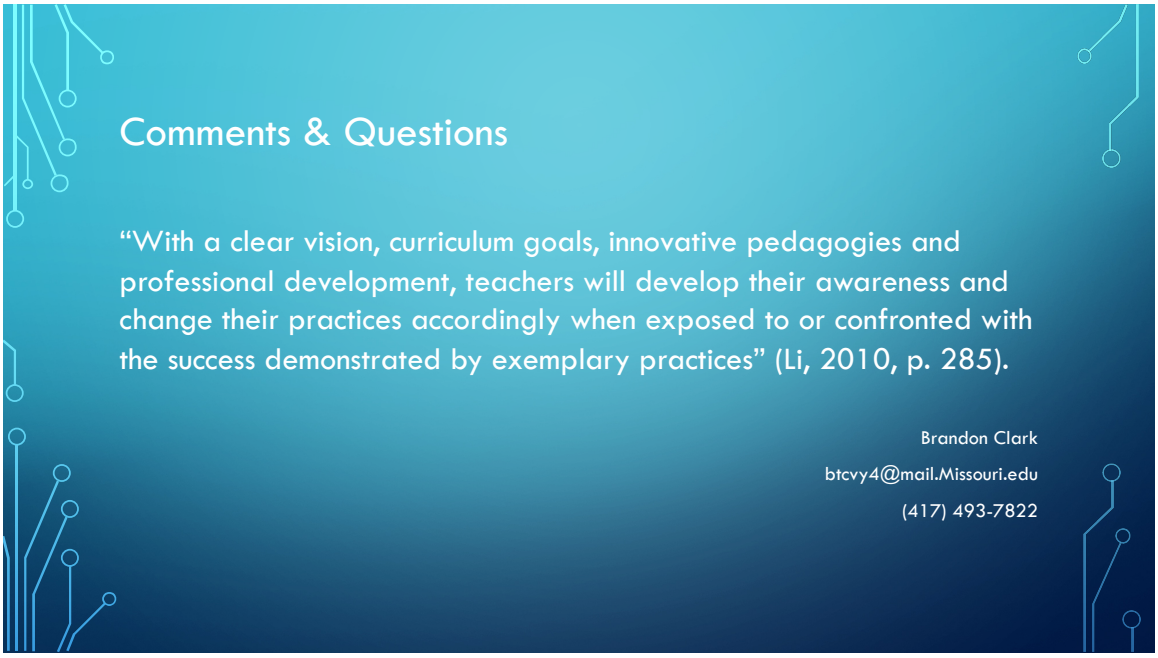



The first recommendation was for further research into the shifting scale score of the MAP ELA test. If any common scale could be established, an independent samples t-test could be utilized to further examine the relationship between the 2016 and 2018 MAP assessment scores. Additionally, it would be necessary for the school district to longitudinally look at the MAP ELA test scores, compared to the state and see if any other patterns or themes emerge from the decreasing proficient and advanced student percentages.

To further justify the expense of technology and professional development, the school district could utilize the already formed Professional Learning Communities (PLCs) as another strategy to gather data on the effectiveness of technology integration. In these groups, teachers could create common formative assessments for reading and create control and experimental groups of students to test the effectiveness of reading instruction with and without technology. Similarly, district administrators could work to gather Scholastic Reading Inventory (SRI) data from 2016 and 2018 and perform a similar analysis to determine any significant differences.

The district curriculum office needs to revisit the professional development provided to teachers for technology integration. As many of the teachers indicated little to no use or change in use of technology for reading instruction, the professional development needs to focus on creating the teacher buy-in, as well as the tools to implement into reading instruction. Inserra and Short (2012) stated, "Presently, K-12 schools have invested heavily to acquire computer-based technologies. However, potential educational benefits of these investments cannot take place unless teachers are prepared to use these computers effectively in their instruction" (p. 938). Even though the school district provided a large district-wide training for teachers as the technology initiative was being rolled out, little to no attention has been given to this important topic in current PD sessions. Examples of topics for the upcoming professional development could include the SAMR model of technology integration, how to use technology as an instruction tool for reading curriculum, and how technology can assist minority student

subgroups with reading achievement, how to use technology as a remedial or differentiation tool, and introducing the topic of cultural hegemony.



# SECTION FIVE

# CONTRIBUTION TO SCHOLARSHIP

## Preface

As school districts across the country have moved toward a greater emphasis on using technology as a primary educational tool, either by choice or due to the COVID-19 pandemic, there was increasing interest on how these expensive investments are impacting student learning (Keengwe, Schnellert, & Mills, 2012; Lei & Zhao, 2008). While there seems to be significant interest in this topic, there was minimal research conducted to address this topic, as well any significant conclusions, from the limited research about the impact of technology on student learning (Claro, Nussbaum, López, & Díaz, 2013). A mixed methods case study focused on a program evaluation of one-to-one technology fits the content desired by the *Journal for Research on Technology in Education (JRTE).* According to the submission guidelines for the International Society for Technology in Education (ISTE; 2023):

> The *Journal of Research on Technology in Education (JRTE*) publishes articles that report on original research, project descriptions/evaluations, syntheses of the literature, assessments of the state of the art, and theoretical or conceptual positions that relate to the field of educational technology in teaching and learning and inform P-16 school-based practice. (Content section, para. 1)

Additionally, the ISTE (2023), who produced the *JRTE*, had created professional development standards for educators that state "Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning" (2.1 Learner section, para. 1). This mixed methods case study took a common educational problem, especially since the COVID-19 pandemic, and provided research that improves educational practice and

gives teachers and administrators a starting point for assessing their technology and its effects on student achievement.

ISTE (2023) provided guidelines for submitting journal articles for the *JRTE* publication. ISTE also provided a template with content and formatting for sections, which included the style and type of headings for APA style (6th ed.), title page format, and content for biography of author.

The following are the requirements for submission:

1. The article must include the following sections:
    a. Introduction to the Problem
        i. Review of the Literature
        ii. Theoretical Framework
        iii. Research Questions
    b. Methods
    c. Results
    d. Discussion
2. Submissions must be between 4,000 and 8,000 words, including title page and abstract, references, and tables/figures.
3. Abstract must be 150-250 words.
4. Submissions must be formatted in APA style (6th ed.).
5. Submissions must be sent as one Word document, either in a .doc or .docx file.
6. Margins for submissions must be one inch on all sides.

The Effectiveness of One-to-One Technology Integration Programs in K-12 Education and its Impact on Student Reading Achievement

University of Missouri-Columbia

Brandon Clark is doctoral student through the University of Missouri-Columbia. Brandon has worked in K-12 education for over 20 years, as a mathematics teacher, Dean of Students, Assistant Principal, and an Athletic and Activities Director. Brandon currently works as the Athletic and Activities Director for Nixa Public Schools in Missouri.

Brandon Clark
University of Missouri Doctoral Candidate
btcvy4@mail.missouri.edu

Dr. Cynthia MacGregor
Missouri State University
Committee Chair

Dr. Kim Finch
Missouri State University
Committee Member

Dr. Denise Baumann
Missouri State University
Committee Member

Dr. William Agnew
Missouri State University
Committee Member

**The Effectiveness of One-to-One Technology Integration Programs in K-12 Education and its Impact on Student Reading Achievement**


## Abstract

As school districts implement technology in the classrooms to increase student engagement, improve student test scores, and combat the ever-increasing need for distance learning, it is imperative to identify practices that justify the cost (Chanlin, 2007; Keengwe Schnellert, & Mills, 2012; Lei & Zhao, 2008). The minimal amount of existing research on this topic has produced no significant correlations between student achievement and technology use in the classroom (Claro, Nussbaum, López, & Díaz, 2013). This mixed methods case study identified one school district, who had implemented a one-to-one technology program, targeting the Missouri Assessment Program (MAP) English Language Arts (ELA) assessment scores for students in grades three through six. A Pearson's chi-square test for homogeneity was conducted for all 2016 (pre-implementation) and 2018 (post-implementation) MAP ELA test scores. Additionally, the same chi-square test for homogeneity was conducted for the student subgroups of free and reduced lunch, special education (IEP status), and ethnic minority students. Qualitative data were collected of teacher's perceptions using Ruben Puentedura's (2012) technology integration model with the six components of reading instruction. Of the 20 chi-square tests, 16 indicated a significant difference in distribution between the 2016 and 2018 sets of data. However, the data indicated a negative relationship between the use of one-to-one technology and student reading achievement. The teacher survey revealed that a majority of teachers were inconsistently integrating technology into the reading curriculum and also indicated that lack of teacher buy-in and untargeted professional development as the causes for lack of implementation.



*Keywords*: bring your own device technology (BYOD), critical social theory. cultural hegemony, equity gaps, one-to-one (1:1), SAMR, student achievement, technology integration


As the American education system pushed for increased use of technology in the classroom to produce twenty-first century ready, skilled students, school districts are struggling with balancing the need for strong results from high-stakes testing with creating meaningful learning through the use of technology. The U. S. Department of Education (2017) stated in the national plan for technology in the classroom, "The conversation has shifted from whether technology should be used in learning to how it can improve learning to ensure that all students have access to high-quality educational

experiences" (p. 7). Students in today's society are becoming more adept at accessing technology at a moment's notice, while teachers struggle to create authentic learning experiences that not only engage students, but increase student achievement on state testing (Devlin, Feldhaus, & Bentram, 2013). Previous research had indicated that technology integration programs have had positive impacts on student engagement and collaboration, but little to no evidence that such technology impacts student achievement (Claro, Nussbaum, López, & Díaz, 2013; Devlin, Feldhaus, & Bentram, 2013). Much of the research in this field indicated the pitfalls with one-to-one technology integration, including lack of teacher and administrator buy-in, lack of funding, inadequate professional development, and unintended consequences for minority student populations (Chanlin, 2007; Claro et al., 2013; Donovan, Green & Hansen, 2012; Inan & Lowther, 2010; Inserra & Short, 2012; Li, 2010). Inserra and Short (2012) asserted that "Educational policymakers are eager to use technology to transform teaching and learning and thereby improve academic performance. However, they require empirical evidence that instructional technology improves test scores" (p. 166).

## Introduction to the Problem

The question of how technology integration impacted student achievement was a multifaceted problem that had a multitude of factors that could influence the success of implementing one-to-one technology. Prior to the COVID–19 pandemic, schools were initially faced with the task of creating twenty-first century ready students through integrating technology, either in a one-to-one format or in a bring your own device (BYOD) program. One of the main factors that influenced school districts to choose one program over the other was the initial cost of implementation.

School districts across the nation spent millions of dollars providing students with a personal electronic device. For school districts who were not financially ready to make such an investment, BYOD programs seemed to be the logical choice, but not without some unintended consequences. Sangani (2013) asserted that even though students in today's culture were obtaining personal electronic devices, like smartphones, there was still the opportunity for schools to unintentionally create equity gaps, as there could be significant differences in the type of devices families could afford or in many cases for underprivileged students, no opportunity to own such a device due to the financial hardship. Regardless of the choice of program by a school district, factors of equity, impact on minority student groups, teacher and administrator buy-in, and professional development must be considered as a part of the evaluation of technology integration effectiveness.

**Purpose of the Study**

The purpose of this study was to provide K-12 educators and scholars research that contributed to the topic of technology integration in K-12 education and its impact on student achievement. Additionally, this study added to the growing base of scholarly research of how technology affected at-risk or underprivileged student subgroups, specifically free and reduced lunch, special education (IEP), and ethnic minority student achievement as measured by state assessments. For the practitioner, this would provide qualitative and quantitative data to justify the cost of implementing technology integration programs, especially one-to-one adoptions.

## Review of Literature

As the expectations for higher accountability continued to be a demand from legislative policies at the state and federal level, schools across the country had constantly adjusted their approach to classroom learning to meet the demand of high-stakes student assessments. The more recent trend in education had been the one-to-one student technology programs that had emerged, but with high costs associated with this level of implementation, school districts have involved voters to pass expensive bonds and tax levies, modified tight budgets, or investigated grant opportunities (Lei & Zhao, 2008). For school districts who cannot afford to provide a personal device for every student, a bring your own device (BYOD) approach to learning had emerged as a cost saving option. However, this cost-saving measure came with its own price of creating inequities for certain student subgroups who may not be able to afford the technology (Bruder, 2014). For either technology integration option, mixed outcomes from the research existed with limited data and conflicting results for student achievement, but suggested technology could have an effect on underrepresented student populations (Harper & Milman, 2016).

**Technology in the classroom.** As early as 1985, reports like *A Nation at Risk* and the federal mandates from the *No Child Left Behind Act* (*NCLB*) have placed a new emphasis on high-stakes student assessments. These new mandates and open data reporting at the state level urged school districts to place a stronger emphasis on student testing readiness, while balancing the newer standards of technology literacy (Devlin, Feldhaus, & Bentrem, 2013). Chanlin (2007) stated these new standards looked to integrate technology through the "use of technology to enhance instruction and to create

rich environments to help each individual student develop a depth of understanding and critical thinking skills" (p. 45). It is quickly noted that this definition mentioned nothing about increasing student achievement as a required by-product of technology integration, even though most school districts would base the success of the investment on its impact on student achievement, as measured by standardized state tests.

Due to the expensive cost of one-to-one programs, relevant research must be conducted to evaluate the effectiveness of such programs on a regular basis. As previously mentioned, the current research on technology integration in classrooms produced mixed results with some indicating positive effects on student achievement, and in other similar studies, no evidence of any impact. Due to the lack of evidence, some school districts in the United States were changing course and canceling their one-to-one programs, while others were starting these programs as a way to combat failing test scores (Harper & Milman, 2016). Research studies had primarily focused on teachers and student perceptions to integration, changes to student motivation and engagement, and barriers to implementation.

A research study by Keengwe, Schnellert, and Mills (2012) investigated the perceptions of teachers and students at a Midwestern high school toward their one-to-one laptop program. Research showed that the teachers' perceptions were positive and felt the laptops better engaged students and provided more meaningful learning, but no quantitative data were collected to determine any impact on student achievement. Similar studies with no quantitative data were conducted by Bebell and Kay (2010), Hutchison, Beschorner, and Schmidt-Crawford (2012), McClure and Pilgrim (2021), and Urrea (2010), and all studies indicated similar perceptions from teachers and students

about higher levels of student engagement with one-to-one programs, even with low socioeconomic (SES) student groups. However, Hur and Oh (2012) noted similar initial levels of high student engagement that slowly decreased as the newness and uniqueness of the technology became common place in the classroom. To the contrary of the previous research studies, Donovan, Green, and Hartley (2010) reported their study showed a decrease in student engagement, as demonstrated by off-task behavior that led to school discipline with no significant increase in student motivation.

For the studies that gathered quantitative data for the purposes of establishing a connection between technology integration and student achievement, similar mixed results emerged with an emphasis on some student achievement benefit and the potential to reduce the achievement gap for low SES student groups (Harper & Milman, 2016). In studies with small student samples in Israel and China, Rosen and Mann-Ikan (2011) and Lin, Shao, Wong, Li, and Niramitranon (2012) showed increased student achievement on computer-based assessments in mathematics for low SES students. Kposowa and Valdez (2013) showed significant gains in achievement in fourth and fifth grade English Language Arts (ELA) assessments, but quickly admitted the narrow scope of the study would hinder the researcher's ability to generalize the results to any other context. Harper and Milman (2016) emphasized from their collection of research that any gains in student achievement could be attributed more to the teacher's instructional strategy and familiarity with integrating technology.

**Barriers to implementation.** Even though the research showed a potential for one-to-one technology programs to positively affect student engagement and achievement, researchers have shown cost, stakeholder buy-in, and professional

development to be barriers for implementation. Kamal, Weerakkody, and Irani (2011) discovered that stakeholder perceptions were critical to the success of one-to-one technology programs, as it not only created the necessary buy-in, but also the desire to acquire the knowledge to develop a successful plan for implementation. As teacher and administrator buy-in was noted as a key to success, Inan and Lowther (2010) furthered the research by relating the teacher beliefs and perceptions about the new technology to what level the technology was integrated into the curriculum. Lack of teacher buy-in affected the attitude toward the one-to-one program, the strategies used to engage students in learning with technology, and to what level teachers participated in relevant professional development (Chanlin, 2007; Claro et al., 2013; Donovan, Green, & Hansen, 2012; Inan & Lowther, 2010; Inserra & Short, 2012; Li, 2010). Regarding administrator attitudes towards one-to-one technology integration programs, Schrum, Galizio, and Ledesma (2011) noted that lack of buy-in, background knowledge, and overall leadership skills were the main determining factors in how these technology programs were implemented. For these type of technology programs to be successful, administrators needed to provide a clear vision, collaborative goals, and professional development that would give teachers concrete data and educational practices of success to convince teachers to modify their current curriculum and lessons (Li, 2010).

**SAMR framework.** Part of providing a clear vision and goals would be for administrators to provide a tool to measure the level at which teachers could implement technology into their everyday lessons. Caukin and Trail (2019) asserted, "Technology should never be considered the classroom babysitter or the busy workstation. Rather, technology is used intentionally and strategically as a tool to allow students to engage

meaningfully in authentic learning experiences" (p. 47). Ruben Puentedura (2012) created a two-level, four-tier evaluation tool for technology integration that embodied a similar structure and reasoning to the Bloom's Taxonomy Model. The model's hierarchy was bifurcated into the two major categories of enhancement and transformation.

The Enhancement category started with the substitution level, where teachers replaced one paper and pencil task with technology, gaining no functional adaptation to the lesson (Jacobs-Israel & Moorefield-Lang, 2013; Lacruz, 2018; Puentedura, 2012). Caukin and Trail (2019) indicated this level of the SAMR model was basic and gave students a choice to complete certain tasks via personalized learning devices, complete tasks at home, or allow teachers to gather feedback digitally. The second level of the Enhancement category was Augmentation, where teachers used technology as a functional improvement for a part of the lesson. Hamilton, Rosenberg, and Akcaoglu (2016) provided an example of functional change in a lesson through a digital reading program. Initially, the change in the lesson was at the substitution level, where the lesson required students to read a book on their personal learning device, but the functional improvement was demonstrated through the student's ability to choose a story for their developmental level, as well as work at their own pace through a guided lesson.

The next category of the SAMR integration model was the Transformation phase, which included two levels, modification and redefinition. This category of the SAMR tool required teachers to significantly redesign their lessons to include authentic learning experiences that could not be done without technology (Puentedura, 2012). The Modification level was demonstrated through how students used an interactive program to learn about how light travels. The significant change came by the teacher changing

from a basic diagram about light and instead replaced this part of lesson with an interactive program that allowed students to adjust a multitude of variables to see what effects it had on light travel (Hamilton et al., 2016). The Redefinition level was the highest form of integrating technology in the classroom, where teachers created new learning opportunities that would be impossible without technology (Puentedura, 2012). Liu and Tsai (2013) provided an example of English as Foreign Language (EFL) students learning English through a mobile phone application that utilized GPS, providing EFL students English descriptions of objects around campus, viewed through the phone's camera and screen.

**Digital inequity.** As previously mentioned, limited research studies had shown positive impact for low SES student achievement with non-generalizable results. Similar to studies looking for correlations between technology integration and student achievement, studies that looked to focus solely on underrepresented student populations had yielded the same mixed results with no significant conclusions (Claro, Nussbaum, López, & Díaz, 2013). Further research was needed to evaluate the impact that one-to-one technology integration programs have on the underrepresented student groups of free and reduced lunch, IEP, and ethnic minorities.

Shank and Cotton (2014) divided digital inequity for underrepresented student groups into two levels, access to technology and use of technology. Access to technology for these student groups was witnessed more with the highest underprivileged groups, like urban students, and included issues like access to personalized devices, Internet access, and age at which technology was introduced to the student. Warschauer, Cotton, and Ames (2012) conducted research on a school district in Alabama that provided

personal electronic devices for all students, even though 47% of the students did not have access to the Internet in their home.

The second level of digital inequity focused on how underprivileged students used technology for social media and digital communications, and how technology was modeled and used in the home (Shank & Cotton, 2014). An additional piece of information obtained from the Warshauer et al. (2012) study indicated that even with student access to a personal learning device, teachers struggled to create authentic learning experiences, and underprivileged students were not able to fully appreciate the full power of the technology at their fingertips, due to the lack of proper modeling in the home for educational purposes. The Organization for Economic Development (OECD, 2016) asserted that when low SES students had access to the Internet and a personal electronic device, the majority of the low-income families used the technology in non-educational ways, compared to higher SES students. These types of underprivileged students struggled with learning through technology integration, as they were consumers and not producers of technology (Roswell, Morell, & Alvermann, 2017). OECD (2016) claimed this disparity had little to do with a student's underprivileged status, but instead the student's ability to read. OECD (2016) summarized the disparity with underrepresented student groups stating:

> Disadvantaged students in low- and middle-income countries have fewer opportunities to access the Internet than advantaged students. Reducing this gap is important, but the experience of high-income countries shows that inequalities in the ability to learn using digital tools persist even when all students have easy access to the Internet. Ensuring that every child attains a baseline level of

> proficiency in reading will do more to create equal opportunities in a digital world than will expanding or subsidizing access to high-tech devices and services. (p. 4)

**Theoretical Framework**

The critical theory lens was used in this research project as a guide to frame and analyze the purpose, findings, conclusions, and recommendations. The intent of using the critical theory framework was to provide a basis to analyze the dominant ideologies in K-12 education, especially as they related to decisions that affect the implementation of technology in the classroom and student achievement. As school leaders consider implementing technology in the classroom, at whatever level for students, the design and application of the technology use has to be seen through a lens of how it affects marginalized student groups.

Critical theory emerged in the early twentieth century as a balance to the dominant traditions and ideologies of western, capitalist society that either intentionally or unintentionally marginalized oppressed populations of people (Brookefield, 2014; Tar, 1975). Brookfield (2014) stated, "Western democracies are highly unequal societies in which economic inequity, racism, and class discrimination are critical realties; that the way this state of affairs is reproduced as seeming to be normal, natural, and inevitable" (p. 418). For groups of people either in the majority or in positions of power, little thought or care was given to why certain structures, traditions, or systems exist, as most of these systems benefited those of privilege. Merriam and Bierema (2014) stated, "Critical theory acknowledges that the social world creates structures that confer privilege to some and marginalizes other based on attributes such as race, ethnicity, gender, age, sexual orientation, religion, class, physical ability, and so on" (p. 215).

Critical theorists' main goal was to not only to dig and uncover the entrenched, dominant traditions and ideologies, but also to create plans of action to ensure marginalized groups of people would no longer be oppressed by such structures (Freire, 2000).

Lears (1985) discussed the concept of cultural hegemony, developed by Antonio Gramsci, as a way to tackle the differences between power and culture in a capitalistic society. Cultural Hegemony could be defined as the norms, structures, and traditions of a dominant class of people within a diverse culture being universally accepted as the norm for all of the people of that society, even though it may truly only benefit the ruling class of people (Vaandering, 2010). bell hooks (1994) took this definition to another level and applied it to the American education system, where the industrialized ideologies and structure of education for young people were geared for a "one size fits all" approach with no differentiation or consideration of the effects on marginalized students.

The current educational policies and structures were an example of cultural hegemony, as the dominant social group attempted to force their values, morals, and beliefs on students, regardless of age, race, socioeconomic status, or disability. Traditional classrooms in the United States asserted the teacher as the gatekeeper of the knowledge and students as only a depository of what is taught by the teacher. This type of system required no creativity or the ability of students to form new and meaningful learning from the given instruction (Freire, 2000; hooks, 2003; Mitchell, Crowson, & Shipps, 2011). Friere (2000) stated, "Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other" (p. 72). Further marginalization occurred in how students are judged, labeled, and assessed through a

limited amount of success indicators (Keeson, 2011). Many educators view the education structure as a neutral system, where age, race, socioeconomic status, and disability were inadmissible when creating policies or new learning opportunities. Freire (2000) stated:

> This seeming lack of distinction is conveniently adopted by those educators who believe that education is neutral as they engage in a social construction of not seeing. That is, they willfully refuse to understand that the very term "pedagogy" mean(s) "to lead a child." (p. 25)

Critical theory looked to abolish this type of simple structure, and instead create a more complex structure that embraced the diversity and complexity of all students (hooks, 2003).

When looking through the critical theory lens, a one-to-one technology integration program would better align with meeting the diverse needs of underrepresented student groups, as well as differentiate the experience of each student in the hopes of tapping into the unique qualities and abilities that each student can bring to the table. Critical theorists asserted that even with equal access to technology, the curriculum and pedagogy would need to be addressed, as this new marriage of technology and learning could still oppress and marginalize underrepresented groups of students (hooks, 2003).

Using the SAMR model, as an effort to redesign and reimagine the pedagogy and curriculum, would be one positive step in helping educators integrate and assess the use of technology in the classroom. The SAMR model, in and of itself, would not be a sole solution for addressing the digital divide and equity gaps that naturally exist, and were created as school districts look to create successful technology integration experiences.

Instead, additional research and attention to the problems related to educating underprivileged students with technology should be conducted, like effects of one-to-one programs on reading student achievement.

### Research Questions

The research questions guiding this mixed methods case study are the following:

1. What is the impact of a one-to-one technology integration program on student reading achievement?
2. What is the impact of a one-to-one technology integration program on the student reading achievement of student sub-groups, as defined by free and reduced lunch, special education (IEP), and ethnic minority students?
3. What is the primary factor, as perceived by teachers, for determining the effectiveness of a one-to-one technology program on student reading achievement?

## Methods

The case study focused on one Missouri public school district, who implemented a one-to-one technology integration program prior to the COVID-19 pandemic. The school district consisted of over 6,000 students, six elementary schools, one junior high, and one high school. Approximately 40% of the households in the school district earned under $30,000 per year with a free and reduced lunch rate around 25% and a 20% non-white student population. The school district boasts a 90+ % post-secondary placement in either a college or vocational school or training. The school district moved to a one-to-one technology adoption during the 2016-17 school year and provided a three-year

professional development plan that started one year prior to implementation (school web site, 2022).

**Data Collection**

For this mixed methods case study, historical Missouri Assessment Program (MAP) English Language Arts (ELA) state assessment scores were gathered for students in grades three through six and elementary teacher perceptions regarding the implementation of the one-to-one technology program. Historical MAP data were gathered for the 2016 and 2018 end of year assessments. The 2017 data were excluded since it was the district's first year under the new one-to-one program, and the data could potentially be skewed and show an implementation dip. Each set of data included a raw score and a categorical score of (a) below basic, (b) basic, (c) proficient, and (d) advanced. Due to the shifting numerical score from year to year, a Pearson's chi-square test for homogeneity (Turhan, 2020) was deemed the most appropriate tool for analysis.

The quantitative and qualitative data utilized a mix of Likert scale questions and open-ended responses concerning the level to which technology was being integrated in each teacher's classroom, the effects of the district's professional development on technology integration, and the effects of one-to-one technology on student reading achievement of minority student populations, as defined by free and reduced lunch, IEP, and ethnic minorities. The questionnaire was sent to all elementary teachers in the school district, but eliminated certain responses from consideration, based on the teacher's years of experience with the school district. For purposes of this research, only teachers who taught in the district at least six years were considered part of the sample group because it

ensured they were present during the initial implementation of the professional development and technology integration.

The teacher questionnaire utilized the SAMR levels of technology integration and compared them to the six components of reading instruction which included (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary, (e) text comprehension, and (f) spelling. The components of reading instruction were a good partner for the MAP ELA assessment, as these were required skill sets to master to demonstrate high levels of student success. A five-level, Likert scale was used to assess teachers' perceptions regarding the frequency they integrated technology for different components of reading instruction, as defined by the SAMR model. The five level, Likert scale consisted of descriptors ranging from Never to Always. Additionally, three open-ended questions gathered teachers' perceptions about effects of technology integration on reading instruction, the effectiveness of the school district's professional development, and the effects of the technology integration on the minority student subgroups.

**Data Analysis**

For the quantitative data, a Pearson's chi-square test for homogeneity (Turhan, 2020) was performed comparing the 2016 and 2018 MAP ELA data for each individual grade, as well as the individual grades for each of the student minority subgroups of free and reduced lunch, IEP, and ethnic minorities. Additionally, a cross-tab table was produced for each set of data, allowing raw categorical numbers and percentages to be compared from 2016 to 2018 with the state averages for those same years. Tables of each chi-square analysis were produced with expected frequency counts, degrees of freedom, and a *p*-value test for significance.

Additional quantitative data from the teacher survey using the SAMR model and Likert questions were used to assess the level of technology integration. These questions produced a table of percentages for the level of frequency each teacher perceived they integrated technology for each of the six reading components for instruction. For the qualitative portion of the study, the open-ended questions were open coded using keywords and phrases, then through the process of analytical coding, these keywords and phrases were grouped into larger themes (Merriam, 2009). From these themes, tables were produced indicating the frequency at which teachers answered similarly.

## Results

From the 2016 and 2018 student assessment data, Table 1 showed the breakdown in student data with over 1800 student scores for each of the data sets. For each grade, over 400 student assessment scores were compared in both 2016 and 2018. Additionally, ethnic minority students produced a sample of approximately 50 to 60 students, free/reduced lunch students ranged approximately from 140 to 200 students, and IEP students ranged from 50 to 70 students for each grade and data set.

Table 1

*Number of Student Participants*

| 2016 | | 2018 | |
|---|---|---|---|
| Student Group | *n* | Student Group | *n* |
| 3rd-6th | 1841 | 3rd-6th | 1877 |
| 3rd | 480 | 3rd | 474 |
| 4th | 426 | 4th | 444 |
| 5th | 478 | 5th | 522 |
| 6th | 457 | 6th | 437 |
| Minority | 244 | Minority | 271 |
| IEP | 240 | IEP | 262 |
| Free/Reduced Lunch | 715 | Free/Reduced Lunch | 653 |

A total of 66 teachers responded to the questionnaire with 42 of the teachers qualifying with enough years of experience in the school district. Table 2 broke down the number responses on each part of the teacher questionnaire. Of the 42 qualifying teacher responses, 31 to 42 teachers responded to the levels of technology integration questions, while only 15 to 16 of the teachers answered the open-ended questions.

Table 2

*Teacher Questionnaire Participants*

| SAMR Levels of Technology Integration | *n* |
|---|---|
| Q2 - Substitution | 42 |
| Q3 - Augmentation | 35 |
| Q4 - Modification | 34 |
| Q5 - Redefinition | 31 |
| Qualitative Feedback | |
| Q6 - Instruction & Assessment | 16 |
| Q7 - Professional Development | 15 |
| Q8 - Minority Subgroups | 15 |

*Note.* 66 teachers responded to the survey with an average of 11.1 years of experience.

Of the 20 different chi-square tests for homogeneity, 16 of the data sets produced a *p* value less than .05, indicating a significant difference in the distribution of scores from 2016 to 2018. These comparisons showed a significant decrease in the amount of proficient and advanced students from 2016 to 2018, except for the six grade IEP students, who increased from 32.7% to 37.7%. Table 3 displayed the change in proficient and advanced student scores, as it was a common practice to talk about the grouping data, like proficient/advanced, as it was a natural break point for evaluating the effectiveness of instruction and overall success of schools. Due to the decreasing nature of the data, the original hypothesis of finding some positive effect of technology integration on reading test scores was not supported.

Table 3

*Proficient and Advanced Student Percentages*

| | % of Proficient/Advanced | | |
|---|---|---|---|
| Grade | 2016 | 2018 | Difference |
| 3rd | 80% | 63.1% | -16.9% |
| 4th | 84.7% | 65.1% | -19.7% |
| 5th | 79.9% | 55.2% | -24.7% |
| 6th | 71.8% | 66.1% | -5.6% |

*Note*. Average drop in scores was -16.73%

Table 4 illustrated the comparison of the full set of over 3600 third through six grade students with individual grades and as a full set of data for all four grades. All five chi-square tests for homogeneity showed a significant difference in the distribution from 2016 to 2018. It is important to note the major shift in categorical data came from the basic and proficient student achievement categories. In some grades, the change from proficient to basic was as high as 18% or approximately 130 more students classified as basic in 2018.

Table 4

*Grades 3-6 Crosstabulation of MAP ELA Scores*

| Grade | Year | | Achievement Level | | | |
|---|---|---|---|---|---|---|
| | | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | Count | 23 | 73 | 239 | 145 |
| | | Expected Count | 38.7 | 97.6 | 194.7 | 148.9 |
| | | % within Year | 4.8% | 15.2% | 49.8% | 30.2% |
| | 2018 | Count | 54 | 121 | 148 | 151 |
| | | Expected Count | 38.3 | 96.4 | 192.3 | 147.1 |
| | | % within Year | 11.4% | 25.5% | 31.2% | 31.9% |
| 4*** | 2016 | Count | 18 | 47 | 200 | 161 |
| | | Expected Count | 23.5 | 84.2 | 184.1 | 134.2 |
| | | % within Year | 4.2% | 11.0% | 46.9% | 37.8% |
| | 2018 | Count | 30 | 125 | 176 | 113 |
| | | Expected Count | 24.5 | 87.8 | 191.9 | 139.8 |
| | | % within Year | 6.8% | 28.2% | 39.6% | 25.5% |
| 5*** | 2016 | Count | 31 | 65 | 234 | 148 |
| | | Expected Count | 33.5 | 124.3 | 193.1 | 127.1 |
| | | % within Year | 6.5% | 13.6% | 49.0% | 31.0% |
| | 2018 | Count | 39 | 195 | 170 | 118 |
| | | Expected Count | 36.5 | 135.7 | 210.9 | 138.9 |
| | | % within Year | 7.5% | 37.4% | 32.6% | 22.6% |
| 6** | 2016 | Count | 29 | 100 | 203 | 125 |
| | | Expected Count | 28.6 | 113.0 | 175.3 | 140.1 |
| | | % within Year | 6.3% | 21.9% | 44.4% | 27.4% |
| | 2018 | Count | 27 | 121 | 140 | 149 |
| | | Expected Count | 27.4 | 108.0 | 167.7 | 133.9 |
| | | % within Year | 6.2% | 27.7% | 32.0% | 34.1% |
| 3-6*** | 2016 | Count | 101 | 285 | 876 | 579 |
| | | Expected Count | 124.3 | 419.4 | 747.7 | 549.6 |
| | | % within Year | 5.5% | 15.5% | 47.6% | 31.5% |
| | 2018 | Count | 150 | 562 | 634 | 531 |
| | | Expected Count | 126.7 | 427.6 | 762.3 | 560.4 |
| | | % within Year | 8.0% | 29.9% | 33.8% | 28.3% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

When analyzing the chi-square tests for ethnic minority students in grades three through six, Table 5 indicated only two of four grades revealed a significant difference in the distributions from 2016 to 2018. However, when looking at the overall analysis for all grades, three through six, the chi-square test produced a *p*-value of less than .001, indicating a drastic shift in the student achievement scores. When looking at all grades, there was as high as a 20% shift from proficient to basic and below basic, with about one quarter of the student achievement scores shifting to the below basic category.

Table 5

*Ethnic Minorities Grades 3-6 Crosstabulation of MAP ELA Scores*

| | | | Achievement Level | | | |
|---|---|---|---|---|---|---|
| Grade | Year | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | Count | 3 | 12 | 47 | 17 |
| | | Expected Count | 9.1 | 16.6 | 32.2 | 21.1 |
| | | % within Year | 3.8% | 15.2% | 59.5% | 21.5% |
| | 2018 | Count | 15 | 21 | 17 | 25 |
| | | Expected Count | 8.9 | 16.4 | 31.8 | 20.9 |
| | | % within Year | 19.2% | 26.9% | 21.8% | 32.1% |
| 4 | 2016 | Count | 6 | 7 | 22 | 19 |
| | | Expected Count | 5.0 | 12.4 | 21.3 | 15.4 |
| | | % within Year | 11.1% | 13.0% | 40.7% | 35.2% |
| | 2018 | Count | 4 | 18 | 21 | 12 |
| | | Expected Count | 5.0 | 12.6 | 21.7 | 15.6 |
| | | % within Year | 7.3% | 32.7% | 38.2% | 21.8% |
| 5** | 2016 | Count | 7 | 8 | 28 | 12 |
| | | Expected Count | 4.2 | 15.0 | 21.3 | 14.6 |
| | | % within Year | 12.7% | 14.5% | 50.9% | 21.8% |
| | 2018 | Count | 3 | 28 | 23 | 23 |
| | | Expected Count | 5.8 | 21.0 | 29.8 | 20.4 |
| | | % within Year | 3.9% | 36.4% | 29.9% | 29.9% |
| 6 | 2016 | Count | 3 | 18 | 20 | 15 |
| | | Expected Count | 5.3 | 17.7 | 17.2 | 15.8 |
| | | % within Year | 5.4% | 32.1% | 35.7% | 26.8% |
| | 2018 | Count | 8 | 19 | 16 | 18 |
| | | Expected Count | 5.7 | 19.3 | 18.8 | 17.2 |
| | | % within Year | 13.1% | 31.1% | 26.2% | 29.5% |
| 3-6*** | 2016 | Count | 19 | 45 | 117 | 63 |
| | | Expected Count | 23.2 | 62.1 | 91.9 | 66.8 |
| | | % within Year | 7.8% | 18.4% | 48.0% | 25.8% |
| | 2018 | Count | 30 | 86 | 77 | 78 |
| | | Expected Count | 25.8 | 68.9 | 102.1 | 74.2 |
| | | % within Year | 11.1% | 31.7% | 28.4% | 28.8% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

The free and reduced lunch student subgroup chi-square tests produced *p*-values of less than .001 for four out of the five student groups. As already noted in the previous student groups, there was a significant shift in the number of students classified as proficient and basic. As seen in Table 6, the 2016 and 2018 student achievement scores showed on average a 16% increase in the number of basic student MAP ELA scores.

Table 6

*Free and Reduced Lunch Grades 3-6 Crosstabulation of MAP ELA Scores*

| | | | Achievement Level | | | |
|---|---|---|---|---|---|---|
| Grade | Year | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | Count | 13 | 36 | 109 | 43 |
| | | Expected Count | 21.2 | 48.9 | 85.8 | 45.1 |
| | | % within Year | 6.5% | 17.9% | 54.2% | 21.4% |
| | 2018 | Count | 26 | 54 | 49 | 40 |
| | | Expected Count | 17.8 | 41.1 | 72.2 | 37.9 |
| | | % within Year | 15.4% | 32.0% | 29.0% | 23.7% |
| 4*** | 2016 | Count | 15 | 27 | 75 | 35 |
| | | Expected Count | 18.9 | 40.4 | 66.3 | 26.4 |
| | | % within Year | 9.9% | 17.8% | 49.3% | 23.0% |
| | 2018 | Count | 20 | 48 | 48 | 14 |
| | | Expected Count | 16.1 | 34.6 | 56.7 | 22.6 |
| | | % within Year | 15.4% | 36.9% | 36.9% | 10.8% |
| 5*** | 2016 | Count | 21 | 36 | 99 | 41 |
| | | Expected Count | 23.8 | 62.0 | 75.4 | 35.7 |
| | | % within Year | 10.7% | 18.3% | 50.3% | 20.8% |
| | 2018 | Count | 27 | 89 | 53 | 31 |
| | | Expected Count | 24.2 | 63.0 | 76.6 | 36.3 |
| | | % within Year | 13.5% | 44.5% | 26.5% | 15.5% |
| 6 | 2016 | Count | 16 | 56 | 62 | 31 |
| | | Expected Count | 18.6 | 59.5 | 52.2 | 34.7 |
| | | % within Year | 9.7% | 33.9% | 37.6% | 18.8% |
| | 2018 | Count | 20 | 59 | 39 | 36 |
| | | Expected Count | 17.4 | 55.5 | 48.8 | 32.3 |
| | | % within Year | 13.0% | 38.3% | 25.3% | 23.4% |
| 3-6*** | 2016 | Count | 65 | 155 | 345 | 150 |
| | | Expected Count | 82.6 | 211.7 | 279.1 | 141.6 |
| | | % within Year | 9.1% | 21.7% | 48.3% | 21.0% |
| | 2018 | Count | 93 | 250 | 189 | 121 |
| | | Expected Count | 75.4 | 193.3 | 254.9 | 129.4 |
| | | % within Year | 14.2% | 38.3% | 28.9% | 18.5% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

Following the same pattern as the previous subgroups, the IEP student achievement data revealed four out of the five chi-square analyses exhibited a significant difference in the distributions in scores from 2016 to 2018. As witnessed in Table 7, all but grade six showed a significant *p*-value with a less than 1% drop in proficient student scores. However, when comparing the entire third through six grade groups from 2016 and 2018, a *p*-value of less than .001 was produced. Noteworthy drops in the number of proficient student scores were also noted with an approximate 20% increase in basic scores for the fourth-grade group.

Table 7

*IEP Grades 3-6 Crosstabulation of MAP ELA Scores*

| Grade | Year | | Achievement Level | | | |
|---|---|---|---|---|---|---|
| | | | Below Basic | Basic | Proficient | Advanced |
| 3*** | 2016 | Count | 11 | 17 | 34 | 4 |
| | | Expected Count | 19.7 | 20.7 | 20.2 | 5.4 |
| | | % within Year | 16.7% | 25.8% | 51.5% | 6.1% |
| | 2018 | Count | 29 | 25 | 7 | 7 |
| | | Expected Count | 20.3 | 21.3 | 20.8 | 5.6 |
| | | % within Year | 42.6% | 36.8% | 10.3% | 10.3% |
| 4*** | 2016 | Count | 5 | 12 | 20 | 9 |
| | | Expected Count | 9.9 | 17.6 | 13.3 | 5.2 |
| | | % within Year | 10.9% | 26.1% | 43.5% | 19.6% |
| | 2018 | Count | 18 | 29 | 11 | 3 |
| | | Expected Count | 13.1 | 23.4 | 17.7 | 6.8 |
| | | % within Year | 29.5% | 47.5% | 18.0% | 4.9% |
| 5*** | 2016 | Count | 18 | 21 | 25 | 3 |
| | | Expected Count | 19.6 | 29.2 | 14.6 | 3.6 |
| | | % within Year | 26.9% | 31.3% | 37.3% | 4.5% |
| | 2018 | Count | 25 | 43 | 7 | 5 |
| | | Expected Count | 23.4 | 34.8 | 17.4 | 4.4 |
| | | % within Year | 31.3% | 53.8% | 8.8% | 6.3% |
| 6 | 2016 | Count | 15 | 26 | 19 | 1 |
| | | Expected Count | 14.4 | 25.1 | 18.7 | 2.7 |
| | | % within Year | 24.6% | 42.6% | 31.1% | 1.6% |
| | 2018 | Count | 12 | 21 | 16 | 4 |
| | | Expected Count | 12.6 | 21.9 | 16.3 | 2.3 |
| | | % within Year | 22.6% | 39.6% | 30.2% | 7.5% |
| 3-6*** | 2016 | Count | 49 | 76 | 98 | 17 |
| | | Expected Count | 63.6 | 92.7 | 66.5 | 17.2 |
| | | % within Year | 20.4% | 31.7% | 40.8% | 7.1% |
| | 2018 | Count | 84 | 118 | 41 | 19 |
| | | Expected Count | 69.4 | 101.3 | 72.5 | 18.8 |
| | | % within Year | 32.1% | 45.0% | 15.6% | 7.3% |

*Note*. Degrees of freedom for all cases was 3.
*$p < .05$, **$p < .01$, ***$p < .001$

For the additional quantitative findings, Table 8 produced the percentages of how frequently teachers were integrating the SAMR model of technology integration. This portion of the teacher survey produced 31 to 42 teacher responses about their perceptions of how often they integrated technology for reading instruction. For questions two through five, approximately 50% to 75% of the teacher responses indicated they "Never" or "Rarely" used technology to teach any component of reading instruction. For each of the reading instructional components, Text Comprehension was the most frequently used area of reading instruction with 32.26% of the teachers indicating they integrated technology "Often" at the redefinition level of the SAMR model. For the most basic level of the SAMR model, the substitution method of using technology to replace a paper/pencil task was on average indicated "Often" integrated into the reading lesson only around 13% of time.

Table 8

*Teacher Perceptions of Technology Integration*

| Question 2 – How frequently do you use ***Substitution*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
|---|---|---|---|---|---|
| *n* = 42 | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 30.95% | 19.05% | 28.57% | 16.67% | 4.76% |
| Spelling | 30.95% | 35.71% | 26.19% | 7.14% | 0.00% |
| Vocabulary | 33.33% | 23.81% | 26.19% | 16.67% | 0.00% |
| Phonics | 35.71% | 30.95% | 21.43% | 11.90% | 0.00% |
| Fluency | 38.10% | 26.19% | 19.05% | 16.67% | 0.00% |
| Phonemic Awareness | 38.10% | 28.57% | 21.43% | 9.52% | 2.38% |
| Question 3 – How frequently do you use ***Augmentation*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
| *n* = 35 | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 28.57% | 20.00% | 37.14% | 11.43% | 2.86% |
| Vocabulary | 37.14% | 20.00% | 28.57% | 14.29% | 0.00% |
| Spelling | 42.86% | 31.43% | 20.00% | 5.71% | 0.00% |
| Phonics | 42.86% | 17.14% | 37.14% | 2.86% | 0.00% |
| Fluency | 45.71% | 11.43% | 34.29% | 8.57% | 0.00% |
| Phonemic Awareness | 45.71% | 22.86% | 25.71% | 5.71% | 0.00% |
| Question 4 – How frequently do you use ***Modification*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
| *n = 34* | Never | Rarely | Sometimes | Often | Always |
| Vocabulary | 29.41% | 38.24% | 11.76% | 20.59% | 0.00% |
| Text Comprehension | 32.35% | 17.65% | 26.47% | 20.59% | 2.94% |
| Phonics | 38.24% | 35.29% | 17.65% | 8.82% | 0.00% |
| Spelling | 38.24% | 32.35% | 14.71% | 14.71% | 0.00% |
| Fluency | 41.18% | 23.53% | 14.71% | 20.59% | 0.00% |
| Phonemic Awareness | 41.18% | 32.35% | 17.65% | 8.82% | 0.00% |
| Question 5 – How frequently do you use ***Redefinition*** as a method for technology integration when teaching the following components of reading to your students? | | | | | |
| *n = 31* | Never | Rarely | Sometimes | Often | Always |
| Text Comprehension | 32.26% | 16.13% | 16.13% | 32.26% | 3.23% |
| Vocabulary | 38.71% | 19.35% | 19.35% | 22.58% | 0.00% |
| Spelling | 38.71% | 29.03% | 19.35% | 12.90% | 0.00% |
| Phonemic Awareness | 41.94% | 29.03% | 16.13% | 12.90% | 0.00% |
| Phonics | 41.94% | 29.03% | 19.35% | 9.68% | 0.00% |
| Fluency | 45.16% | 29.03% | 16.13% | 9.68% | 0.00% |

For the open-ended portion of the teacher questionnaire, only 15 to 16 of the 42 qualifying teachers responded to the questions. Three questions were asked of teachers to obtain their perceptions on how the technology integration has changed reading instruction, how technology has affected minority subgroup student achievement, and the influence of the professional development on the one-to-one technology integration and reading instruction. Of the combined 46 responses, three major themes emerged from the teacher survey data as seen in Table 9: (a) no impact or effect, (b) student engagement, and (c) technology used for enrichment and remediation.

Table 9

*Teacher Qualitative Survey Open-Ended Responses*

| How has reading instruction and assessment changed, if at all, since implementing the one-to-one technology initiative? | |
|---|---|
| *n = 16* | Frequency |
| Rarely used/no change | 4 |
| Student engagement/differentiated student learning opportunities | 4 |
| Technology used as enrichment, not instruction | 3 |
| Acclimatization to online reading assessments | 3 |
| More access to technology | 2 |
| Students losing motivation for reading literature | 1 |
| **In what ways, if any, has the professional development provided by the school district influenced your implementation of one-to-one technology for reading instruction.** | |
| *n = 15* | Frequency |
| No change/not effective | 8 |
| More emphasis on collaboration and evaluating data | 3 |
| Better insight on how to use technology in the classroom | 3 |
| PD provided for enrichment, no instruction | 1 |
| **In what ways, if any, has the one-to-one technology initiative affected the engagement, learning, and reading achievement of minority student populations, specifically free and reduced lunch, IEP, and ethnic minority students?** | |
| *n = 15* | Frequency |
| Higher student engagement and opportunities for differentiated instruction and remediation | 8 |
| No change/no use | 4 |
| Created behavior issues when transitioning away from technology | 2 |
| More access to grade level and minority literature | 2 |
| Immediate feedback for students | 1 |
| Strengthen student skills | 1 |

**Lack of Impact of One-to-One Technology on Reading Instruction**

The first major theme that emerged from the teacher survey, both in the quantitative and qualitative data, was the lack of use or no use of technology for reading instruction. As previously noted in Table 8, the majority of the teachers were never or rarely using technology for reading instruction. The qualitative data further emphasized this finding, as 7 of the 16 teachers claimed the technology had no effect on student achievement with some teachers choosing not to use it all for reading instruction. This same theme appeared as teachers were asked their perceptions on the effects of the one-to-one integration on minority subgroup student achievement. Nearly 25% of the responses stated the technology had little to no effect on these student subgroups (T22, T35, T58, & T60, Question 8).

The theme of little to no impact continued as teachers were asked teachers how the professional development provided by the school district impacted the reading instruction and assessment. The overwhelming majority, 8 of 15 teachers, indicated the district's professional development had minimal to no effect on reading instruction. Teacher 40 (T40) and Teacher 41 (T41) stated in question eight, "No difference" or "No influence," respectively, and did not expound on the reasons for the ineffectiveness of the professional development. Other teachers revealed most of the professional developed was geared toward specific lessons or modules, not specifically toward integrating the technology as an instructional tool. T60 explained the non-use of technology and its lack of impact in the classroom asserting, "It hasn't very much. We have been given professional development for technology but not so much about how to integrate curriculum with tech" (Question 8).

**Student Engagement**

The second major theme of student engagement emerged as 16 responses indicated technology integration provided new and more appealing options to students. T40 stated, "Students have differentiated lessons using technology, providing sometimes more interesting and engaging materials for them" (Question 6). T54 supported the increased student engagement asserting, "Any technology is going to engage the students more. It allows me to have follow through and immediate feedback to students while I am working in small group reading/writing" (Question 8). Additionally, the teachers felt as if the technology increased student engagement for the minority student subgroups. T4 stated, "I feel it has raised engagement due to the numerous programs and texts that allow for different reading levels and languages and topics" (Question 8). T27 agreed that minority subgroup students were positively impacted by technology through student engagement, but also insinuated it created additional discipline and off-task behavior, as these students struggled to stay on task or transition away from the technology at different points in the school day (Question 8). T60 reported:

> I teach sped [Special Education] and it has been a mixture of helpful and frustrating. A lot of my students struggle with shifting activities and they don't want to get off of technology to switch to other tasks. It causes a lot of problems. However, it is nice to have access to audio books so they can still participate in grade level literature discussions. (Question 8)

### Technology as a Tool for Enrichment and Remediation

The third theme that emerged from the qualitative data were the perception that technology was not an effective tool for instruction, but better used for enrichment, differentiation, and remediation. Nine of the teacher responses specifically called out the use of technology as an enrichment piece after traditional instruction, and felt the minority student groups benefited by the additional remediation and self-paced options. This theme was also noted in the teachers' perceptions about the professional development offered, as teachers were given some instruction on how to integrate technology, but rarely for instruction, but instead isolated lessons, enrichment learning opportunities, or new digital assessments (T6, T16, T46, T58, T60, & T61, Question 8). T46 supported the notion of technology as enrichment and stated, "In my classroom, technology is used after traditional instruction. Technically is then used only to review, enhance, or strengthen the content that was already taught" (Question 6).

### Summary of Findings

With the lack of evidence to support any positive effect of the one-to-one technology implementation from the quantitative data, as presented through the Pearson's chi-square test for homogeneity, more emphasis could be weighted toward some of the specific findings from the teacher's perceptions about technology integration. Due to the overwhelming discovery where teachers were rarely or inconsistently using technology as a tool for reading curriculum, drawing any conclusions or inferring any type of concrete findings about the impact of one-to-one technology, as it related to student achievement, was impossible and produced no significant insight. However, the qualitative data did provide some clarity and direction for many of the next steps this school district could

take in order to make the technology integration more effective, specifically as it related to the student minority subgroups. The qualitative data showed teachers at some levels were misappropriating the technology, regardless of its potential impact on at-risk student subgroups, and instead are promoting some level of resistance by sticking to the established norms and traditions of teaching reading components.

The first research question asked about the impact of one-to-one technology on student reading achievement, and it was conclusively determined there was no significant, positive impact on student reading achievement from the one-to-one technology integration. From the statistical data, 16 of the 20 Pearson's chi-square tests for homogeneity showed a significant difference in the distribution of the 2016 and 2018 school district's reading scores, as defined by the MAP ELA exam. However, the significance in the data showed a decrease in each grade's overall proficient and advanced student percentages. The argument could be made, based on the SAMR integration questions and the teachers' open-ended responses that the one-to-one integration program was either not or inconsistently implemented for any of the six levels of reading instruction.

The first open-ended question in the teacher survey asked teachers to evaluate how the one-to-one technology changed reading instruction. Even though there were a variety of answers, the major themes of no change or only used for testing and enrichment activities emerged from the responses. About half of the teachers indicated that either nothing changed or the technology was not used for reading instruction. T4 indicated, "It hasn't really changed my instruction, but it does give more availability of different types of texts" (Question 6). Furthermore, one out of four teachers felt the

technology provided differentiated opportunities for students to learn at their level or provided enriching opportunities for students to practice more for the MAP test. Teacher 38 (T38) stated:

> Assessments can now be taken through various methods online and can provide immediate feedback to the teacher and the student. Reading instruction, in my opinion, should not be instructed through technology, but by a teacher face to face with their students. Technology can be used as a supplement to the lesson, but not the means for instruction. (Question 6)

Even though there was a positive effect on the students' and teacher's ability to get and provide feedback for learning, T38 captured the majority of the teacher's perceptions in that the teacher is the most valuable asset and source for learning reading components. T46's perception echoed that sentiment where the main instruction should be received through traditional learning methods and technology only be used as a source for enrichment (Question 6).

The additional quantitative data collected in Table 8 from the teacher survey supported this point and provided insight into the lack of technology impact on student reading achievement. Teachers demonstrated a consistent non-use of technology for reading instruction, as high as three out of four teachers indicated they never or rarely used the one-to-one technology for any component of reading instruction. Even at the most basic level of the SAMR technology integration model, which only required replacing a paper and pencil task with technology, on average, more than half of the teachers responded they never or rarely used technology for reading instruction.

The second research question asked the same question of impact on student reading achievement, except it specifically focused on the minority student subgroups of ethnicity, IEP, and free and reduced lunch. Similar results were found in each minority student subgroup with 8 of the 12 chi-square tests showing a significant difference in the distribution of scores from 2016 to 2018. However, even though four specific grades across the three subgroups showed no significant difference in the distributions, all three chi-square tests when looking at all grades, third through sixth, produced a $p < .001$ for all three student subgroups. Like the overall grade level comparisons, each of the minority subgroups showed a decrease in the percentage of proficient and advanced students from 2016 to 2018, demonstrating the one-to-one technology integration program had no impact on minority student subgroup reading achievement.

The qualitative data collected from the teacher survey differed some, in that over half the teachers felt like the technology was having a direct impact on student engagement for the minority student subgroups. T4 felt the technology provided options, like reading levels and interest, better engaging these student subgroups (Question 8). T25 stated:

> There are so many interactive platforms available to reach individual students and grab their attention to learning. The platforms are so precise, the student is able to experience success at any level and continue to make improvements on an individual basis like never before (Question 8).

T41 took the student engagement to another level, as it related to ethnic minority students and stated, "It provides more opportunities to show representation of minorities in what students are reading" (Question 8). This teacher was the first and only teacher to address

the lack of diversity in many of the reading offerings provided in the school's curriculum. T38 further perceived that technology provided distinct advantages for this subgroup, as many of these students are not receiving enough teacher support. This teacher implied that due to the lack of direct teacher instruction or attention paid to the deficits presented by many of these subgroups, technology integration could be used to fill this instructional gap (Question 8).

Even with the potential for student engagement, one teacher felt as if the technology was only exacerbating many of the problems seen with IEP students. T27 asserted:

> I think there is a higher level of engagement for these students, but I have also noticed that they are more likely to get off track because they want to use the computer time as game time or play time. This is especially true for students with ADHD or students that are on the spectrum. It is sometimes a struggle to end computer time. (Question 8)

Though some teachers felt there was a risk of classroom misbehavior, the majority of the teachers perceived the ability to differentiate instruction and potential for remediation and additional support had a significant impact on the minority student subgroups, even though the statistical data did not support this finding.

The third research question posed asked teachers their perceptions about identifying a primary factor for determining the effectiveness of a one-to-one technology implementation on student reading achievement. Building on the prior arguments, the majority of the teachers felt the lack of implementation was directly related to the school district's professional development. The second open-ended question from the teacher

survey sought to gather information regarding the quality of the professional development, as it related to the one-to-one technology program. Over half of the teachers who responded indicated the professional development offered was not effective and provided no content that affected their application of technology in the classroom. Many of the responses did acknowledge the school district attempted to provide professional development, but felt the application was limited to specific projects and not overall instructional strategies. T38 asserted,

> Having been through Tech Academy, I feel that there was quality instruction provided for the inclusion of technology to enhance a lesson or project, but not a means of instruction. There has been an adequate amount of PD provided, but with new members of faculty each year, I do find it a benefit to continue to provide quality professional development to teachers in regards of how to implement technology in the classroom effectively (Question 7).

T38's comments match those of most of the teachers who responded, calling for the need for additional, targeted professional development. T54 supported this notion and stated, "Several years ago it was very heavily pushed in PD, but in the past several years the district has actually done away with the model as a basis of instruction. They're actually telling us to use less technology" (Question 7). T27 took lack of PD to another level and stated, "I do not feel that we have had a lot of PD in (the school district – school name omitted) to merge reading and technology at the elementary level" (Question 7). The lack of targeted professional development toward reading instruction was a common perception amongst the teachers and supported the conclusion that the school district's

professional development was beneficial to introduce how to integrate technology into specific lessons, but never reached the level of affecting the teaching pedagogy.

Overall, it was evident there was no significant effect of the school district's one-to-one technology initiative on student achievement, whether comparing all students or the student minority subgroups of ethnicity, IEP, or free/reduced lunch. Through the teacher survey, both quantitative and qualitative data revealed the teachers' lack of implementing technology as an instructional tool. Additionally, the teachers' open responses revealed untargeted professional development as one of the major barriers to successful implementation. Even though professional development was a major theme as a barrier for implementation, it could be argued that a philosophical belief of favoring traditional teaching methods over technology integration could have played a role in the teachers' lack of implementation.

## Discussion

The findings of this research study have proven to be typical compared to past research with common barriers to successful implementation, like teacher buy-in and poor professional development (Chanlin, 2007; Claro et al., 2013; Donovan, Green, & Hansen, 2012; Inan & Lowther, 2010; Inserra & Short, 2012; Li, 2010; Zheng, Warschauer, Lin, & Chang, 2016). However, this study approached the relationship of educational technology and student achievement from a critical theory lens, exposing the entrenched ideologies of traditional classroom instruction as a barrier to minority subgroup student achievement, masked by excuses of untargeted professional development. Even though additional research would be prudent to further uncover the

reasons for the lack of technology integration, some level of cultural hegemony may be present within this group of teachers.

Due to the lack of implementation and buy-in, this research study turned out to be in line with many past quantitative research studies regarding student achievement, where factors of teacher buy-in were at the top of the limiting factors for successful integration. Zheng, Warschauer, Lin, and Chang (2016) stated:

> a number of studies suggested that teachers had initial concerns about use of laptops for instruction, either due to limited technology skills, lack of sufficient technical support, uncertainty about ways in which the technology would affect them, or fear of losing control in the classrooms. (p. 1071)

This lack of utilizing technology spoke directly to the findings in this study, as many teachers chose not to use technology for reading instruction, even at the lowest level of integration. The lack of use of technology in the classroom could be directly correlated to the absence of or non-targeted professional development to better increase teacher confidence (Chanlin, 2007; Claro et al., 2013; Donovan, Green, & Hansen, 2012; Inan & Lowther, 2010; Inserra & Short, 2012; Li, 2010). Claro et. al (2013) asserted in their study that the support provided by the school district to equip teachers was not sufficient, and "teachers require much clearer and more systematic guidance and orientation in order to use the new resources" (p. 325).

As teachers perceived a lack of support to integrate technology into a complex task, such as reading instruction, this perception negatively affected their attitudes toward the technology and created a barrier for change, and perpetuated a desire to stick with what works or what they are familiar with when teaching reading concepts to students

(Zheng et al., 2016). Claro et al. (2013) reported in their research study the major barriers for successfully integrating the technology into everyday lessons "included lack of time for planning, project overload and little technical or pedagogical support" (p. 325).

Teacher buy-in was a clear determining factor for effective technology integration, as noted in past studies. The infrastructure the school district provided, through support and professional development, was vitally important to keeping teachers' perceptions positive toward the technology (Inan & Lowther, 2010; Zheng et al., 2016). As school districts supported teachers through the learning curve, teachers became more confident and were able to integrate technology into their everyday instruction (Inan & Lowther, 2010; Lei, 2010). The teachers' perceptions in this study did reveal a similar pattern of apathetic attitudes toward integrating technology as a primary teaching tool, using the lack of professional development and support as a key contributor to lack of technology implementation. However, laying alongside the aforementioned barriers, teachers revealed personal beliefs toward integrating technology as a part of reading curriculum. The entrenched, traditional beliefs of educating students could play a major role in the failure of the technology to affect student achievement scores. The inability of teachers to adopt this new trend in education, even with past research demonstrating a positive impact on low-SES students, potentially pointed toward a belief of a one size fits all philosophy (Zheng et al., 2016).

**Critical Theory Conclusions**

Even with more targeted plans toward professional development, Schrum et al. (2011) asserted that teacher buy-in was one of the most important pieces to ensure

effective technology integration. Both the quantitative and qualitative teacher data in this study clearly stated that teacher willingness to implement technology was not achieved on a large scale. Many of the teacher responses referred to technology as an opportunity for enrichment and remediation, but not a replacement for a traditional teacher to student information learning approach. This type of belief about technology integration could speak directly to the lack of implementation seen in this research study. Furthermore, teacher comments about technology having no place in reading instruction spoke to a much deeper issue that could be addressed by the concept of cultural hegemony.

With the history of success noted by this school district (school web site, 2022), many teachers were prescribing to the philosophy of the "one size fits all" and refusing to look deeper at the potential impact of technology on minority subgroups in more of a way other than enrichment or remediation (hooks, 1994). As noted in the SAMR questions and open-ended responses, the vast majority of the teachers surveyed were choosing not to implement the technology, even though they did feel it had a positive impact on minority student subgroup engagement. This paradox was noted as teachers spoke about their perceptions with no concrete evidence of impact on student achievement, yet still felt traditional learning was the best route for all students.

bell hooks (2004) asserted that some of the problems may be related to individual teachers' beliefs about learning, but in many cases, the pressure for high achievement on standardized tests could produce the disadvantage for minority student subgroups. hooks (2004) stated:

> And if required standardized testing is institutionalized anew, it will be even harder for public school teachers to bring creative ideas to the work of teaching. They

> will be required simply to relay information as though the work they do is akin to that of any worker on an assembly line. (p. 16)

The greatest challenge would be to determine whether the problem of technology implementation lay in the entrenched teachers' beliefs about teaching reading curriculum or whether it was a flight or fight response to the extreme nature and stress of high-stakes standardized student assessments. Educators must understand how their own personal beliefs and principles intertwine with their professional values. The ability of the educator to differentiate between the two values would help determine whether or not the problem of technology integration lay with the educator or within the structure of the organization. Patterson (2013) asserted, "Discerning how these two forms of consciousness intersect helps educators come to terms with conflicts that may arise between their principles and the values they are expected to uphold within their organizations" (p.12). Using the critical theory lens as a structure to view this research not only provided better context to the findings concerning lack of technology integration, but "it has the ability to unveil and address structures that promote alienation and brokenness" (Vaandering, 2010, p. 173).

**Limitations**

The limitations for this research study were mainly seen in the gathering of quantitative data form the school district. Initially, Scholastic Reading Inventory (SRI) data were sought to perform both an independent *t*-test and a Pearson's chi-square test for homogeneity. Due to a recent change in the school district's data storage program, past SRI data were no longer retrievable. Even though the MAP ELA data had the same potential to compare both 2016 and 2018 student achievement data, due to the State of

Missouri shifting their categorical range for the four levels of achievement, it made it impossible to perform an independent *t*-test without creating some scale factor to make the two years of data similar in their categorical ranges.

Regarding the qualitative data, even though there were no conflicts of interest, it was still difficult to gather information from teachers regarding a district program. This made it imperative to allow teachers to respond to an anonymous survey, where they could express their feelings and perceptions without fear of repercussions. Ideally, the researcher would have been able to gather additional, more in-depth data to better answer research questions through one-on-one interviews or focus groups, but felt the lack of anonymity would have potentially skewed the participation and responses.

**Future Research**

Based on the results of this research study, additional quantitative research could be conducted to advance either future studies within this school district or expand similar research with a new school district implementing one-to-one technology. One future research opportunity would be to use an independent *t*-test, comparing SRI scores for another school district using one-to-one technology. This would provide a better comparison between the years and allow the researcher to better track individual students and their achievement. For this case study, the same third and fourth grade MAP ELA data could be utilized to track a random sampling of each of the subgroups from third to fifth grade (2016-2018) and fourth to sixth grade (2016-2018). The students could be tracked for the three grade levels and data analyzed on their individual performances on the MAP ELA. Even though we know the data had a downward trend for 2018,

individual students may have seen positive changes in achievement, especially within the minority student subgroups.

For the qualitative data, future studies within this school district would be necessary to further explore the teachers' perceptions and reasons for not implementing technology for their reading curriculum. This would be important, as it would help the school district better understand the barriers to technology implementation, whether due to lack of buy-in, professional development, personal beliefs about educating large groups of students, or the stress and pressures of high-stakes student testing. Understanding the basis for this lack of technology integration would help the school district to not only eliminate biases and structures that would inhibit students from reaching their full potential, but also give them a focused plan of attack for implementing technology in such a way to transform the learning and lives of the students they serve. Li (2010) stated, "With a clear vision, curriculum goals, innovative pedagogies and professional development, teachers will develop their awareness and change their practices accordingly when exposed to or confronted with the success demonstrated by exemplary practices" (p. 285).

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# SECTION SIX

# SCHOLARLY PRACTITIONER REFLECTION

## Introduction

One of the main reasons I chose to pursue the Ed.D. program through the University of Missouri was to expand my knowledge of leadership, critical thinking, and research. I have been blessed with a diversity of experience and degrees from three different institutions, and as I was given opportunities to join other doctorate programs, I was specifically looking for a proven system to challenge and push me as an educator. Along the way, I can attest to how the curriculum and readings challenged my entrenched views on education and brought me to a place of enlightenment. Many times, the experiences in this program were stressful and rigorous, pushing me out of comfort zone, but ultimately made a path for personal and professional change. Bennis and Thomas (2011) interviewed several top leaders who "were able to point to intense, often traumatic, always unplanned experiences that had transformed them and had become the sources of their distinctive leadership abilities" (p. 99). These new ways of thinking and looking at my world, as an educational leader and scholar, have now become a part of my everyday processes.

## Dissertation Influence as an Educational Leader

As an educational leader, the dissertation curriculum significantly influenced me as a practitioner by balancing my approach to managing and leading. For years, my greatest strength was found in organizing people and processes, efficiently planning and accomplishing tasks, and problem solving. As my current job morphed into a leader of leaders, I was being forced to set the direction, vision, and goals for my department. Heifetz and Laurie (2011) asserted that "Instead of maintaining norms, leaders have to challenge 'the way we do business' and help others distinguish immutable values from

historical practices that must go (p. 59). For the first time in my career, I was setting the direction and helping others deal with the inevitable change that is required to stay relevant and successful in education.

This experience helped me narrow my approach to leadership as I looked to inspire and motivate those I led, and also helped me to refine and close the gap between my knowledge and actual application of what a servant leader should look like in an educational setting. A servant leader can be defined in many ways, but these types of leaders put the needs and well-being of those they lead first, focusing on their personal and professional growth as a top priority (Northouse, 2013). This process of leadership influenced how I hire teachers and coaches, the feedback and influence of how people I lead are evaluated, and the growth opportunities I look to create for them. A specific example can be seen in how I ask each coach to set goals at the beginning of the year, not only for their program, but for their personal goals as a future leader. Many times I noticed they set goals to become an administrator, so I look to give them authentic experiences and learning opportunities, like running district tournaments to leading a stipend review committee. All of this is an attempt to demonstrate the qualities of a servant leader and put the needs of those who follow me first, and working with them to obtain their professional goals.

The next way in which the dissertation process influenced my practice as an educator is through the analysis of my organization and community, using Bolman and Deal's (2008) organizational frames. Viewing my organization through these four frames guided me as I planned tax levies and bond projects, and started new programs and

endeavors. The two most common frames I utilized in my position are the human resources and political frames.

For human resource frame, it all starts with hiring the right people and viewing them as your most important commodity. Bolman and Deal (2008) stated, "Strong companies know the kinds of people they want and hire those who fit the mold" (p. 143). Even though this statement sounds like simple, effective advice, the hiring process can be difficult if you do not what type of people you need to hire. Through extensive research, as I looked to improve our programs and create winning traditions, I found that many successful teams and organizations focus on building culture through student leadership. Where it is easy to focus on hiring people who have demonstrated a tradition of winning, I started creating a picture of what my coaches need to look like, which included building a culture of people over winning. As I searched for a new football coach across the nation, I specifically looked for coaches who fit this mold, and through sticking to this approach for hiring, I was able to hire a coach who turned the program around in less than one year.

I used other principles in the human resources frame, like promoting from within. I made it clear to all my coaches that we will always look to promote from within, as long as they demonstrate the characteristics I laid before them. This encouraged some of my coaches, who could have left for other head coaching jobs to stick around and be promoted from within. The last principle of the human resource frame I used was to empower those I lead. I always stated that if every process and practice begins and ends with me, we will never grow as a department and organization. I sought to empower my coaches by keeping them informed of all pertinent information, encouraging them to take

risks and dream big, and giving them an equal seat at the table to give feedback and inform decisions.

The second frame that significantly influenced my approach to understanding my organization was the political frame. Understanding the different groups within the organization and what groups hold power, along with building relationships and bridges to and between the various stakeholders was essential to creating change within my department. Bolman and Deal (2008) asserted that a leader "has to walk a tightrope: developing a direction, building a base of support, and cobbling together working relations with both allies and opponents" (p. 214).

Passing bonds and tax levies in my position as an Activities Director has always been challenging as I fight to balance the needs for the athletic and activity programs. When proposing new building projects, I learned to look for the dominant, powerful stakeholders who could benefit by the project. Bringing the leaders of those programs to the table for planning and input helped me build a bridge between programs who can tend to be selfish, instead working together for a mutually beneficial project. This was especially critical as some of my larger programs have significant influence on the parent groups, who then go out and vote for these bonds and tax levies. My learned ability to navigate my organization's political terrain and my strength in building networks within the programs in my department allowed me to unite our community, pass bonds and tax levies, and build athletic and activity facilities that support our department goal of supporting student growth and success.

## Dissertation Influence as a Scholar

One of the very first topics discussed in our initial summer curriculum had to do with inequality regimes and entrenched paradigms in our society. As a white male, many of these first attempts to challenge my way of thinking upset and offended me on many levels. As a scholar, part of this process was embracing different views on society, culture, and learning, and how this affected marginalized groups within our society. The influence of the dissertation process as a scholar has been to look at the world through multiple lenses, and the ability to be recognize that privilege and inequalities in organizations and society are not happening somewhere else, but are entrenched in many of our everyday processes, practices, and policies (Acker, 2006). As a researcher, part of the process was to acknowledge my place of privilege, then seek to question everything, challenge the status quo, and promote change from within my organization (Guido, Chávez, & Lincoln, 2010).

In a simpler example of how the dissertation process has been a significant influence, my background is in mathematics, and my natural inclination was to gravitate only to toward quantitative research studies. Research grounded in mathematical computations or historical data were the main direction in my past two research theses. With my analytical background, numbers were the easiest path for me to draw logical conclusions, making qualitative research seem like a convoluted and time-intensive process to mine anything of significance from the research. With this narrow mindset, qualitative research was not in my initial plan for my dissertation and research, as I did not understand the value that people's perceptions through interviews and surveys could

add to research. Through the dissertation process, I began to see that qualitative research informed many of the "why's" that accompany the quantitative data results.

My first real experience with a mixed methods case study, which opened my eyes to the value of qualitative research, involved a local chocolate factory owner. The study used a quantitative survey given to the owner and employees asking them to rate various leadership qualities about the owner. The data came back and indicated Mr. Askinosie was a strong, transformational leader. However, as we began the interviews, I learned much more about the transformational leader and the organization. The qualitative data demonstrated how he was transformational, as he used his own personal stories to inspire and motivate others within the organization to be creative and successful. Through the use of his personal story and hardships experienced throughout his life, his name became a symbol for overcoming adversity. Similarly, his organization was run with the same care and concern for his clients and his employees, and even though the business growing exponentially, he still inspired his employees to embark on company and individual humanitarian efforts. Without the qualitative data form this research study, it would have been easy to conclude that the leader was transformational, but the qualitative data painted a broader and more revealing picture of why. Due to this project, modifying my dissertation project to a mixed methods case study was essential, as I now desire to find out the truth behind the numbers.

The next prominent area I felt this process affected me as a scholar was in the motivation to influence others as an expert in my field. The dissertation coursework taught me to be a thorough researcher and comb through extensive amounts of research studies to arm myself with the most current knowledge about a subject area. I learned

how to find research through a variety of means, use that research to find original, authentic sources of data, then draw conclusions that are not only scholarly, but practical in application. This approach set me apart in my field as an intelligent leader, which has given me great influence within K-12 education and activities. This scholarly process inspired me to write articles, speak as an expert at conferences, and work to influence educational legislation and local and state policies. Even though my dissertation research topic was not associated with my current job in education, the results inspired me to share this with our various leaders, and I also asked to be considered as a part of the team that looks to reimagine our district's technology initiative.

The last area I feel that the dissertation coursework influenced me as a scholar was through instilling a strong value of becoming a life-long learner and developing a culture of learning. Gill (2010) stated, "A culture of learning is an environment that supports and encourages the collective discovery, sharing, and application of knowledge. In this kind of culture, learning is manifested in every aspect of organizational life" (p. 5). As a scholar, I am looking to inspire those I lead to follow suit, and not be stagnant in the status quo. I am encouraging a discourse that challenges our everyday practices, decisions, and policies, but with the expectation of finding the solutions. I inspired many to not come to the table with problems, but instead research solutions that brings positive change that affects our programs and student success. Heifetz and Laurie (2011) sum up the essential challenge of a leader, where the leader "has to engage people in confronting the challenge, adjusting their values, changing perspectives, and learning new habits" (p.78).

## Summary

The process of reflecting on my growth as a practitioner and scholar was difficult, as I was able to take every aspect that I learned as a scholar and find practical application for how it informed and affected my practice as an educational leader. Even though this dissertation process was extremely difficult and challenging, I would not change any aspect of it, as it has completely transformed me as a person and a leader in K-12 education. Throughout the process, my sphere of influence has been widened to include critical theories and influences of authors, like bell hooks, who look to identify and eradicate dominant ideologies, whether intentionally or unintentionally that look to marginalize student minority groups. Similarly, my mind was enlightened to see my organization through a variety of filters to not only identify the imperfect structures and politics of large organizations, but use those imperfections to create harmony, uniting coaches and teachers with a multitude of agendas to put students first and care for their well-being and success. Lastly, it ignited my fire and passion for those I lead, where I would lay down my own agendas and personal advancement to see them succeed. This entire dissertation process has been transformational in my learning process. Merriam and Bierema (2014) stated, "transformative learning is a form of learning very much embedded in life experience. The process actually begins with an experience that causes us to question our assumptions about how the world works or how life is" (p. 107).

I am grateful for the transformative learning opportunities and believe this process has truly affected my life through coupling doctoral learning with life and professional experience which will continue to affect how I lead and make decisions of policy and practice.

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Appendix A

**SAMR Technology Integration and Reading Achievement**

Q1 How many years have you taught in your current school district?

Q2 How frequently do you use Substitution as a method for technology integration when teaching the following components of reading to your students? Substitution - Classroom technology acts as a direct substitute for paper/pencil functional change to the lesson.

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| Phonemic Awareness | ○ | ○ | ○ | ○ | ○ |
| Phonics | ○ | ○ | ○ | ○ | ○ |
| Fluency | ○ | ○ | ○ | ○ | ○ |
| Vocabulary | ○ | ○ | ○ | ○ | ○ |
| Text Comprehension | ○ | ○ | ○ | ○ | ○ |
| Spelling | ○ | ○ | ○ | ○ | ○ |

Q3 How frequently do you use as a method for technology integration when teaching the following components of reading to your students? Augmentation - Technology acts as a direct substitute for paper/pencil with some functional improvements to the lesson.

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| Phonemic Awareness | ○ | ○ | ○ | ○ | ○ |
| Phonics | ○ | ○ | ○ | ○ | ○ |
| Fluency | ○ | ○ | ○ | ○ | ○ |
| Vocabulary | ○ | ○ | ○ | ○ | ○ |
| Text Comprehension | ○ | ○ | ○ | ○ | ○ |
| Spelling | ○ | ○ | ○ | ○ | ○ |

Page Break

Q4 How frequently do you use Modification as a method for technology integration when teaching the following components of reading to your students? Modification - Technology allows for significant redesign of the project or task in the lesson.

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| Phonemic Awareness | ○ | ○ | ○ | ○ | ○ |
| Phonics | ○ | ○ | ○ | ○ | ○ |
| Fluency | ○ | ○ | ○ | ○ | ○ |
| Vocabulary | ○ | ○ | ○ | ○ | ○ |
| Text Comprehension | ○ | ○ | ○ | ○ | ○ |
| Spelling | ○ | ○ | ○ | ○ | ○ |

Q5 How frequently do you use Redefinition as a method for technology integration when teaching the following components of reading to your students? Redefinition - Technology allows for creation of new tasks and projects, previously inconceivable within a traditional lesson.

| | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| Phonemic Awareness | ○ | ○ | ○ | ○ | ○ |
| Phonics | ○ | ○ | ○ | ○ | ○ |
| Fluency | ○ | ○ | ○ | ○ | ○ |
| Vocabulary | ○ | ○ | ○ | ○ | ○ |
| Text Comprehension | ○ | ○ | ○ | ○ | ○ |
| Spelling | ○ | ○ | ○ | ○ | ○ |

Q6 How has reading instruction and assessment changed, if at all, since implementing the one-to-one technology initiative?

Q7 In what ways, if any, has the professional development provided by the school district influenced your implementation of one-to-one technology for reading instruction?

Q8 In what ways, if any, has the one-to-one technology initiative affected the engagement, learning, and reading achievement of minority student populations, specifically free and reduced lunch, IEP, and ethnic minority students?

# VITA

Brandon Clark was born and raised in Springfield, MO. He attended Kickapoo High School in southwest Missouri, and after high school, earned his bachelor's degree from Missouri State University. While teaching mathematics at Central High School in Springfield, Missouri, the author earned his first master's degree in teaching from Drury University, then went on to graduate with his second master's degree in educational administration from Evangel University.

Brandon has been an educational leader for 16 years, starting his administrative career as a Dean of Students with an emphasis in at-risk student behavior and achievement. The author went on to become the Athletic Director and Assistant Principal for his high school alma mater, then transitioned out of the Springfield Public School system to take the District Director of Athletics and Activities for Nixa Public Schools.

In his free time, the author is a musician and worship leader for his local church. Brandon has a strong passion for children and assists his wife regularly in their church's children's ministry. He also enjoys spending time with his wife and children, as they have three active children in sport with his oldest daughter playing division I basketball in Tennessee.