The Impact of Instructional Technology on 4th Grade Student Achievement

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ABSTRACT

This study examined the impact of instructional technology on 4th grade students' achievement. The study was conducted at a public elementary school with a predominantly upper-middle class student population. Two pre-existing social studies classes of 25 students each were randomly assigned to the control or experimental condition. Groups did not differ significantly on the previous unit chapter test, which was used as pretest information. Students received four and a half weeks of instruction on events leading to the American Revolutionary War. The control group received traditional instruction, gleaning most of their information from textbooks and paper articles. The experimental group received instruction integrated with technology and accessed most of their information through videos and online articles housed on an online platform. Participants completed a researcher-designed post-test. Questions on the post-test were created using Bloom's Taxonomy and consisted of multiple choice, matching, fill in the blank, and a short response question. Results of the post-test indicated that there was no statistically significant difference in the mean percentage correct between the control (Mean = 87.32, SD = 13.66) and experimental (Mean = 84.44, SD = 13.20) groups [t (48) = .76, p = .45]. Consequently, this researcher can conclude that instructional technology does not differ significantly from traditional methods in promoting academic achievement among fourth grade students predominantly from the upper-middle class, however, observational data suggests that students were more engaged when using laptops to enhance their learning experience. Implications and ideas for future research, including the role of socioeconomic status, are discussed.

CHAPTER I

INTRODUCTION

Overview

Technology has become a staple of living in the 21st century. Smart phones, televisions and computers provide unlimited access to an abundance of information and knowing how to navigate the virtual labyrinth is essential. Schools have noticed the need for a technologically savvy student population and have begun integrating more and more technology into the classroom in order to prepare students for success in the 21st century. What began with desktop computers and overhead projectors has progressed to iPads and smartboards that respond to human touch. Students now have the World Wide Web at their fingertips. More and more, students are being exposed to technology both in and out of the classroom, and are being expected to learn and excel on a virtual platform, but is this truly what is best for students?

Law, Niederhauser, Christensen, and Shear (2016) stated that "integrating the use of digital technology into the learning and teaching process to improve the quality of learning outcomes has become an important strategy for improving educational quality" (p. 73), but this may be easier said than done. Many schools lack the financial means to purchase adequate technology for their schools. Proper device management with large class sizes make the task even more daunting, and to top it all off, educators may lack the confidence to actually implement technology into the classroom. Laptops and other forms of instructional technology "could be one variable that contributes to improving student outcomes" if implemented and monitored correctly (Garwood, 2013, p. 8).

This researcher, a 4th grade teacher, has noticed a significant shift in technology in just the past five years, and students may be struggling to keep up with the increasing demands. This

researcher is drawn to the topic of technology in the classroom because of the benefits it would provide for her students. While excited about the opportunities and plethora of information available to students via the internet, this researcher is concerned that such an abundance of information could be overwhelming to some students and detract from their educational experience. The purpose of this research is to determine not only whether students find technology engaging and exciting to work with, but also whether or not they are able to succeed with the use of technology in the classroom.

Statement of Problem

The purpose of this study is to examine the impact of instructional technology on 4th grade students' achievement.

Hypothesis

The null hypothesis was that post assessment data will indicate no difference in student achievement between students receiving traditional instruction and students receiving instruction with technology integration.

Operational Definitions

Instructional Technology: Instructional technology is defined as technology such as laptops, smartboards, iPads, and mobile devices that allow students to access information for educational purposes. For the purpose of this study, instructional technology refers to laptops students used to access an online social studies curriculum on the events that caused the Revolutionary War.

Student Achievement: For the purpose of this study, student achievement is defined as a student's performance on a researcher designed test, with both paper and online components, that assessed comprehension of the events leading up to the Revolutionary War. Item types included matching, short response, and fill in the blank.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this literature review is to examine the impact of technology on student's academic achievement and overall engagement. Section one outlines the types of technology available in today's classrooms and expectations for appropriate use. Section two discusses attitudes towards technology from various perspectives including teachers, students and parents. Section three will review the impact of technology on student engagement and section four will look closely at the relationship between technology and student achievement. Finally, section five discusses the impact of technology-based interventions on traditionally low-performing students such as those with learning disabilities, English Language Learners, and students with low socio-economic status.

Overview of Technology in the Elementary Classroom and Intended Purpose

Roaming the hallways of any modern elementary school, the amount of technology available to young people under the age of ten is quite surprising. Many classrooms are equipped with a plethora of digital devices that go far beyond the desktop computer of decades past. Classroom chalkboards have been replaced with interactive white boards that respond to human touch. One-to-one devices such as iPads and laptops are being used to promote digital awareness and give students access to the entire internet's worth of information at their fingertips. Some elementary schools have even invited students to bring in their own technology from home to enrich the learning experience. But how is all this technology being used in the hands of students and what benefits, if any, are being seen as a result?

In 1998, the International Society for Technology in Education (ISTE) began developing a set of technology standards for students, educators, coaches and educational leaders. These

standards serve as a framework to "help educators and education leaders worldwide prepare learners to thrive in work and life" in the 21st century (International Standards for Technology in Education, 2019). These standards outline the many roles and responsibilities of individuals accessing technology in the classroom and cover a variety of topics, from implementation and facilitation of technology in the classroom, to acquisition of new knowledge, to safety and security measures as students browse the internet as digital citizens, and beyond as their perspectives are challenged on a global frontier. These standards serve as a reminder that technology is a necessary tool in order for students to "develop the thinking and learning skills necessary to compete in a global economy" (Garwood, 2013, p. 3). The world is changing, and education needs to keep up with the times in order to produce citizens competent to not only survive but thrive in the 21st century world. In order to be successful, educators and educational leaders must not only have access to technology, but also the confidence and expertise to implement technology in ways that will benefit student engagement and achievement.

Attitudes Towards Technology in the Classroom

Technology, when used effectively, can be an engaging and motivating tool for students and result in increased levels of participation in learning activities, but not all educators are comfortable implementing technology into the classroom (Olivares & Castillo, 2018). Educators may be hesitant to or avoid using technology altogether if they lack the required training and professional development to do so with ease. Research has indicated that educators, even those well-versed in the art of technology implementation, confront many challenges when implementing technology in their own classrooms. For example, some educators have difficulty managing new software and find the icons to be confusing or overwhelming (Divaharan & Hwee, 2010). Other educators do not know the correct applications to use that will best support

desired their learning outcomes. Harford County Public Schools, for instance, boasts access to over twenty different online applications on their itsLearning platform (Apps and Tools, 2019), in addition to interactive student response websites such as Padlet, Answer Garden, and ThingLink, but offers little assistance on when and how to use each application in the classroom. In addition to insufficient training, educators often feel that schools receive limited funding for and technical support, there is a lack of digital resources for the growing student populations, and that the time and effort required to plan a well-thought out technology-integrated lesson does not always pay off in terms of student engagement and achievement (Grandol, Carrillo & Prats, 2012).

Educators who have successfully implemented technology into their classroom can leave a lasting impact on their students. Conversations with students can offer valuable insight into their learning experiences with technology. In a study by Dietrich and Balli (2014), when students were asked to describe their past educational experiences with technology, they used words like “cool” and “fun” and seemed genuinely excited to engage in learning opportunities on digital devices. Students mentioned that traditional visual aid tools, such as chalkboards or chart paper, did not grab their attention in the same way that digital tools, such as interactive white boards and iPads, did. One student referred to an activity he completed on a one-to-one device by saying “You get your own independent time to actually find out yourself without [the teacher] telling you, so it gets more challenging” (p. 25).

Digital activities that promote engagement and increased rigor are definitely a welcome site in any elementary classroom, but not all students surveyed by Dietrich and Balli (2014) perceived the technology-integrated lessons in their classrooms as opportunities to gain knowledge. Some students were excited about using new technology but were unable to recall

specific details about the lesson being taught. Others said that it seemed more like they were playing than learning. Other students said that using technology, especially when presenting information to others or solving information in front of the class on the interactive white board, made them feel anxious and nervous. Even more bothersome was the fact that many students admitted that when they were not engaging directly with the technology, for example when their teacher or another student was modeling how to solve a problem on the interactive white board, their minds would "wander off" or disengage completely. It appears that technology, while engaging and exciting for most, may not be able to reach all learners in the same ways.

Another perspective to consider when discussing technology in the classroom is that of parents and guardians. While not exposed to the technology used in school directly, parents are seeing the impact of technology in student's attitudes towards school and grades/student achievement. Parents surveyed by Parsons and Adhikari (2016) mentioned that students seemed more motivated to complete assignments when they were offered on a digital device as opposed to the traditional pencil and paper, but that the quality of work varied depending on the student. Some parents saw improvement in student achievement as well as digital literacy and overall independence when completing homework assignments on such devices. Parents of students with learning disabilities were particularly impressed with the impact technology had on their students' overall engagement. One parent stated "Having a child with ADD - the difference is huge. It engages her in a way that normal teaching doesn't" (p. 73). Other parents found that technology had the opposite effect on their students. Grades dropped and student's work ethic decreased significantly. One parent stated that since assignments have gone digital, her child no longer feels the need to "write out her work [and] she often does not retain information as well as she used to". Based on the perceptions of teachers, students, and parents, it's difficult to

determine whether technology in the classroom is actually benefiting students, so it is important to look next at what the research says.

Impact of Technology on Student Engagement

All educators can agree on the basic principle that in order for meaningful learning to take place, content must be relevant, rigorous and engaging. This has become the mantra over the past several decades, especially in the shift to integrate technology into education. Technology may offer a fun and exciting alternative to traditional textbook-based education, but it is important to consider whether it actually has any meaningful impacts on student engagement.

Student engagement is not a new concept and can be defined as opportunities in the classroom when students are attracted to their work, persist in their work despite challenges and obstacles, and take visible delight in accomplishing their work (Strong, Silver & Robinson, 1995). Student engagement in the classroom can be measured in many ways including but not limited to classroom observations, teacher interviews, student surveys, school attendance rates, etc.

Hutchison, Beschorner, and Schmidt-Crawford (2012) conducted a study that observed three different technology-enriched literacy activities which took place over a three-week span. The teacher's goal when developing these lessons was "to enhance students' learning opportunities with the iPads and provide them with an opportunity to also learn some of the new literacy skills associated with 21st-century technologies" (p. 17). In-class observations and teacher interviews revealed that technology afforded more opportunities for creativity in the classroom, and students did not feel limited to the confines of a worksheet. Students reported that they made greater connections to the text and, with a little practice, would be more willing to use some of the available online tools, such as the online dictionary and note-taking capabilities.

A longitudinal study conducted by Shapley, Sheehan, Maloney, and Caranikas-Walker (2011) observed a 1:1 laptop initiative in rural, urban and suburban middle schools in Texas over a three-year span. They relied on school attendance and frequency of disciplinary actions as indicators of student engagement. The study found that over the three year span, schools from the experimental group which participated in the 1:1 initiative saw less frequent student disciplinary incidents than their counterparts in the control group. Additionally, school attendance rates decreased at a faster pace, signifying that perhaps students were more willing to come to school when offered technological opportunities.

Not all studies found increased levels of student engagement when using technology, however. Hutchison et al. (2012) mentioned that although most students were engaged in the lesson, a few students were not engaged in rigorous activities and needed to be more closely monitored. Donovan, Hartley and Strudler (2010) found middle school students using laptops inappropriately in class, thus distracting them from engaging in the lesson. These researchers noted that "the frequency of observed off-task behavior seemed to correspond directly to students' access to technology" (Harper & Milman, 2016, p. 136). In conclusion, when implemented effectively, technology can create meaningful, rigorous and engaging learning opportunities for students, but clear expectations must be set in order for all students to meet their full academic potential and benefit from its use.

Impact of Technology on Student Achievement

Researchers investigating the relationship between technology and student achievement have used designated measures of achievement such as standardized test scores and curriculum-based test performance to determine whether using technology impacts achievement. Studies

have been conducted across a variety of subject areas and the results appear inconclusive as of yet.

A study conducted by Shapley et al. (2011) reported that the reading achievement of economically advantaged students, as indicated by standardized test scores, in both the experimental group (using technology) and control group (not using technology) decreased over the course of the study. Conversely, the reading achievement of economically disadvantaged students in both the experimental and control groups grew significantly faster than their advantaged peers. The fact that the reading achievement of both the groups with and without technology fluctuated in similar directions seems to indicate that there is no correlation between technology integration and reading achievement. Shapley et al. also examined the impacts of technology on math achievement and found that economically advantaged students in the experimental group performed better on their standardized math assessment than their control group peers. The math achievement scores of economically disadvantaged students in the experimental group remained consistent over the course of the three-year study, whereas their control group counterpart's math scores decreased. This implies that unlike reading achievement, there may be some positive relationship between technology integration and math achievement.

Another study conducted by Suhr, Hernandez, Grimes, and Warschauer (2010) compared the literacy achievement of 4th grade students over a two-year span. Researchers found that the experimental group, which had used 1:1 devices in the previous school year, demonstrated improved literacy achievement on their standardized assessment after the second year of the 1:1 program's implementation, regardless of ability level or socioeconomic status. This contradicts the findings of Shapley's research above. Based on the available literature, it is difficult to say

whether a reliable relationship exists between technology and student achievement and whether that relationship is positive, negative, or simply nonexistent.

Impact of Technology-Based Interventions on Student Engagement and Achievement

While it is difficult to identify the impact of technology on overall student achievement, many researchers have gone a step further and investigated the impact of technology-based interventions on the engagement and achievement of traditionally low achieving students. These individuals include students with identified learning disabilities, students of low socioeconomic status (SES), English Language Learners (ELL), etc.

Page (2002) conducted a study in five Louisiana elementary schools and looked specifically at the impact of technology on students with low socioeconomic status. He compared standardized test scores from the previous school year to those of the current year after an experimental group was exposed to a year of technology-enriched instruction. Page found that while the post-assessment indicated no significant difference in reading achievement between the two groups, low SES students who participated in the experimental group had significantly higher math achievement scores on their post-test.

A study conducted by Lin, Shao, Wong, Li and Niramitranon (2011) reported similar findings in regards to the impact of technology on the math achievement of traditionally low performing students. Lin's study was designed to determine whether a "collaborative virtual tangram activity diminished the ability-based achievement gap within the classroom" (Harper & Milman, 2016, p. 132). Low-performing students performed significantly better on the geometry post-test, increasing their mean percentage from a 61.60% to a 73.28%, successfully narrowing the achievement gap between high-achieving and low-achieving students (Lin, et al., 2011).

Findings from these studies indicate that integration of technology into the classroom may have the potential to reduce SES-based and ability-based achievement gaps for certain content areas.

Conclusion

While it is difficult to say for certain whether technology has an impact on student engagement or student achievement, but this review of research helps us draw some valuable conclusions. First, educators must be aware of changes and updates to technology and provided with appropriate and meaningful professional development opportunities to support their learning. This will provide them with the confidence and expertise to effectively integrate technology into the classroom. Second, technology can be a very engaging tool when used effectively. Children of the 21st century are very accustomed to using technology outside of school, but must be explicitly taught their new roles and responsibilities when using technology in the classroom. Clear expectations must be set and revisited so that students understand that digital devices in the classroom are serving as educational tools, not toys. This will help to ensure that students remain on-task and engaged when participating in technology-enriched lessons. Finally, the data indicates that technology integration has the potential to improve student achievement, especially in math instruction of low-achieving students.

CHAPTER III

METHODS

Design

This quasi-experimental study investigated the impact of technology (independent variable) on student achievement (dependent variable). Scores from the immediately preceding social studies unit on the early stages of American colonialism were used to assess students' overall ability and ensure that both groups began the social studies unit with similar social studies skills. The control group was taught one social studies module on the events preceding the Revolutionary War using traditional teaching methods without integrating technology. The experimental group was taught the same content but with technology integration. The duration of the study was four and a half weeks. At the conclusion of the social studies module, both the control and experimental groups were given the same posttest to assess understanding. The posttest scores from the control group were converted to percentages, then compared to the posttest percentage scores of the experimental group to determine whether the inclusion of technology impacted student achievement.

Participants

This study took place in a public elementary school with 155 4th grade students, distributed among six classes. The student population is comprised of mostly upper-middle class families, with only 12.4% of the student population receiving free and reduced meals (Maryland State Department of Education, 2019). Two of the classes were used in the study. One class, composed of 25 4th grade students, served as the control group. In this class there were 16 males and nine females; 18 students identified as white/Caucasian, two students identified as

black/African American, and five students identified as Asian. One student in the control group had a 504 plan for a hearing/speech impairment.

The second class of 25 4th grade students served as the experimental group. This group consisted of 15 males and 10 females; 20 students identified as white/Caucasian, one student identified as black/African American, and four students identified as Hispanic/Latino. Three students in the experimental group had 504 plans for ADHD, and one student in the experimental group received accommodations for being an English Language Learner.

The two participating classes were grouped based on their performance on the previous year's PARCC data and math benchmark assessments. Both groups consisted of a combination of high average and below average students. The results of an independent samples t-test comparing their performances on the social studies unit test preceding the intervention indicated that there was no significant difference mean percentage correct on the pre-test between the control (Mean = 79.44, SD = 12.31) and experimental (Mean = 74.12, SD = 13.27) groups [t (48) = .1.47, p = .15]. Classes were randomly assigned to the control or experimental condition. Research was conducted in a grade level that is departmentalized, which allowed the researcher to provide instruction to both classes for the entire duration of the experiment. The remaining four classes were not included in the study as they received gifted instruction or instruction from another teacher.

Instrument

The researcher created an evaluation instrument with questions derived from the various levels of Bloom's Taxonomy. Students could earn a total of thirty points. The raw number of points students earned out of a possible thirty was then converted to a percentage.

The first part of the instrument was a pencil and paper assessment in which students were asked to complete a matching activity. They were given 14 events that led to the Revolutionary War and asked to match each event with the correct description. This activity was derived from the lower levels of Bloom's Taxonomy and required students to recall facts and basic concepts about each event, then identify the correct match. Students received one point for each event they matched correctly. Students were also asked to respond to a short response question which asked them which event they believed was the most important and why. This question aligned with the higher levels of Bloom's Taxonomy as students were required to evaluate each event and make a judgement about which event was most important, then provide evidence to support their thinking. Students could earn a total of three points for this portion of the assessment: one point for naming an event and two points for providing sufficient evidence to support their thinking.

The second part of the instrument was an online assessment consisting of thirteen multiple choice questions developed through Microsoft Forms. Students could earn a possible thirteen points, one point per question. Questions on this part of the instrument were designed using the middle tiers of Bloom's Taxonomy and focused on the difference between primary and secondary sources, different colonial perspectives at the time of the Revolutionary War, and what motivated major political groups such as the King of England and the Sons of Liberty. As the instrument was created by the researcher, there is no reliability or validity data available.

The researcher-created instrument differed slightly from the pre-test. The pre-test was an assessment provided by the county as part of the existing social studies curriculum. The pre-test required students to analyze and respond to five questions about a primary source regarding population trends of the Chesapeake Bay area during colonial times. All five questions on the pre-test were multiple choice, with some questions requiring students to select more than one

correct answer. The pre-test was worth a total of eleven points. Questions were weighted based upon how many answers needed to be selected. The researcher-created post-test instrument asked students to recall information and respond to questions about the revolutionary war. Students were asked to respond to a variety of question types including multiple choice, matching, fill in the blank and short response questions. Unlike the pre-test, students were not required to analyze any primary sources on the post-test, but did still have to apply their understanding of the social studies module.

Procedure

The control group and experimental group both received social studies instruction for 45 minutes a day, five days a week, for a total of four and a half weeks. Both groups were exposed to the same social studies content but instructional activities were modified to reflect either a traditional teaching method or teaching integrated with instructional technology. Students in both groups were familiar with educational technology and had used laptops periodically throughout the year to conduct research, but not on a consistent basis due to insufficient resources; two laptop carts of thirty laptops each are shared between six 4th grade teachers and one-hundred fifty-five 4th grade students, with occasional interruptions due to other grade levels borrowing the technology.

Students participated in learning activities designed to add to their schema of the events preceding the Revolutionary War. Events included the French and Indian War, the Sugar Act, the Stamp Act, the Townshend Act, the Tea Act, the Intolerable Acts, the Boston Massacre, the Boston, Annapolis and Chester Town Tea Parties, the First and Second Continental Congress and finally the writing of the Declaration of Independence. Lessons followed an inquiry-based approach and began with an engage piece where students were asked a question or shown an

image that would grab their attention. They then proceeded to research each historical event by watching educational videos or reading informational articles. Students added notes to their social studies composition book or typed notes on an online notebook via OneNote. The lesson concluded with a whole-group discussion with the teacher to clarify and misconceptions.

The control group gleaned most of their information from reading the *History Alive: America's Past* textbook (Bower & Lobdell, 2001) and paper articles. They did receive some technology integration in the form of instructional video segments which the class viewed as a whole group on the classroom Promethean board.

The experimental group had access to laptops on a daily basis and gathered most of their information through online research. This group was accessing the same information as the control group but through an online platform called itsLearning. This platform acted as an online file folder, and housed the important texts and videos that students would access throughout the module. The experimental group read the same informational articles as the control group, but online rather than printed on paper. Content from the *History Alive: America's Past* textbook was transferred to itsLearning so that students could read it on the computer rather than in their textbooks. They also had access to the same educational videos but viewed them independently at their own pace. itsLearning did not have any additional educational features, such as the ability to highlight or underline important text, however, some of the websites students accessed through itsLearning allowed the text to be read aloud.

Students were told a week in advance that they would be tested on their knowledge of the historical events that caused the Revolutionary War. Both the experimental and control groups were provided with a study guide that outlined what information would be present on the assessment. The assessment consisted of fill in the blank, multiple choice and matching

questions as well as a written response. Assessments were scored by this researcher and were worth a total of thirty points. The test scores were compared using an independent samples t-test.

CHAPTER IV
RESULTS

The purpose of this study is to examine the impact of instructional technology on 4th grade students' achievement. This researcher assessed students' performance on a summative assessment on the events preceding the Revolutionary War after receiving traditional instruction or instruction integrated with technology. Both the control and experimental group, composed of high average and below average students, demonstrated similar social studies skills prior to beginning the study.

An independent samples t-test was conducted with the independent variable being the use of instructional technology and the dependent variable being student achievement. There was no statistically significant difference between the mean percentage correct on the post-test between the control (Mean = 87.32, SD = 13.66) and experimental (Mean = 84.44, SD = 13.20) groups [t (48) = .76, p = .45]. Please see Table 1. Consequently, the null hypothesis that post assessment data will indicate no difference in student achievement between students receiving traditional paper/pencil instruction and students receiving instruction with technology integration was retained.

Table 1. *Means, Standard Deviations, and t-statistic for Student Achievement under Instructional Technology or Paper Conditions*

Condition	N	Mean	SD	t-statistic
Control	25	87.32	13.66	.76 (NS)
Experimental	25	84.44	13.20	

NS = non-significant at $p \leq .05$

CHAPTER IV

DISCUSSION

The purpose of this study was to determine the impact of instructional technology on 4th grade student's achievement and overall engagement. 50 4th grade students, beginning with similar social studies skills, received four and a half weeks of social studies instruction, either traditionally or with technology integration, on the events leading up to the American Revolutionary War. Student performance was measured by a researcher-created post-test with both online and paper components to assess students' understanding of events preceding the Revolutionary War. The null hypothesis that post assessment data will indicate no difference in student achievement between students receiving traditional paper/pencil instruction and students receiving instruction with technology integration was retained.

Implications of the Study

After reviewing the results of the study, there is no significant evidence that providing students with technology-integrated instruction instead of traditional methods impacts overall achievement. Traditional instruction utilizing paper, pencil and school bought textbooks, proved just as effective as instruction with technology integration as there was no significant difference in mean post test scores between the control and experimental groups. Based on empirical evidence alone, this researcher can conclude that instructional technology did not impact student achievement, either positively or negatively, as compared to more traditional techniques.

It is important to note that throughout the duration of the study, this researcher observed some definite benefits and drawbacks to technology integration. Students in the experimental group who received technology-integrated instruction appeared overall more engaged with the social studies content. They were able to work through the various events leading up to the

Revolutionary War at their own pace, and collected notes on information that they deemed important. Students in the experimental group appeared more focused and on-task when allowed to engage with the laptops. Conversely, students in the control group often asked about the laptops and whether they would be allowed to use them in class today. They had a more difficult time staying on-task and often asked to work in groups or with partners to make the work more enjoyable. Both groups were reading and analyzing the same social studies content, but the platform on which it was delivered significantly changed students' level of motivation, engagement and work ethic.

While technology integration offered some promising insight into student engagement, there were also some notable drawbacks, the first of which was time management. Students in the experimental group dedicated a significant amount of instructional time to simply retrieving, logging in, and navigating to the appropriate website. This process did get faster and more efficient as the study progressed, but was certainly a drain on instructional time, with many students unable to complete a whole lesson in one class period. Another potential drawback to consider was the balance between teacher and student-centered instruction. The experimental group followed a more student-centered approach, with students having the freedom to work independently and at their own pace, but this researcher found that many students from the experimental group had neglected to take notes on some of the events preceding the war and had trouble studying those events when it came time for the post assessment. Students in the control group, conversely, followed a more teacher-centered approach, with all participants working at the same pace. In the control group, the teacher was able to ensure that all students had the necessary notes to be successful on the post test before moving on to a new topic. Furthermore, accessing the notes to study at home was an unforeseen obstacle. Students in the control group

were able to bring their notes home with them in their social studies composition book and access the information there. Students in the experimental group had to log on to their online notebook from home and access notes online. Some students from the experimental group did not have access to technology at home and were unable to retrieve the notes. Other students had difficulty logging in to OneNote from home because they couldn't remember their username or password. In both instances, students were allowed to print their notes in school and study from this paper copy of their online notebook.

When considering both the statistical and anecdotal evidence of this study, this researcher can conclude that while there are no significant impacts to student achievement, students were considerably more engaged and on-task when exposed to technology. That being said, there are some routines and procedures that need to be established prior to introducing technology so that all students can be successful.

Theoretical Consequences

The widely accepted theory among educators and policy makers in the educational system is that technology is an integral component in preparing students for success in the 21st century. The International Society for Technology in Education has developed standards to ensure that technology is being implemented in a responsible way that will help students to develop the critical thinking skills necessary to thrive in a global economy. Technology can offer an engaging opportunity for students to strengthen their problem-solving skills, access information beyond the four walls of their classroom, and engage in self-directed instruction that is meaningful and relevant. While this study indicates that technology did not impact 4th grade students' social studies achievement, observational data implies that students were certainly more eager and excited to learn when given the opportunity to learn with a laptop. Social studies

is a subject typically described as “boring” and “irrelevant” since the events discussed have already happened, but allowing students access to technology to learn about historical events certainly piqued their interest and curiosity. This study did not support the theory that technology integration is critical for student achievement. Observations, however, from the study support the theory that technology is engaging; students certainly renewed their love and excitement for learning by being exposed to technology-integrated instruction. With sufficient expectations, routines and procedures in place, educators can utilize technology to their benefit and engage students in a way that traditional teaching may not.

Threats to Validity

There were some threats to validity that should be taken into consideration in regards to this study. Firstly, the instrument used to assess student achievement was created and scored by the researcher. This could result in the external validity threat of experimental bias because the researcher was the only person involved in the instruction, testing and scoring of both groups of students.

Another threat to the external validity of this research is the small sample size with a relatively homogenous population. The sample population consisted of a total of 50 4th grade students and did not include any students receiving gifted and talented or special education services. Furthermore, the study took place in a public elementary school composed of predominantly upper-middle class families, with only 12.4% of the student population receiving free and reduced meals (Maryland State Department of Education, 2019). This makes it difficult to generalize the results of the research to a wider population of students as not all ability levels or socioeconomic status were represented in the sample.

A threat to the internal validity of the study was the inconsistency in availability of the technology. As mentioned previously, a total of 60 laptops are shared between six 4th grade teachers and 155 4th grade students, with occasional interruptions due to other grade levels borrowing the technology. In addition, not all 60 laptops are operational at any given time since many are out for various repairs. While students in the experimental group had access to technology on most days, there were a few days where scheduling conflicts did not permit the use of laptops and the teacher resorted to traditional instruction. Consequently, the inconsistency in availability of the technology may impact the internal validity of the study.

An additional threat to the internal validity of the study is the student's familiarity with the technology. Students were aware of the laptops and had been exposed to lessons involving instructional technology throughout the school year, but never on a consistent basis. Being unfamiliar with not only the technology itself, but also the teacher's expectations with said technology, may have impacted the internal validity of the study.

Connections to Previous Studies and Existing Literature

The statistical findings from this study, that instructional technology was not differentially effective as compared to traditional methods among 4th grade students, are consistent with many other previously conducted studies. Shapley, et al. (2011) conducted a similar study intended to assess middle school students' math achievement when participating in a 1:1 technology initiative. Their findings indicated no significant statistical difference. Another study conducted by Hur and Oh (2012) explored the effects of 1:1 devices on middle school students' language arts and science achievement. Again, no significant statistical differences were reported from this study. All researchers noted that despite the lack of evidence to support the relationship between instructional technology and student achievement, participants appeared

to be more engaged when utilizing instructional technology. It appears that regardless of the content area, whether math, science, language arts, or social studies, technology integration does not have a significant impact on student achievement but may impact student engagement.

Interestingly enough, studies that involved sample populations of students with low socio-economic status found technology to have a positive impact on student achievement, and even served as a vehicle to close achievement gaps between low-achieving students and their higher performing peers. The results from the study conducted by Shapley et al. (2011), when broken down to reflect students' socio-economic status, indicated that when students were given access to technology-integrated instruction, especially outside of school, their math and reading achievement improved significantly. Another study conducted by Lin, et al. (2011) analyzed the math achievement of traditionally low-performing middle school students. Their results indicated that after being exposed to technology-integrated math instruction, low-performing middle schoolers scored significantly higher on their post-test and were able to narrow the achievement gap. While the student population involved in this researcher's study was composed of predominantly upper-middle class students, and did not focus specifically on students with low socio-economic status, there is data from other studies that indicates technology may have a positive impact on this specific student population. The results of the current study, in conjunction with others reported in the literature, suggest that the achievement benefits of technology over traditional methods is found primarily with lower income students.

Implications for Future Research

Those wishing to conduct further research on the relationship between instructional technology and student achievement may find it helpful to use a larger sample size that could be more representative of the elementary school population. Additionally, it would be interesting to

see the impacts of instructional technology when students are exposed to it for a longer period of time. The duration of this researcher's study was only four and half weeks but in that length of time, students had become much more adept at online note-taking and navigating to various websites.

While this study did not directly assess the relationship between instructional technology and student engagement, there were notable differences in motivation, work ethic and overall engagement when students were exposed to technology. Through the use of teacher and student surveys, and classroom observations, one could examine the impact of instructional technology and student engagement in future research.

Conclusion

The findings from this study indicate that traditional paper and pencil instruction is just as effective as instruction integrated with technology in promoting the social studies achievement of 4^{th} grade students from a predominantly upper middle class background. It is important to note that, as with any quality instruction, students were more successful with technology once clear expectations, procedures and routines were established. While student achievement was not differentially impacted by instructional technology, observational data suggests that a relationship exists between instructional technology and student engagement, but further research is required. It will be interesting to see how technology will continue to shape educational practices. Since the study did not indicate any significant impact between technology and student achievement, teachers should continue to use the instructional methods and strategies, either traditional pencil and paper or technology-integrated, that best suit their students' needs and the logistical and economical demands of their classroom.

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