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Technology: Engagement and Motivation in the Elementary Classroom

Abstract

This action research study examined how increased levels of technology use in the elementary classroom affected student engagement and motivation. Fifth grade students were observed using minimal levels of technology in math and reading lessons for three weeks, then using high levels of technology for three additional weeks. In addition to data collected by observations, students answered a survey about their views of technology in the subjects of math and reading before and after the study was performed. The results of the study suggest that one positive benefit of implementing technology in lessons in the elementary classroom may be increased engagement or prolonged periods of student engagement. While survey results were not statistically significant, they suggest that students have differing opinions toward technology use depending on the subject.

Document Type

Thesis

Degree Name

Master of Education (MEd)

Department

Graduate Education

First Advisor

Patricia C. Kornelis

Keywords

Master of Education, thesis, technology, human-computer interaction, motivation in education, elementary education

Subject Categories

Curriculum and Instruction | Education

Comments

Action Research Report Submitted in Partial Fulfillment Of the Requirements for the Degree of Master of Education

This thesis is available at Digital Collections @ Dordt: https://digitalcollections.dordt.edu/med_theses/136

Technology: Engagement and Motivation in the Elementary Classroom

by

David Nieuwsma

B.A. Calvin College, 2012

Action Research Report
Submitted in Partial Fulfillment
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Department of Education
Dordt University
Sioux Center, Iowa
August 2019

Technology: Engagement and Motivation in the Elementary Classroom

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Abstract

This action research study examined how increased levels of technology use in the elementary classroom affected student engagement and motivation. Fifth grade students were observed using minimal levels of technology in math and reading lessons for three weeks, then using high levels of technology for three additional weeks. In addition to data collected by observations, students answered a survey about their views of technology in the subjects of math and reading before and after the study was performed. The results of the study suggest that one positive benefit of implementing technology in lessons in the elementary classroom may be increased engagement or prolonged periods of student engagement. While survey results were not statistically significant, they suggest that students have differing opinions toward technology use depending on the subject.

Between the years of 2011 and 2017, the percentage of students between the ages of 3 and 18 that used the internet at home, school, or other locations has increased from 61.8% to 73.1% (NCE, 2018). As student internet use increases, school systems add technology. The U.S. Energy Information Administration found in 2016 that 95% of the nation's school buildings have computers (Mayclin, 2016). At the same time, students growing up in today's technological culture think much differently than students before them. "It is now clear that as a result of this ubiquitous environment and the sheer volume of their interaction with it, today's students think and process information fundamentally differently from their predecessors" (Prensky, 2001, p. 1). Educators need to know how the increasing technology use in their schools can be harnessed to get the attention of the students in their classrooms and teach them more effectively.

Today's "digital native" students must be viewed by educators differently than students in the past due to the differences in their upbringing (Prensky, 2001). Regardless of size, location, or funding, school systems must take a close look at the benefits and drawbacks that different levels of technology bring. Student concentration on a given topic can only happen when their "attention is focused on the required learning material" (Bester & Brand, 2013). To the students growing up in a technology-filled world, technology in the classroom may be a highly engaging and motivating tool for teachers to depend on.

Problem

In our current culture of constant technology use, school systems need to decide how much technology should be used to engage and motivate students to allow for deep learning. The purpose of this study was to examine the motivational and engagement impacts that different level of accessibility to technology have on the students.

Research Question

To fulfill the purpose of this study, the researcher sought to answer the following question:

How is student engagement and motivation affected by increased levels of technology use in the elementary classroom?

Definition of Terms

For the purpose of this study, the following definitions are used. The definitions are the author's own, unless otherwise indicated:

Augmented Reality refers to "games played in the real world with the support of digital devices (PDAs, cellphones) that create a fictional layer on top of the real-world context" (Squire & Jan, 2007, p. 6).

Digital Natives are students today who are "all 'native speakers' of the digital language of computers, video games and the Internet" (Prensky, 2001, p. 1).

Educational Technology refers to the digital or technological tools used by teachers and/or students in an educational setting.

Gamification is "the use of game elements, mechanics, features, design, and structure in a non-game environment or context" (Alsawaier, 2018, p. 57).

1:1 Laptop Programs occur in schools that provide each student with a laptop for educational use.

Literature Review

With classrooms of students who are already using technology more than ever before, educators are looking to technology to engage their students and motivate them to learn. Carver (2016) noted that "The major reason teachers chose to use technology was because they felt it resulted in increased student engagement" (p. 115). Carver (2016) found that over half (59%) of

the teachers surveyed believed technology use in their classroom would lead to student engagement. Similarly, Liu (2016) gathered survey responses regarding teachers' reasons for using technologies like ELMO projectors and website resources in their lessons. Liu (2016) found that almost 32% of teacher responses cited engagement and motivation, and another 17% cited gamification-type benefits, like excitement.

To determine if students are actually more engaged through the use of technology in schools, Ravenel, Lambeth, and Spires (2014) compared two math instructional groups, one having students participate in individual computer-based programs and the other without technology use. They found that elementary students who used laptop programs during math lessons had higher student engagement (91% on task) than students participating in physical math games requiring no technology (84% on task). This 7% increase on average across the seven-week study was statistically significant to show that technology use was more engaging to elementary math students.

In a similar effort to determine student engagement using technology, Folkestad and O'Shea (2011) observed student pairs that used augmented-reality technology while exploring a botanical garden. Folkestad and O'Shea (2011) concluded that student partnerships were highly engaged with the curriculum through augmented-reality (45 minutes of the 98 minutes observed time), while at the same time, students were motivated enough to continue the learning task even though technology issues continually interrupted the lesson. Researchers identified that students were distracted by the technology less than 8% of time, leading the researchers to conclude that augmented-reality technology does not get in the way of student engagement and collaboration in learning.

In a study specifically targeting the motivation of students in common school tasks, Bebell and O'Dwyer (2010) concluded that traditionally repetitive or often time-consuming tasks, like writing, were found to be more engaging when students used 1:1 technology. Also, Rosen and Beck-Hill (2012) conducted a comparative study on the effects of 1:1 computer program use in 4th and 5th grades. When students participated in math and reading lessons almost solely through individual laptop programs, the research findings clearly showed that higher motivation to participate led to increased standard test scores in reading, with a jump of 61.2 test points in 5th grade, compared to an increase of 40.1 points in the control group. The experimental group also showed an increase of 45.9 points from pre-test to post-test in math, compared to 27.7 points in the control group. In this same research, the researchers concluded that students who were a part of the 1:1 program were motivated to show up to school more often than those outside of the program, and that these students had fewer discipline problems while at school (Rosen & Beck-Hill, 2012).

Many studies aim to find how specific technologies engage students. Plass et al (2013) examined the gamification nature of a math program called "FactorReactor" which is made specifically for students to practice a variety of math skills. Through observation of students in an after-school math club participating in this technology, the researchers found statistically significant data ($p = .03$) that the competitive game mode led to the highest interested level and motivation to continue when compared to a solo game, showing that an educational math program involving a gamification strategy of competition, was effective in engaging students. In a separate study looking at the website "Khan Academy," Light and Pierson (2014) engaged in observations of 25 math lessons being taught to elementary school students without any

technology and 25 lessons with Khan Academy as a component to the lesson. They concluded that the technology's gamification style was an effective engagement tool in the classroom.

Teachers also favor the use of technology in classrooms because of higher student engagement (Dietrich & Balli, 2014). Min and Siegel (2011) conducted two weeks of observation in math and science lesson, and they similarly found that when SMART board technology was used in whole-class math and science lessons, student engagement rose between 21-29 percent compared to lessons without it. Additionally, their research concluded that technology use along with effective teaching produced above-average student engagement when compared with only one of these two factors.

Technology can also be used by teachers for improving their own practice, which in turn affects student motivation. Rosen and Beck-Hill (2012) found that teachers who participated in 1:1 laptop instruction gave descriptive feedback to their students more often, differentiated instruction more often, and adjusted lesson content based on student response and data almost three times as often. Rosen and Beck-Hill's (2012) research suggests that when teachers are equipped with technology tools and the knowledge to use them well, other strategies that support student engagement also increase.

Research studies have shown that technology use by students during their learning not only keeps them more engaged in their work, but also helps them to stay motivated to keep learning and to be better students. For example, Bester & Brand (2013) tested the role that technology plays in motivation and concentration in the teaching of lessons in math, English, and geography. Through the survey responses by a control learning group of students not using technology and a second group using technology, the researchers concluded that there was significant increase in attention and engagement levels ($p < 0.01$) in the group implementing

technology. Additionally, researchers saw increased achievement scores in the technology group, which they attributed to higher engagement.

Summary

Teachers choose to use technology because they believe that it helps grab the attention of their students and keeps them engaged in content (Carver, 2016; Liu, 2016). Furthermore, the use of technology by students in an educational environment has been shown to increase their engagement and motivation (Bebell & O'Dwyer, 2010; Bester & Brand, 2013; Folkestad & O'Shea, 2011; Ravenel et al, 2014). Specific examples of technology used in classrooms often possess gamification, which is a highly engaging and motivating tool (Plass et al, 2013; Light & Pierson, 2014). Higher motivation levels in students due to the use of technology has been shown to lead to increased test scores (Bester & Brand, 2013; Rosen & Beck-Hill, 2012). Technology use in the classroom has clear ties to student engagement, so more research into how technology use in elementary subject areas impacts the motivation and engagement of learners would better inform teachers to use available technologies effectively.

Methodology

This study was conducted through observation and surveys in a classroom of 17 fifth grade students over the course of six weeks to determine the levels of student engagement in lessons with highly integrated technology use and those with minimal integration of technology. Carver's (2016) research identified student engagement as a main goal for teachers that implement technology but noted that more research would be needed to find out if that was actually happening or if it was simply a hopeful goal. Through observation of on-task behavior during lessons in math and reading and by analyzing student surveys that were given before and

after the six-week period, this researcher aimed to determine if higher student engagement is a benefit of high technology implementation.

Materials

During the non-technology weeks of the study, students used notebooks and physical books for reading and math, but during the portion of this study with high technology integration, students participated mainly with their individual laptops. For math, this involved online videos and practice for each topic that was covered. In reading, students read using both physical and online books, and they typed on their laptops instead of writing in notebooks. All students involved had experience with using their laptops and how the specific activities and programs function.

The teacher used a whiteboard with verbal instructions and teaching during the first half of the study,but switched to using an Elmo projector and screen as well as mirroring the screen of their laptop to teach during the technology portion.

In order to measure the amount of student engagement during lessons, the researcher video recorded both math and reading lessons from the six-week study period. An observation tool (Appendix A) was then used to tally the number of students who were on task and those that weren't.

A survey, located in Appendix B, was given to the 17 students before and after the study to gather student perceptions of their engagement in reading and math lessons involving technology. The survey had three statements about math and three about reading. Students chose from four options that best described their feeling of the six statements: "not true for me," "not really," "most of the time this is true," and "yes, that's me."

Procedure

Before the observations began, student participants were given a survey to answer anonymously regarding their personal preferences toward their learning involving technology. This same survey was given again after all observations were complete at the end of the six weeks.

In the first three weeks of this study, participants learned new concepts in both math and reading through traditional methods involving minimal technology use in both individual work and whole-group learning. For each math lesson, the teacher used the school's provided curriculum books for teaching the new topics while students participated using physical notebooks and pencil. Students practiced each lesson using paper worksheets and notebooks either individually or in partnerships. Reading lessons involved the teacher reading example texts directly from a physical book instead of having it projected or on laptops. Students read their individual books and responded to the learning goal by writing in their notebooks. The teacher also taught small group mini-lessons by using paper copies of worksheets and books.

During the second half of the study, students learned math and reading with a high level of technology integration. Each of these daily lessons were separated by a few hours during the day: math during the morning and reading in the afternoon. This was done to minimize an overexposure to technology throughout the day that might lead to a potential skew in data.
In math, students learned new topics and reinforced them through video teachings from Khan Academy. Furthermore, participants practiced new concepts through online practice problems and activities online using resources by Khan Academy and Freckle. These problems included matching, multiple choice, and short answer questions while students could take advantage of

digital manipulatives and workspace available inside of the programs. Students were able to go back to the teaching videos at any time to review it, and the teacher was available to problem-solve any technology issues during this time. Students that struggled with grasping the new concepts were also able to work through it with the classroom teacher while still using the problems on their laptops. For participants that quickly mastered the daily objectives, an additional online program called Khan Mappers was available for them to go beyond the learning goal.

During the reading lessons, students accessed texts on their laptops independently, and the teacher projected texts using a document projector for whole-class instruction. Freckle was also used for students to practice specific English language skills. Students responded to the learning target on their laptops for the teacher to assess their growth. Much of the reading by students was done through laptops instead of traditional books, but there were still physical books being used occasionally.

To observe student engagement, the researcher video recorded three lessons each week. The researcher then determined student engagement by observing student participants via video recording and tallying the number of students on-task and off-task every 5 minutes of the 40-60 minute periods. On-task behaviors included raising hand, actively sharing or questioning, discussing with partner, writing when appropriate, looking at the teacher or video. Off-task behaviors included looking away from the teacher or video (daydreaming,) distracting others, talking to others when not appropriate, using the laptop for anything other than the assigned practice, and writing or drawing when not appropriate.

Results

The research question in this study aimed to identify how student engagement is affected by different levels of technology use in the classroom. Math and reading lessons were observed by the researcher, and the number of students engaged during those lessons was recorded every 5 minutes throughout each lesson. To determine if high technology-use lessons produce a change in student engagement, this data was recorded as a percentage of engaged students; then the average percentage of engaged students was found for each of the two parts in this research. The average percentages of on-task students are shown below in Figure 1.

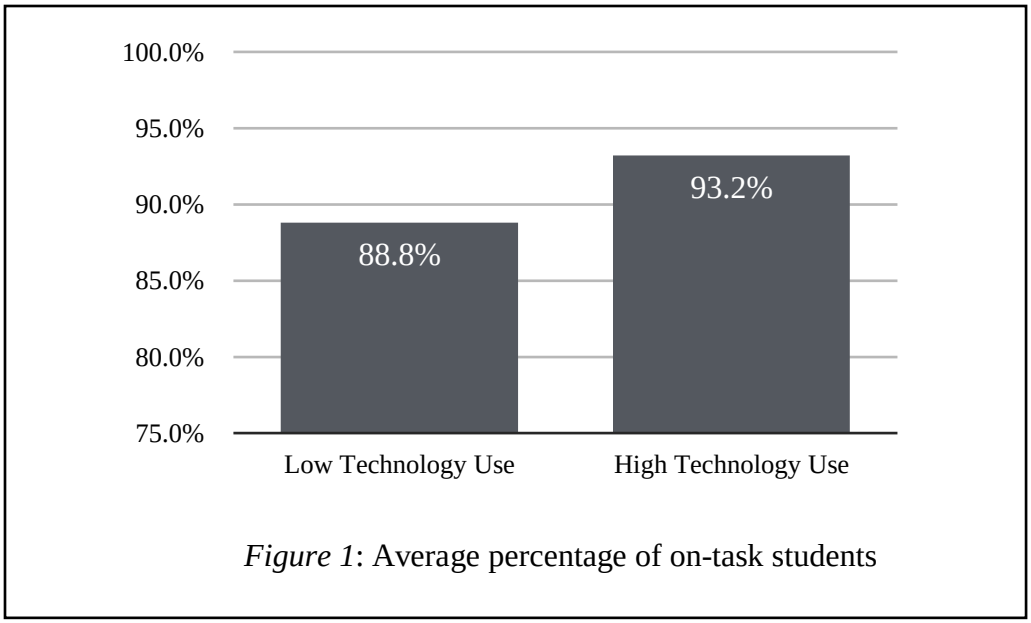

Figure 1: Average percentage of on-task students

A percentage increase of 4.4% was observed when students used high levels of technology in reading and math lessons when compared to minimal technology use.

A percentage increase of 2.7% was seen in student engagement during reading lessons from low technology use to high technology use. In math lessons, students were more engaged 5.6% of the time during high technology lessons. These results are shown in Figure 2 below.

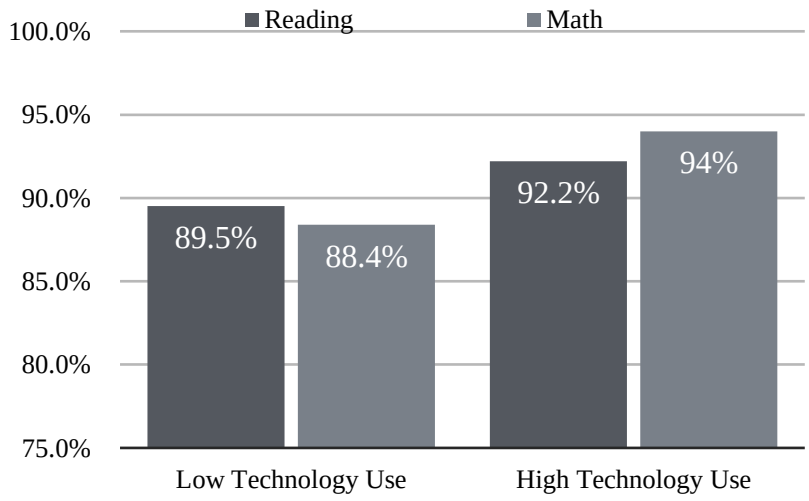

Figure 2: Average percentage of on-task students in math and reading

Below, Figure 3 displays the amount of time the researcher observed every student in the classroom being on-task. An increase of 17.2% occurred when students used high levels of technology (45%) which was up from the 27.8% of students during the observations during the low technology use period.

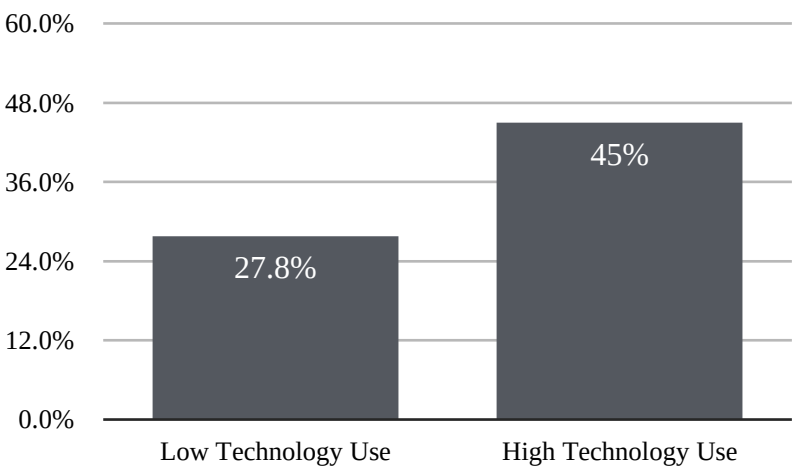

Figure 3: Percentage of all students on-task

While the data showed a slight increase in engaged students from low technology to high level of technology, it is interesting to note that the increase in student engagement often showed toward the end of the observed lessons. Figure 4, below, displays 40.7% of the time, every student is engaged in a high technology lesson in the final 15 minutes, as opposed to only 16.6% of the time, all students are engaged in the final 15 minutes of low technology lessons.

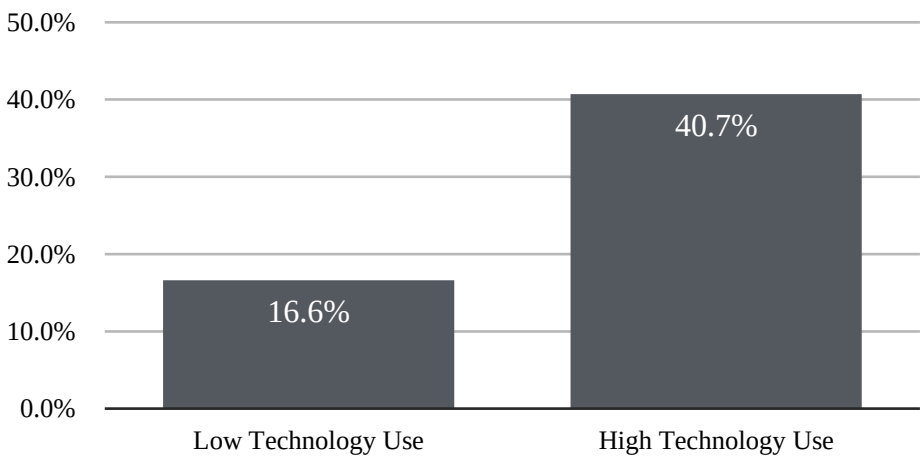

Figure 4: Percentage of students demonstrating on-task behaviors in the last 15 minutes of observed lesson.

When comparing the student surveys before and after the research was performed, responses differed between math and reading related questions. Answers to survey questions were given a numerical value according to a scale 1-4: a response of “Not true for me at all” was given the number 1, “not really” assigned 2, “this is true most of the time” a 3, and “yes, that’s me” was given a 4. With these assigned values, the average was found for students’ responses in both pre- and post-surveys.

Below, Figure 5 shows the average responses for math related questions. The percentages were lower for questions around focus and interest in math when technology is highly involved. When a paired t-test was performed, the p value of 0.213 showed no statistical significance.

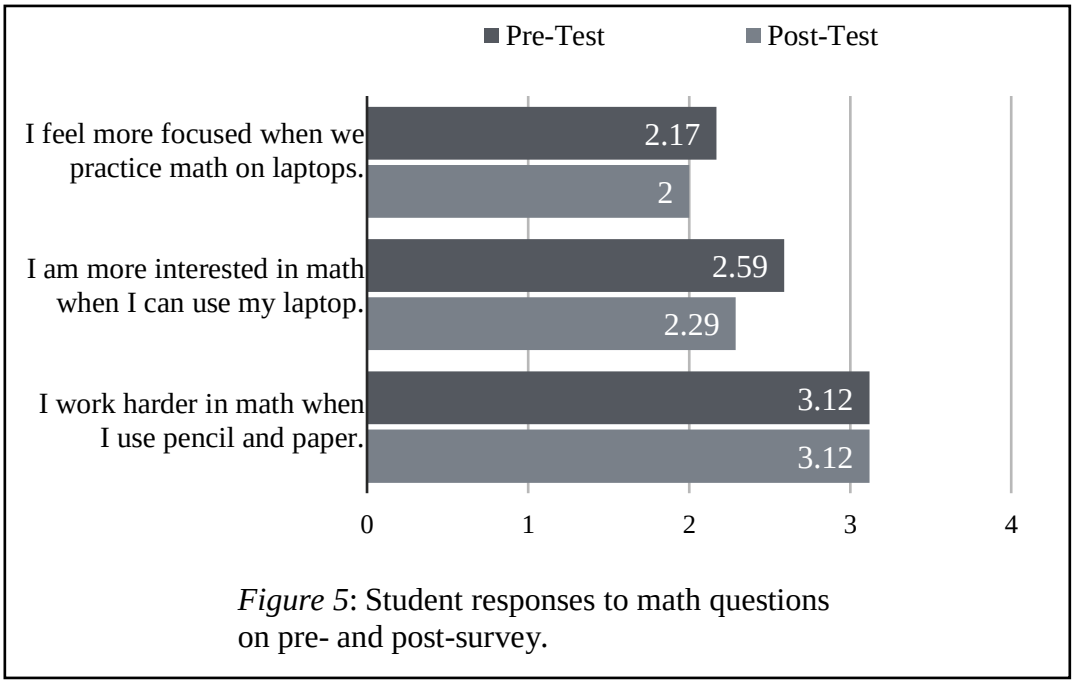

Figure 5: Student responses to math questions on pre- and post-survey.

The opposite was true for answers relating to reading, as shown in Figure 6 below. Students generally felt slightly more engaged when reading physical books after experiencing weeks of reading on technology. A jump of 0.53, the largest across all survey questions, occurred

from pre-survey to post-survey regarding the classroom teacher leading reading lessons from a laptop or using a projector as opposed to reading from physical books. Even so, a p-value of 0.236 was found using the paired t test, which again showed no statistical significance from pre-survey to post-survey.

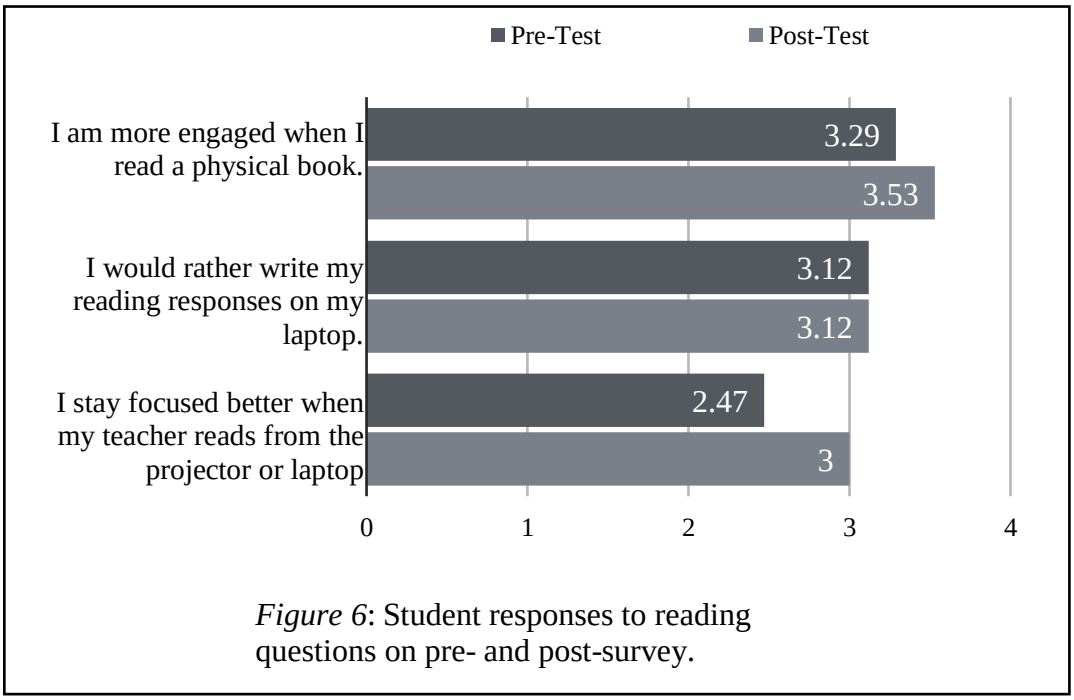

Figure 6: Student responses to reading questions on pre- and post-survey.

Discussion

Overview

The purpose of this study was to see if student engagement and motivation were affected by increased levels of technology use in the elementary classroom. Elementary school students were observed for three weeks of low technology use in math and reading lessons, then an additional three weeks of high technology use. Students also shared their perceptions through anonymous surveys both before and after the observation portion.

Summary of Findings

The data collected by classroom observations indicated that student engagement went up by 4.4% when technology was used often by students, which is expected when compared to similar research (Bebell & O'Dwyer, 2010; Bester & Brand, 2013; Folkestad & O'Shea, 2011; Ravenel et al, 2014). Specifically, in the subject of reading, students were engaged 2.7% more while using technology, while engagement in math saw a greater increase of 5.6% with high technology implementation. It may be that the difference in findings between subject areas may be a result of familiarity. Reading words on paper or on a screen may not be all that different to elementary students compared to math activities which are very different online than in a traditional setting. Bester and Brand (2013) concluded through their similar research that a greater percentage (40%) of a rise in math test scores was because of technology use, while 29% of the rise in reading scores was from technology. Their research findings supports the research results found in this study, that a greater difference is seen in math due to engagement when compared to reading. Additionally, past studies indicate that the gamification quality that Khan Academy and similar math resources provide has been found to increase engagement (Light & Pierson, 2014; Plass et al, 2013), so seeing a larger increase in student engagement specifically for math may affirm these prior studies.

The researcher observed all students engaged 17.2% more often during higher technology use. While this alone is expected given the 4.4% increase in student engagement, through further analysis of the percentages of engagement every five minutes, it was noted that this increase almost always came toward the end of a high-technology lesson, suggesting that higher technology usage yields longer lengths of student engagement during classroom lessons. A similar conclusion was noted in the study by Ravenel, Lambeth, and Spires (2014), in that the

researchers found participants of technology-enriched math lessons stayed on-task longer than those participating in a physical dice game teaching the same concept.

Finally, student input through surveys did not produce statistically significant results, but the results did show a slight difference between student attitude toward technology in reading and math. Students generally chose answers to the math-related questions that were more positive toward technology, while they tended to choose answers more negatively toward using technology in the subject of reading. While there could be many reasons for this difference in opinion between subjects, the technology used in math lessons leaned toward providing a gamification feel, while the reading lessons observed during the high-technology period used technologies that didn't change the experience for students as much; for example reading a digital text instead of a physical text. Similarly, Folkestad and O'Shea's (2011) research found that students working with technology in more independent settings instead of full class groups were highly engaging.

Limitations of the Study

The first limitation of this study was the observed group size. While students were carefully observed every five minutes during the research, a larger participant group may produce more consistent results. With a smaller class size of 17 students, even a few students who consistently struggle with engagement due to outside reasons can have a larger affect to the data than in larger sample sizes. Ravenel, Lambeth, and Spires (2014) identified the importance of group size as well, noting that when researchers observe student behaviors in only one classroom, the classroom teacher may be focused on keeping certain students engaged more than others. Future research in this area on a larger scale may even out the differences between students and teachers.

Additionally, this study consisted of fifth graders only. Future studies into technology engagement of students could focus on classrooms across elementary grade levels. Ravenel, Lambeth, and Spires (2014) identified this limitation as well, recognizing that specific content at one particular grade level may be more or less engaging to students compared to another grade level's coverage of the same subject. Including multiple grade levels in future studies may lead to more generalized results.

Finally, this research did not account for students' views of the content of math or reading going into the research or other outside factors contributing to students' survey answers. The addition of technology use was also certainly not the sole difference between the two parts of the study. For example, the second half of the observations took place further into the year, which gave students more time to develop their knowledge of the content and may have contributed to their survey answers instead of the addition of technology.

Recommendations

Alsawaier (2018) suggested that there is not enough focus on observation studies on the effects of technology, like gamification, being used in schools. Instead of solely relying on quantitative data, qualitative research like observation is needed to gain a better understanding of technology's impacts on student learning. Comparing quantitative data like student test scores certainly has merit, but observational data could lead educators to better know how students are responding to the day-to-day teaching, which affects how classroom teachers deliver content to meet the needs of their students.

One change observed in this observation study was the difference of 17.2% in all students engaged from low-technology use to high-technology use. Future studies in this area could increase the timeframe of observation to try to identify if this trend exists on differing lengths of

lesson times, or if it instead happened during the three weeks simply because the technology was still different and exciting.

Additionally, while this study observed student engagement in both math and reading, future studies could focus on the observation of separate students. The observations of this research saw an increase in student engagement of 2.7% in reading and 5.6% in math when technology was highly implemented, so future studies into how technology impacts the engagement of students across difference subjects may lead to useful results. Math and reading are generally taught differently from each other, so future research into how technology could be most engaging in different subject areas for elementary students may guide educators to use technology more effectively in their classrooms of digital natives.

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Appendix A

Student Observation Chart

Date of observation: _____

Subject observed:_____

Number of students being observed:_____

Time	On-task Students	Off-task Students
5:00		
10:00		
15:00		
20:00		
25:00		
30:00		
35:00		
40:00		
45:00		
50:00		
55:00		
60:00		

On-task behaviors include: raising hand, actively sharing or questioning, discussing with partner, writing when appropriate, looking at the teacher or video.

Off-task behaviors include: looking away from the teacher or video, distracting others, talking to others when not appropriate, using the laptop for anything other than the assigned practice, and writing or drawing when not appropriate.

Appendix B

Math and Reading Survey

Please circle on of the four options that best describe you for each statement:

1) I feel more focused when we practice math on laptops.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**
2) I am more interested in math when I can use my laptop.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**
3) I work harder in math when I use pencil and paper.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**
4) I am more engaged in my reading when I read a physical book.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**
5) I would rather write my reading responses on my laptop.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**
6) I stay focused better when my teacher reads from the projector or laptop.	**Not true for me at all.**	**Not really.**	**This is true most of the time.**	**Yes, that's me!**