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How Technology Can Be Integrated Into The Seventh Grade Mathematics Classroom To Ensure A Positive Impact On Student Learning And Engagement

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HOW TECHNOLOGY CAN BE INTEGRATED INTO THE SEVENTH GRADE

MATHEMATICS CLASSROOM TO ENSURE A POSITIVE IMPACT ON

STUDENT LEARNING AND ENGAGEMENT

By

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A capstone submitted in partial fulfillment of the

requirements for the degree of Master of Arts in Education.

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DEDICATION

To my husband, Jason, who has offered me continuous encouragement and support throughout this process. To my mother, Cori, for pushing me to pursue a higher education. To my content reviewer, Sara, who offered critical feedback in the creation of this capstone. All of your continuous support helped aid me in the completion of this capstone and degree. I am forever grateful.

ABSTRACT

Strachota, M. Integrating meaningful technology into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement (2018).

In recent years, there has been a movement for more technology in classrooms across the country. With this new movement, many teachers and students have been hesitant on where to begin and how to use technology in the classroom. This movement in education led for the author to explore the following research question: *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* It records one teacher's creation of a website designed to offer students and teachers an array of resources in one location for the middle school math classroom, while aligning to the Minnesota State Mathematics Standards.

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CHAPTER ONE

Introduction

Overview

When you are shown an old photograph of yourself from your childhood, you often comment and laugh at how ridiculous your hair and clothing style was. Most of us would not even think about wearing the same style clothing as we did as a child because as the fashion trends have changed we have adapted and changed with them. That is because as our world is constantly changing and evolving around us, we adapt with it. One of the most significant changes that we have adapted to over the past twenty years has been the advancement of technology in our everyday lives. The advancement of technology has changed many aspects of both our personal and professional lives. Many companies have changed protocol, created new positions, and new expectations as they have incorporated technology into their businesses. According to the National Center for Education Statistics (2015), in 2013, 71% of the United States population age 3 and older reported that they used the internet. As more employers are expecting their employees to be technology savvy, the education world has had to incorporate and adjust to using technology in the classrooms as well. The school district I teach in is a small rural district in Minnesota. We have recently begun to transition to every student having a device from grades six through twelve. With this new initiative there have been many questions that have brought up. As a seventh grade math teacher, the question I keep coming back to is: *How can meaningful*

technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?

I keep coming back to this question because my students are growing up in a world and an educational world much different than the one I experienced as a child. As a teacher I wonder what impact this is having on their young minds and their learning. I do not want to incorporate technology just for the sake of using it in my classroom. I want the technology to be meaningful to my curriculum and helpful to my students. I have seen and experienced many benefits of technology, but I have also witnessed and experienced cases where it is best to not use technology. Throughout the remainder of this chapter, I discuss my personal educational experience with and without technology, my experience as a teacher using technology in my classroom, and a conclusion and preview into Chapter 2.

Personal Experience

Growing up, I attended a very small private elementary school. In the basement of our school was our library. One half of our library was books and the other half was a computer lab. To check out a book or look up a book, we had to use the library catalog system which was a bunch of drawers with cards on the wall when you entered the room. There was no computer system that looked up the book for us and told us where it was located. On the other side of the wall, in the computer lab there were two rows of small computers and keyboards. It was one of the most anticipated days when our class got to go down to the computer lab, insert the large floppy disk and play Oregon Trail on the black and green screen. As I got older, our computer lab still

contained these same computers and we still played Oregon Trail on the floppy disk, but each year that went by there were a few more color Apple computers added into the computer lab. When it was my turn to use this large colorful computer, I inserted a disk and worked on different math skills and reading skills while playing a game. I was slowly becoming more accustomed to using technology at school and at home.

When it came to doing a school project, I remember looking through our home encyclopedias for information and filling out my bibliography cards. I did not have the internet at my disposal to look up unlimited information about our topic. In sixth grade when we had a project for class I remember it was the first project that was required to be typed. I had saved my information onto a floppy disk. By the time I got to high school, most students had dial-up internet at home. Our papers and projects were expected to be typed. If we did not have access at home, we were expected to find time to do so in the school library. By the time I was a senior, we were no longer saving our papers onto floppy disks but were saving them onto this thing called a flash-drive. However, I remember anytime I had to write a paper I always hand wrote it on notebook paper, sometimes multiple times, and then would sit down at the computer and type the paper before I turned it in. While I realized that my methods of writing were not as time efficient as having just sat down at the computer and started typing my paper, I preferred to hand write it first. In college, I eventually had to train myself to write my papers on my computer for time purposes. To this day, there are still some things I prefer to handwrite versus using my computer or cell phone. For example, I know it would be more efficient to keep my planner and calendar on my

phone, but I still prefer a small paper planner. This has made me wonder if some of

my students prefer the same things, or if I prefer some of these things because I did

not grow up in an era of technology as my students have.

Teaching with Technology

Computers are not the only form of technology that has changed in the

educational world over the past decade. The very first teaching experience I had was

in a high school math classroom back at my former high school. I had prepared the

lesson and examples I wanted to go over by looking through the textbook and writing

down my plan on paper. When I taught the lesson, I wrote the notes and curriculum on

both a chalkboard and on a whiteboard. By the time I was student teaching, I was

creating my lessons on SMART Notebook technology on my computer and using a

SMART Board and Promethean Interactive Whiteboard to teach my lessons. This

required me to understand the different interactive programs and boards, while

understanding how to work the projector from the ceiling. While it required a little

more work up front on my part, I appreciated the fact that I could have the problems

and other items already saved in the lesson and did not have to waste my time

rewriting them on the board each hour. This technology also allowed me to print notes

from class for any students that were absent.

When I began teaching full-time six years ago, there were many ways I used

technology to help aid my teaching. I continued to use the SMART Notebook and

SMART Board for my lessons. I used an online gradebook to calculate and post my

grades. All missing assignments were entered online on a moodle forum so other

teachers in our grade level could help keep students informed on what they were missing. I was also using a math program that required "clickers" and a printer for my students to send their answers from the clicker and it would print their report. While I am still using many of these things in my classroom, I have seen a shift in my short time teaching. In the past two to three years our school has really jumped on the Google bandwagon and has tried to incorporate these aspects into our classrooms. Instead of using Moodle, each teacher uses Google Classroom on a daily basis to post assignments and announcements for our students. We have also switched math programs to an online program that is more interactive for our students. Many teachers have stopped handing out textbooks and post everything online through Google Classroom. Our students now take the Minnesota Comprehensive Assessments (MCA) and other progress monitoring tests all online. Many of these features have made my life easier as a teacher. However, they were not necessarily easier at the beginning. There was and still is a large learning curve of how to best incorporate devices and technology into our classrooms.

Student Perspective

By next year all of our students grades six through twelve will have a device. Our initiative is a bring your own device initiative (BYOD), where students provide their own device in the classrooms. Some of these devices include Chromebooks, laptops, and tablets. However, Chromebooks are the preferred device. Our school district offers students different options to buy, rent, or borrow a Chromebook device if they are unable to afford one. When our school first proposed this initiative of going

one-to-one with devices, where each student would have a device, I thought there would be much backlash from parents. While there was some backlash, there was not as much as I would have anticipated. I think parents understand technology is becoming part of our daily lives and that this technology needs to become incorporated in their student's classrooms as well. One main concern I had was for students that could not afford a device. Our school worked with low-income families to provide a much cheaper option of renting a device and also have a number of devices on hand that students can check out from the school library to use for the day. However, I have seen some students become frustrated with some of these factors. I have students that do not have a device and have tried to check out a device from the school library, only to find that there are none left for them to check out. This forces us as teachers to have a backup option on paper for them. I have seen students become embarrassed by this when they are forced to be different than their peers because they do not have access to a device. I have heard from a few students that do not have internet access at home and are struggling to find ways to complete their homework when they are not at school. I have seen students become very frustrated at school when our internet has not worked and they cannot get connected or stay connected to the internet. I have seen students in tears when their device breaks or does not work in fear that their parents will be angry at them for wrecking their device. Sometimes when I see these reactions from students it makes me wonder if all of this emphasis on technology is worth it.

While I have seen students become very frustrated with technology, I have also witnessed the awe and excitement of using devices in the classroom. I have seen students become more engaged as they are able to access endless information at their fingertips. I have seen students interact with each other and show each other how to use different features on their devices. The math program we use allows students to know if they are doing the math correctly with instant feedback. When they get a problem wrong, the program shows them the correct steps on how to do the problem and then gives them another problem similar to the one they just got wrong. There are so many things I am seeing happening in the classroom revolving around technology, that could have never happened ten years ago.

Conclusion

Just as it would be ridiculous for us to think about wearing the same type of clothing we wore 20 years ago, it is ridiculous to think our classrooms should look the same way they did 20 years ago. As our styles have changed, so has technology and the integration of technology into the classrooms. As teachers, we need to understand that integrating technology in the classroom can have a positive impact both in our teaching and student learning and engagement. However, many teachers are unsure of how to start or are hesitant of change. This is what led me to my research question: *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* This question was generated based off of my personal experiences as a student, teacher, and the perspectives of my students. Some of the most significant

advances of technology occurred while I was in school. I had experiences before the internet and computer era and I have had educational experiences after the internet and computer era. As a teacher, I began my teaching career at the very beginning of the transition into the technological educational world. I taught without much access to technology and when my students did not have access to devices in every class. I am now currently teaching where students do have access to a device and the internet on a regular basis in all of their classes. I have witnessed first hand the positive and negative effects technology has had on my students. All of these experiences have led me to want to dive deeper into the topic of technology in education. I want to really understand how to best utilize technology in my seventh grade math classroom. This is a question that I hope to answer through my research and reevaluate in the remaining chapters.

As we look ahead to Chapter 2, I present the research that has been done on the use of technology in the classroom and different ways it has been used in the math classroom. As we move on in Chapter 3, I provide a preview and introduce my project. Finally, in Chapter 4, we will look back on the questions I had at the beginning of Chapter 1, and what I have learned through my research and experiences.

CHAPTER TWO

Literature Review

Overview

Technology can be a wonderful educational resource, but it must be meaningful if it is going to have a place in the classroom long term. For technology to be meaningful means that it must impact and aid student learning in a positive manner. Technology can play different roles in different classrooms and subject areas. How technology looks in the mathematics classroom can be very different from how it looks in an English classroom. Which leads to the question, *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* This question will be fully explored throughout this chapter.

In this chapter, I present an overview of the research on an educator's role in technology integration in the classroom. Secondly, I discuss the research on technology's impact on student achievement and engagement. I also discuss the research on the impact technology has on as-risk youth. Finally, I present different digital tools in the mathematics classroom specifically. All of these topics are essential in building and creating an understanding of how to best integrate meaningful technology resources into the mathematics classroom to ensure technology has a positive impact on student learning and engagement.

Technology and educators

Learning in the 21st century is much different than in the past. In a traditional classroom setting, the teacher stands in front of the classroom presenting an idea or concept. Students are expected to pay attention, take notes and then practice this concept or idea on their own. They play a very passive role in their learning and only benefit marginally from this type of instruction (Lowerison, Sclater, Schmid, & Abrami, 2006). As technology has evolved, more schools across the United States are integrating technology into their classrooms. Rather than having students play a passive role in their education, technology is allowing students to have an active role in their learning. "Students can learn from technology, such as in the class of drill and practice, or with technology as a construction and communication tool" (Lowerison et al., 2006, p. 405). In this section I present different barriers and mindsets of teachers and also discuss strategies to help aid educators with integrating technology into their classrooms.

Barriers and mindsets. Educators play a vital role in the integration of technology in the classroom. However, in order to successfully integrate technology into their classrooms, there are often barriers or mindsets that they must overcome. Whether an educator has been teaching for one year or for twenty years, most educators grew up in a traditional classroom setting and learned to teach in a traditional classroom setting. While there are many technology trainings for teachers to learn how to use technology, it is important to keep in mind that "Learning subject

matter with technology is different from learning to teach that subject matter with

technology" (Niess, 2005, p. 509). Before a teacher can learn to teach the subject

matter with technology, they must first understand the technology themselves.

According to Niess (2005), the National Center for Education Statistics found that

only 20% of current public school teachers feel comfortable using technology within

their teaching. Research has shown the more familiar teachers are with technology, the

more willing they are to integrate technology in their classrooms (Wood, Mueller,

Willoughby, Specht & Deyoung, 2005).

Another barrier that needs to be taken into consideration is the demands that

are placed on teachers. Teachers already face many demands of their time when

dealing with curriculum and student engagement and accountability (Wood et al.,

2005). There are many different ability levels and interests within a classroom setting.

Teachers face the demand of trying to keep all students engaged in the lesson and face

the demand of making sure they hold students accountable for doing quality work and

turning their work in on time. The integration of technology into the classroom is

another demand placed upon teachers. With this new demand, teachers also face a new

role as a teacher (Wood et al., 2005). In the traditional classroom, the teacher is the

giver of information and the student is the receiver. In a technology enriched

classroom, teachers "promote learning as a partnership" (McKnight et al., 2016, p.

195). With this new role, teachers are often hesitant of where to begin. There are many

strategies to helping educators successfully integrate technology into their classrooms.

Strategies to aid educators. Educators often feel overwhelmed and do not know where to begin when looking at integrating technology into their classrooms. One of the most popular and successful models to help aid teachers is the SAMR model. SAMR stands for: Substitution, Augmentation, Modification, and Redefinition (Puentedura, 2014). The first step, substitution, is often where teachers are encouraged to begin. With substitution, teachers are replacing an existing worksheet or activity with an activity that uses technology ("SAMR model explained"). An example of substitution would be if students type up a response to a writing prompt, instead of handwriting their response. Teachers are often encouraged to start small and try to substitute only a few lessons or activities at a time. The goal is for teachers and students to become familiar with the technology and continue towards augmentation, modification, and redefinition. When a classroom has reached a redefinition level, they have reached a point where students are "doing something that was inconceivable without technology" ("SAMR model explained"). When technology is used in this way, the classroom has transformed from a teacher lead classroom to a learner-centered classroom. The SAMR model can be very helpful for teachers because it gives them a place to start with integrating technology into their classrooms. It also offers some reassurance that it is okay to start small and to try to not integrate everything all at one time.

In a learner-centered classroom, students have a choice and help control their learning process (McKnight et al., 2016). Technology allows teachers an opportunity to individualize learning for each student (McKnight et al., 2016). Students in

learner-centered classrooms have been shown to have increased participation and motivation, which has lead to higher levels of learning (McKnight et al., 2016). Another aspect of a learner-centered classroom, is the difference in the physical set-up of the room. In the traditional setting, students sit in rows so they can see the board. In a technology enriched classroom, teachers can help students by arranging desks and areas in the classroom that promote collaboration (Davis & Forbes, 2016). By allowing students a choice where to sit and a little flexibility within the lesson with the individualized learning offered through the use of technology, teachers are tapping student motivation (Davis & Forbes, 2016).

  While the goal is to transform a classroom to a learner-centered classroom, it is not the teacher's sole responsibility for successfully integrating technology into their classrooms. To successfully integrate technology into the classroom, it requires a systems approach. "A systems approach focuses on school and community context, culture, resources, and teacher and student factors and how they impact the success of technology initiatives" (McKnight et al., 2016, p. 195). To help teachers successfully integrate technology into their classrooms, school leaders can offer support, and instructional models (McKnight et al., 2016).

  One last strategy that can help teachers successfully integrate technology into their classrooms to ensure student learning is by educating them before they get into the classrooms. While many preservice teachers learn about teaching with technology in a classroom setting, few learn how to teach with technology to their specific content area (Niess, 2005). "For technology to become an integral component or tool for

learning, science and mathematics preservice teachers must also develop an overarching conception of their subject matter with respect to technology and what is means to teach with technology" (Niess, 2005, p. 510). The more familiar and comfortable teachers can become with the use of technology, the easier it is to integrate technology into their classrooms.

Conclusions about technology and educators. Teachers have grown up learning and teaching in a traditional classroom setting. Most current teachers did not grow up in a technology enriched era. There can be much apprehension when asked to integrate technology into the classroom. Many educators do not feel comfortable with the technology themselves, which makes it difficult to teach their students how to learn with it. However, there are many strategies out there to help make the transition easier for teachers. The most popular approach is the SAMR approach (Puentedura, 2014). This approach encourages teachers to start out small and to start with substitution. The more teachers use technology in their classrooms, the more comfortable they will become. This is important to keep in mind when trying to answer the question, *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* The key for successful integration is to start small.

Student achievement

There are often new trends in education that come and then end up leaving as fast as they were implemented. The trends that stick are the ones that impact student learning in a positive manner. Technology has been a trend that has hit the educational

world fast and teachers want to ensure the technology is impacting student learning

positively. In this section I present the impact technology has on student learning and

achievement, how technology impacts student engagement and motivation, and how

assessments have changed over time.

   Impact on student learning and achievement. According to Uden and

Beaumont (2006), learning is defined as, "the amount of change that occurs in an

individual's level of performance or behaviour" (p. 3). When educators try to

implement new instructional strategies or resources into their classrooms, they are

concerned of the impact it has on student learning. The goal is that the new strategies

and resources impact student learning in a positive manner. The same applies to the

integration of technology into the classroom. Technology helps teachers provide

immediate feedback, individualized learning opportunities, and encourages active

cooperative learning amongst students (Eyyam & Yaratan, 2014). When students learn

in a cooperative learning environment, they have shown an "increased efficacy, value,

and mastery goal orientation regarding math" (Ryan & Patrick, 2001, p. 438). A

cooperative learning environment also helps build students' problem solving skills,

reasoning, critical thinking, and active use of knowledge, all of which are critical

components of the mathematics classroom (Uden & Beaumont, 2006). Research has

shown that when technology is used to help student work through complex problems

and higher-order thinking skills, the impact on student learning was much greater than

when technology was used for drill practice (Wenglinsky, 2005). To ensure technology

is positively impacting student learning, teachers need to be intentional that they are

using technology to promote collaboration and higher order thinking. While there has been much research that has shown that technology impacts student learning positively, opponents also argue that the integration of technology in the classroom can hinder student learning.

Technology has many new opportunities to offer students and educators. With all of these new opportunities comes a large learning curve for students. When students learn with technology in the classroom, they are forced to learn concepts both in the real world and in the digital world (Chu, 2014). Having to learn items in both forms has been shown to cause a cognitive overload for students (Chu, 2014). Cognitive load theory is defined as, "the way in which humans' cognitive architecture deals with learning objects during the learning process or when performing a particular task" (Chu, 2014, p. 333). It has been shown that the human memory can only handle a small amount of information at a time to truly comprehend and learn a given concept (Chu, 2014). When students learn with technology, they have an unlimited amount of information at their fingertips. This can lead to high amounts of cognitive overload for students. When students are experiencing high cognitive loads, they are more inclined to rush to answer a question, which leads to incorrect responses. In addition, they are inclined to not take the time to process their mistakes and continue to make the same mistakes on a given task (Chu, 2014). When integrating technology into the classroom, it is important to try to focus on one small task at a time to help reduce students' cognitive load (Chu, 2014).

Student engagement and motivation. When looking at the impact of technology on student learning and achievement, it is also important to look at the impact technology has on student engagement and motivation. Motivation is defined as a, "set of beliefs that drive and sustain behavior" (Kiefer, Ellerbrock & Alley, 2014, p. 1). Motivation and student engagement becomes critical in the middle grades. In the middle grades, achievement is taken more seriously as it can begin to shape the career path of students (Anderman & Maehr, 1994). Some research has shown that negative attitudes and behavioral patterns increase in the middle grades (Anderman & Maehr, 1994). Due to these negative attitudes and behavioral issues, it can be quite challenging for teachers to try to keep students engaged and motivated on the subject matter. Teachers play a critical role in tapping into student motivation and engagement by setting high expectations and connecting with their students (Kiefer, Ellerbrock & Alley, 2014). When teachers have established a positive rapport with students, it allows them to do more hands on activities and cooperative learning opportunities with their peers in class. This is an important component to the integration of technology into the classroom setting, as cooperative learning with technology has been shown to positively impact student learning and achievement (Ryan & Patrick, 2001).

Assessments over time. One area of education that technology has impacted across multiple grade levels is assessments. In the past, state standardized tests, the American College Test (ACT), the Scholastic Aptitude Test (SAT), and many other standardized tests were taken using paper and pencil. With the advancement of technology, almost all standardized tests have transitioned to an online assessment

format. This leads many to wonder, is there a difference in paper-pencil assessments results compared to online assessment results? There has been many studies done comparing the results of paper-pencil assessments to online assessments. One particular study that was conducted by the Minnesota Department of Education (2012), found that students grades 3-8 who took the standardized Mathematics Comprehensive Assessment III (MCA III) test using paper-pencil scored higher than their peers that took the test using the online format (Herold, 2016). Minnesota was not the only state that reported these discrepancies between paper-pencil standardized testing and online assessments. Rhode Island reported that 42.5% of students that took the paper-pencil version of the Partnership for Assessment of Readiness for College and Careers (PARCC) English and language arts exam were proficient, compared to 34% of their peers that took the online version of the assessment (Herold, 2016). Minnesota and Rhode Island are not alone as other states have reported similar findings. Why is there such a difference? Some suggest that student's lack of familiarity of technology can play a significant role (Graham, 2016). If a student is unfamiliar with technology, they are prone to score lower on a computerized assessment. The more exposed students are to technology in their learning, the less potential there will be of discrepancies between paper-pencil assessments and online assessments.

  Conclusions about student achievement. There are both positive and negative effects of technology integration on student learning and achievement. Many teachers worry about the impact technology integration will have on student achievement and

engagement and are hesitant to incorporate technology into their classrooms because of this fear. However, if technology is used to promote student collaboration and higher order thinking, research has shown that technology can have a significantly positive impact on student learning, achievement, and engagement (Ryan & Patrick, 2001). Students are not only able to connect and collaborate with their peers in the classroom, but technology also allows them to connect with students across their region, country or world (Moos & Honkomp, 2011). It is important for teachers to recognize all the ways students could benefit from technology integration and begin to integrate some of these opportunities for students in the classroom. While this section looked into student learning and achievement in general, many wonder what impact technology has on at-risk students?

Technology's impact on at-risk youth

Technology can impact student learning in many different ways. These effects can be even greater for at-risk youth, such as youth that come from low-income families or youth that may have special needs. This is something that should be taken into consideration when looking at integrating technology into the classroom setting. In this section I will present the positive effects technology has on at-risk youth and also discuss how the lack of access to technology impacts our at-risk youth.

Positive effects. When discussing our at-risk students and technology, the focus is often on the negative effects. However, technology is opening doors for at-risk youth that would never be possible without the use of technology. According to Page (2002), "technology contributes to the personal worth each student assigns to

himself or herself during the technology-assisted process" (p. 390). Research has also

shown that there was an increase in student's self esteem, positive attitudes, writing

abilities, collaboration, and confidence when technology is integrated into the

classroom setting (Page, 2002). This has especially been true when looking at students

with special needs or low socioeconomic status.

Research has shown that "students with special needs have experienced

increased levels of performance and support when engaging in instruction involving

computers" (Page, 2002, p. 392). Technology gives educators a chance to differentiate

and individualize learning for student, which can be particularly helpful when teaching

students with special needs (McKnight et al., 2016). Technology allows students that

may be extremely shy to record or present on a device. For students that may be

extremely distracted, online assessments help reduce the number of questions and

items that appear on the screen at a time. Technology also allows nonverbal students

the ability to communicate with their peers through online forums and class

discussions (McKnight et al., 2016). Research also found low-ability students spent

more time activity engaged when they were grouped with high-ability students and

technology was used (Page, 2002). While there are many positive effects that

technology has on at-risk youth, there are still some negative effects that are a result of

technology use in education.

Lack of access to technology. One of the most significant downfalls of

technology use in the classroom is the "gap between those who have and do not have

access to computers and the Internet" (van Dijk, 2006, p. 221). This gap is referred to

as the digital divide. This divide is most prevalent among students of a low

socioeconomic status. Many schools have begun to close the gap by providing

students an opportunity to check out devices from school (Vidgor, Ladd & Martinez,

2014). However, lack of access to a device is only part of the problem. While students

may have a device, it does not ensure that they have access to internet at home. When

students do not have the access to technology at the same level as their peers, they are

missing out on "immediate feedback, individualized diagnostics, and greater academic

support" (Page, 2002, p. 394). This greater academic support in turn contributes to

higher levels of productivity and learning (Page, 2002).

Conclusions about technology's impact on at-risk youth. Technology can be

a very positive tool for at-risk youth. It can give them access to collaboration,

information, and give them a voice when they may not have otherwise been able to

contribute or learn in a traditional setting (McKnight et al., 2016). However, while

there are many positive effects of technology on our at-risk youth, there is one large

concern in the digital divide. The concern is that at-risk youth, such as students with

special needs or students of poverty, do not have access to the same technological

resources as their peers do. This creates a divide between students that have access to

technology and internet and those that do not have access (van Dijk, 2006). The digital

divide is a very heavy ethical issue that needs to be considered by districts and

teachers before the integration of technology into the classroom can be successful for

all students.

Digital tools in the mathematics classroom

Technology can and should be used in many different ways in education and in the classroom. How technology is used in the mathematics classroom may look very different from how it is used in the English or social studies classroom. Digital tools in the mathematics classroom should include both content specific and content neutral tools ("Strategic use", 2011). The goal of technology in the mathematics classroom is to strengthen teaching and learning. The National Council of Teachers of Mathematics (2011), stated the following position on technology in the classroom:

It is essential that teachers and students have regular access to technologies that support and advanced mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students.

In order for teachers to be able to use technology strategically, they must understand mathematical fidelity, the different ways technology can be used in the mathematics classroom, and the different resources available. In this section, I present the concept of mathematical fidelity in the math classroom with technology resources, resources specific to the math classroom, and the flipped classroom approach.

Mathematical fidelity. When using technology in the mathematics classroom to ensure the technology is meaningful, it must have mathematical fidelity. Mathematical fidelity is defined as, "the faithfulness of technology-based behavior and properties of virtual objects to the mathematical behavior and properties of the objects

they are intended to represent" (Niess, Driskell & Hollebrands, 2016, p. 51). A

common example of mathematical fidelity is the use of a graphing calculator. When

graphing an exponential function on a graphing calculator, the calculator will often

appear to graph a vertical line. However, anyone familiar with exponential functions

knows that this cannot be true. If the window settings on the calculator are adjusted

appropriately, the calculator will show the intended graph. While the graphing

calculator is helpful in showing students a visual representation of an exponential

function, the graphing calculator does not have a high level of mathematical fidelity

(Bos, 2009). Another common example is when taking the square root of an imperfect

square. The calculator often gives a decimal answer that only goes eight or nine digits

after the decimal point. This is a problem, as it can lead students to believe that the

square root of an imperfect square terminates, or ends, when in fact it is irrational and

goes on forever. While the calculator is useful in helping students approximate the

square root, it again lacks a high level of mathematical fidelity (Bos, 2009). These are

just two examples of technology lacking mathematical fidelity. The limitations that

technology places on mathematical fidelity is a growing concern for mathematicians

and educators. However, when technology is used correctly within the mathematics

classroom, research has shown a significant positive impact on achievement (Page,

2012).

Resources in the mathematics classroom. The National Council of Teachers

of Mathematics suggests that there are six different ways technology can be used in

the mathematics classroom (Bos, 2009). These six formats include: game format,

informational format, quiz format, virtual manipulative format, static calculation

format, and an interactive math object format which uses multiple representations

(Bos, 2009). While these are the most six most common formats used in the

mathematics classroom, this list is not exhaustive. There are other methods, such as

the flipped classroom approach, that are not covered within these six formats.

In the first format, the game format, is often used as a way to practice rote skill

and memorization of math facts. This can be helpful and engaging for students, but

can also take away from the main objective or goal. When practicing mathematics in

the game format students often focus on the goal of winning rather than exploring the

mathematical concepts (Bos, 2009). This tends to be one of the most popular formats

when technology is first used by teachers in the mathematical classroom. One popular

website is, http://www.coolmath-games.com/, this website has many games that focus

on logic. Students may be playing the game and not realize that they are actually using

their problem solving skills to help them complete the game. There are other websites,

such as http://www.multiplication.com/games/all-games, which have students play the

game and then they must complete multiplication facts correctly before continuing

with the game. These are just two examples of many websites out there that utilize the

game format.

In the second format, the informational format, students can be provided with

basic information and shown how to solve different mathematical problems. Students

can also research different facts, which can help them to solve or understand a

problem or concept. This format usually lacks connections and interaction, which can

make it difficult for students to fully grasp or understand concepts on their own (Bos, 2009). One of the most popular resources in the instructional format is Khan Academy. Khan Academy offers students instructional videos and personalized learning exercises.

The third format, the quiz format, can provide students and teachers with immediate feedback. This can be beneficial for both students and teachers. Students receiving immediate feedback know that they are not fully grasping a concept immediately, rather than continuing to grasp a concept incorrectly. Teachers also benefit as they can adjust their lesson and objectives based off of the immediate feedback provided from the quiz format. However, from a mathematical standpoint there are a few concerns as the quiz format appeals to recall and does not allow for testing theories, which is a critical part of problem solving (Bos, 2009). Three very common quiz formats are www.quia.com, www.ixl.com, and Google Forms. Quia and IXL are from the same company but offer different opportunities for teachers and students. Quia allows teachers a chance to make online flashcards and online quizzes and other formats for students. IXL is a website used for drill and skill practice. It gives students immediate feedback whether their answer is correct or incorrect and offers an explanation if they get an answer wrong. Google Forms allows teachers to create their own quiz and easily share it with their students.

The fourth format, virtual manipulatives, offer students a way to demonstrate their conceptual understanding of mathematical concept, but can be difficult for teachers as they require many detailed instructions, examples, and supervision (Bos,

2009). This can be a very difficult task for a teacher in a room of thirty or more students. However, researchers still believe that virtual manipulatives hold a place in the classroom as they are a critical step in building students' abstract concept theory (DreamBox_Learn, 2014). One useful website for virtual manipulatives is http://nlvm.usu.edu/en/nav/vlibrary.html. This website offers students multiple virtual manipulatives across grade levels and mathematical topics.

The fifth format, static representation format, is the result of a calculation. This format can be very helpful for students when they are trying to follow procedural steps and perform different mathematical calculations. It can help aide students in the computation in a timely and efficient manner. However, there is a deeper understanding that is not being represented in a meaningful way and static representation can often inhibit generalization (Bos, 2009). To avoid generalization, it is important for students to be exposed to multiple avenues and presentations of a concept (Musti-Rao, Lynch, & Plati, 2015). One helpful website for this format is https://www.desmos.com. This website offers users different representations of calculators from basic, to scientific, to graphing calculators.

The sixth and final format, interactive mathematics object format, is one of the most beneficial uses of technology in the mathematics classroom. This format allows students to see the relationships based on increasing or decreasing values, changing frequencies, or other variations (Bos, 2009). This method tends to appear more frequently in the lower grades (Quillen, 2011). The mathematics object is used in different representations that can be changed based upon the input. Students can make

conjectures and then test those conjectures. Students can also see mathematical

patterns that begin to emerge. Unlike the game or quiz format, the end result is not a

right or wrong answer, but a deeper understanding of the mathematical concept for the

student (Bos, 2009). However, this format can be very difficult in a whole class

setting. Problem solving is a critical component of the interactive mathematics object

format and if students are not willing to put in the time or effort needed to develop the

understanding through the trial and error process, then this format is not meaningful

for the student's learning (Bos, 2009). One helpful website for interactive math objects

is https://www.intmath.com/. This website allows students to interact with different

math topics, while providing them with an example and explanation.

      Flipped classroom. Another way that technology is being used in the

mathematics classroom is with the flipped classroom approach. In a traditional

classroom students receive the lesson during the school day and practice what they

learned at home. In the flipped approach, students watch the lesson video at home and

complete the work in class. This approach has become more popular as the availability

of the internet and audio resources have evolved (Herreid & Schiller, 2013). The push

behind this approach is that work that is typically done at home on their own is better

in class with the help of an educator (Herreid & Schiller, 2013). Having the lesson on

video also allows for students to rewatch a concept for further clarification. "Access at

a time and place convenient to the students allowed them to keep up with the class,

and teachers did not have to spend valuable class time helping absent students 'catch

up'" (McKnight et al., 2016, p. 202). This approach also allows students to work at

their own pace (Fulton, 2012). One downfall to this approach is when a student does not have access to technology at home or a student that comes to class unprepared. While students coming to class prepared is no different than a student not completing their homework in a traditional classroom, it presents a new set of challenges in a flipped classroom. If a student is not prepared in a traditional classroom, it typically means they did not practice the concept on their own for homework. However, they would have still received the lesson when the teacher presented the material in class. In a flipped approach, if a student comes to class unprepared, it means they have not watched the video and have not learned the lesson. While the lack of resources presents a challenge in itself and is a problem that needs to be solved by the individual school district, some educators have solved the problem of students coming unprepared to class by giving a short quiz either online or in class or by requiring homework that references information that could only be obtained from the videos (Herreid & Schiller, 2013). The short quiz has motivated some students to watch the video and also has helped teachers identify which students have not watched the videos. This allows teachers to intervene and try to help the student get caught up on the intended material.

There are both advantages and disadvantages to the flipped classroom approach. The key is how the teacher implements the approach in their classroom and how they ensure that students are learning the intended concepts. The flipped classroom approach offers yet another resource that utilizes digital tools in the mathematics classroom to help aide student learning (Herreid & Schiller, 2013).

Further research needs to be done to truly understand the impact it has on student learning.

Conclusions about digital tools in the mathematics classroom. There are many resources and digital tools available for educators to use within their classrooms. How these tools are used in the mathematics classroom, will vary from how they are used in other content areas. Math educators need to be careful when integrating these resources into their mathematics classrooms to understand the level of mathematical fidelity the resource holds. Educators should also have clear intentions for the use of digital tools in their mathematics classroom when trying to decide which of the six formats to integrate into their classrooms. Math educators may also want to explore the flipped classroom approach, which would fall under the instructional format. Educators have many options to how they want to integrate digital tools into their math classrooms. The important part is finding a balance between all the formats to ensure students are engaged and learning with the technology.

Summary

Integrating technology into the classroom setting can be a complicated concept when looking at all the intricate parts of technology in education. However, when teachers integrate technology into their classrooms slowly and begin to familiarize students with technology, there has been a positive impact on student learning and achievement. Teachers play a critical role in this integration. "When students perceive their teacher as supportive they report higher levels of interest and enjoyment in their schoolwork" (Ryan & Patrick, 2001, p. 440). If teachers build a positive rapport and

safe learning environment, the integration of technology into their classrooms will be much easier. Today's society has become very dependent on technology. Even if teachers resist the integration of technology in the classroom, students are bringing technology into the classroom with them. Many of them have cell phones and other devices that they are using on a daily basis. This is the motivation behind my research question. Technology can impact student learning in a positive manner in the mathematics classroom if it is utilized properly and ensures a high level of mathematical fidelity. Technology can be particularly beneficial for at-risk students, providing them opportunities to individualize their learning to best meet their individual learning needs. Teachers, student achievement, student engagement, and digital tools specific to the mathematics classroom are all topics that support the successful integration of technology into the mathematics classroom. My research question, *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* investigates how all of these topics work together to ensure students benefit from technology in a positive manner. In Chapter 3, I describe the details of my mathematics website implementation project. I present who my project will impact and how they will be impacted.

CHAPTER THREE

Methods

Overview

Change can be difficult for people because they are unsure of what outcome the change may bring. This applies to educators in the classroom. It can be difficult changing the way you teach or integrating new resources as you are unsure if they will impact your students in a positive manner. This thought led me to my research question, *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* This question looks at the impact technology has in the mathematics classroom on student learning and engagement. My research question helped me select which route I wanted to go when creating my capstone project. My project is in the form of a website that helps aid myself and other teachers that may be feeling apprehensive about integrating technology into their math classrooms.

In Chapter 2, I described the importance of integrating technology into the classroom setting and the potential impact it can have on student learning and engagement. In this chapter, I present the description of my website. Secondly, I present the research behind the creation of a website. Thirdly, I describe the project setting and audience. Lastly, I present the intended timeline of my project.

Project Description

      My capstone project I created is a website, housed by Google, designed to help myself and fellow math teachers by providing a variety of links to digital tools for the math classroom. While there are many great sources out there, many teachers often do not know where to start or how they could use certain digital tools. Using digital tools in the math classroom is much different than using them in other subject areas. My website was designed specifically for the mathematics classroom. I organized the website in such a way that makes it easy for teachers to navigate. The website offers teachers an opportunity to search by one of the four different math strands listed in the Minnesota State Mathematics Standards. These four strands include: number and operation, algebra, geometry and measurement, and data analysis and probability ("Mathematics"). Within each of these four strands there are different links to a variety of digital math tools based off of content specific mathematics topics. These digital math tools offer teachers six different formats of ways to use technology within their mathematics curriculum. These six formats include: game format, information format, quiz format, virtual manipulative format, static calculation format, and an interactive math object format which uses multiple representations (Bos, 2009). While the intended focus is on middle school math, some upper elementary, or high school teachers could also benefit from this website as well.

      Our district is currently on year two of three of bring your own device (BYOD) with Google Chromebooks and there has been much resistance from some math teachers due to lack of knowledge and experience. My goal is by providing

teachers with a large variety of different digital tools, located in one easily accessible

location that they will feel less overwhelmed and more inclined to try to use these

different resources within their classrooms with their students.

Project research

When addressing my research question, there are four main components to

integrating meaningful technology into the math classroom to ensure a positive impact

on student learning and engaging. Those four components include: the teacher's role

in technology integration, student achievement and engagement with technology,

technology's impact on low-risk youth, and digital tools in the math classroom.

Integrating technology into the classroom is an important component of today's

education. Technology has been shown to help teachers provide immediate feedback,

individualized learning opportunities, and helps encourage active cooperative learning

amongst students (Eyyam & Yaratan, 2014). When students learn in a cooperative

learning environment, they have shown an "increased efficacy, value, and mastery

goal orientation regarding math" (Ryan & Patrick, 2001, p. 438). Research has shown

that the more familiar teachers are with technology, the more willing they are to

integrate technology into their classrooms (Wood, Mueller, Willoughby, Specht &

Deyoung, 2005). My capstone project is intended to help teachers become more

familiar with technology by providing them with a variety of different math digital

tools in one easily accessible location.

Just as there are important steps to integrating technology into the classroom

setting, there are important steps and factors to consider when looking at creating your

own website. According to Ng (2014), the main three areas to consider when creating

a website are: web accessibility, web usability, and web navigation. The United States

Department of Health and Human Services also offers some research based web

design and usability guidelines to follow when creating a website. When looking at

web accessibility, it is important to consider how easily the website is abled to be

accessed from computers, Chromebooks, iPads, cell phones, or other mobile devices.

My main focus for web accessibility was the web accessibility of the website on

Chromebooks, as that is the device of choice within my school district. If the website

is designed to help aid teachers, it must be easily found when searched for on a given

search engine. The easier the website is the find, the greater number of people it has

an opportunity to impact. Researchers also suggest that the website does not use color

alone when designing components of the website (U.S. Dept. of Health and Human

Services, 2006). Other suggestions for web accessibility include: providing frame

titles, ensure the script and plugins allow for accessibility, and synchronizing all

multimedia elements (U.S. Dept. of Health and Human Services, 2006). The goal was

to make the website easily accessed from multiple devices to attract more teachers and

positively impact a greater number of students.

Web accessibility is not the only element to consider when designing a website.

Two other elements are web usability and web navigation. When considering web

usability and navigation it is important for the website to be user friendly. Research

suggests to help make a website user friendly that little things such as new paging is

included, rather than having the user continue to scroll repeatedly to find a link or

source (U.S. Dept. of Health and Human Services, 2006). It is also suggested that navigation menus be placed on the left panel, as this method follows our standard reading practices and makes it easier for a user to navigate a website (U.S. Dept. of Health and Human Services, 2006). It is also important that navigation only pages be kept short (U.S. Dept. of Health and Human Services, 2006). This was an important component of my website, as it deals with many different links to help aid teachers with navigation. These strategies along with many other minor details were vital in the successful creation of my website.

Project setting and participants

The setting or location of my project is online, but targets a small rural middle school in Minnesota. The school is made up of approximately 750 students grades 6-8. Of those 700 students, approximately 220 of them are seventh grade mathematics students. The school is also approximately 90% white, 6% Hispanic, 2% Black, 1% Asian, and 1% two or more races. My website will impact the seven mathematics teachers at this middle school. It will also have an impact on upwards to 20-30 additional teachers at the middle school. These additional teachers help teach math during our Individual Skill Building (ISB) time for a half an hour each school day. While the focus is on the mathematics teachers in the middle school setting, upper elementary school math teachers and some high school math teachers from our district and other districts may also benefit from this website. Due to my website being online, it is unknown the exact number of participants that will be using my website.

Timeline

My website was created with a focus on the six different formats of digital

tools that can be incorporated into the math classroom within the Minnesota State

Mathematics Standards (Bos, 2009). To create this website, I combined my research

along with research from our district technology integrationist and our Response to

Intervention (RTI) coordinator to help me create the best resources available for the

mathematics classroom. I am taking my Capstone Project in the summer term of 2018.

My website will be created and completed during this timeframe.

Project evaluation

The intent of this website was to help aid other teachers and myself in the

integration of technology into their mathematics classrooms. While I know this

website has helped me, I want to know if it has helped other teachers and if so, in

what ways? To evaluate my project and see if it has helped other teachers in the way I

have intended it to, I will create a survey that will be sent out to other teachers in my

building after the first trimester of the school year. This survey will ask the teachers

how often they have used the website, if they have found it useful, and what areas

could be changed. The survey results will help me evaluate the usefulness of my

website.

Conclusion

Chapter 3 reflects upon the website project I created for the use of math

teachers and students. Different mathematics resources are linked to the website and

organized by grade level, skill, and topic/standard. My audience is intended to be

anyone that teaches Minnesota middle school math standards, with a primary focus on

rural school districts. In my literature review in Chapter 2, I conducted much research on this topic. My research showed why incorporating technology into the math classroom is vital for student learning and engagement in today's society. One of the most common reasons that teachers are not implementing technology into their classrooms is due to lack of knowledge and their own familiarity with technology. With this website project, teachers have many resources located in one location and connected with the specific skill or standard that they are aiming to teach. Within this website creation, it was important to consider the web accessibility, web usability, and web navigation (Ng, 2014). Taking these three concepts into consideration in the website design, helped me create a website that is user friendly, academically relevant, and easily navigated. These components will in turn ensure a higher website traffic, which means a greater number of teachers and students will benefit from this website creation. Chapter 4 will reflect upon the impact my project had on myself, students, and other teachers in our school. Chapter 4 will also discuss limitations and implications of my project.

CHAPTER FOUR

Conclusions

Overview

How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement? This question was my motivation behind the creation and design of my Middle School Math Resources website. In Chapter 4, I revisit the literature review and how it supported the creation of the website and what connections I have made to the literature review. Chapter 4 also reflects on what I have learned through the Capstone process as a researcher, writer, and learner. Thirdly, Chapter 4 addresses any possible implications of my project. Along with any possible implications, Chapter 4 addresses any limitations of my project, future similar projects, recommendations, explanation of communication of project results, and an explanation of how my project will benefit the teaching profession.

Learnings

I remember beginning this Capstone process back in our Capstone Practicum class and being very anxious about the process. I had a lot of insecurities in my research and writing abilities. As a secondary mathematics teacher, I have always excelled with numbers but have sometimes struggled when it comes to putting my thoughts and views down on paper. In this Capstone process, I saw myself as having three different roles: a researcher, writer, and learner. As a researcher, it was my job to

dive into the information that was going to support my research question and help me with the creation of my website. It was also my job to keep an open mind and be willing to adapt my viewpoint based off of what the research was telling me. I found this process quite overwhelming at first, as I had many resources but was unsure where to begin. I realized my resources were guiding me in the direction of my writing. I looked for common themes and realized what the literature was trying to tell me. During this phase, the most unexpected outcomes happened to be what I learned through the research. There were often statistics, or pieces of information that surprised me. These findings helped shape my literature review and helped me in the writing process. As a writer, I learned to let the literature guide my writing while always keeping my research question in mind. This helped tremendously when writing the literature review. In my last role, as a learner, I have learned so many valuable pieces of information. Not only has that information been useful for the completion of my Capstone, but it will be vital in the success of digital math resources in my classroom and my school.

Overall, this Capstone process has really broadened my knowledge in digital resources and how to best implement them in the classroom setting. It has also helped me focus specifically on the different math resources available and how to best support my students.

Revisiting the literature review

In Chapter 2, I looked at literature that addressed the role an educator plays in the use of digital tools in the classroom. I also looked at literature that looked into the

impact technology has on student achievement and engagement. Through my research, I discovered that not all use of digital tools in the classroom were positive, which led me to look at the impact technology has on at-risk youth. Lastly, in Chapter 2 I addressed different digital tools that were specific to the math classroom.

The literature revealed technology helps teachers provide immediate feedback, individualized learning opportunities, and encourages active cooperative learning amongst students (Eyyam & Yaratan, 2014). It is important that teachers recognize the importance of technology in the classroom setting and implement it correctly. When integrating technology into the classroom, it is important to try to focus on one small task at a time to help reduce students' cognitive load (Chu, 2014). This also helps teachers that may be hesitant to implement technology into their classrooms for the first time. Starting out with small doses of technology is beneficial for both teachers and students. Many teachers are hesitant to implement technology into their classrooms. However, if technology is used to promote student collaboration and higher order thinking, research has shown that technology can have a significantly positive impact on student learning, achievement, and engagement (Ryan & Patrick, 2001). Technology simply offers students opportunities they would not otherwise have. This was important for me to consider when designing my website. I tried to keep in mind that when I share my website with other educators, that they may feel overwhelmed with the idea of having to use all of these resources. The website is organized in such a way that they could target a specific math strand from the

Minnesota State Mathematics Standards and just focus on those resources specific to

the content they are teaching.

During my literature review, I also looked specifically at the impact technology

integration had on at-risk youth. This was important to consider when designing the

website, as not all of my students are going to have the same access and background

with technology. I needed to consider their backgrounds to try to simplify the website

for student use as well. When students do not have the access to technology at the

same level as their peers, they are missing out on "immediate feedback, individualized

diagnostics, and greater academic support" (Page, 2002, p. 394). This creates a divide

between students that do have access to technology and those that do not. This is

another reason it is important for teachers to start small when implementing

technology into their classrooms.

The last part of the literature review I looked at was different digital tools

specific to the mathematics classroom. I found this literature to be the most relevant

toward the material I put on my website. One of the most important aspects of the

math literature I found was the importance of the mathematical fidelity of the

resources. Mathematical fidelity is defined as, "the faithfulness of technology-based

behavior and properties of virtual objects to the mathematical behavior and properties

of the objects they are intended to represent" (Niess, Driskell & Hollebrands, 2016, p.

51). While some technology resources are great at giving students a visual

representation, it is important for the teacher to understand the mathematical fidelity.

For example, students may see a graph of a vertical line on a graphing calculator and

assume that the line is vertical when it is really a curved line of an exponential

equation. If the parameters of the calculator are adjusted, students would be able to see

the curved graph. Mathematical fidelity is something I was very aware of when

choosing the resources to put on my website. However, teachers will also have to be

vigilant at looking at the different resources before having their students use them.

Through the literature review process of the Capstone, I learned many valuable

aspects that helped in the creation and design of my website. I learned what math

resources to focus on and how to design the website to best meet teacher and student

needs. I specially put the four different strands on the left hand side of the website

based off of the recommendations of the U.S. Dept. of Health and Human Services

(2006). By putting the links on the left hand side of the website, it makes it easier for

users to navigate the website. The literature review process was a vital component of

the successful completion of the website.

Possible implications

The school district I teach in is in a rural community in Minnesota. We are on

year three of a three year plan to implement technology into each classroom and grade

level at our middle school, which serves students grades 6-8. Additionally, our high

school recently transitioned into implementing technology into every classroom. With

this push for technology, many teachers have been a little hesitant as to where to

begin. Some teachers are ready to dive in, but are looking for more direction. Within

our math department meetings, many teachers have expressed concerns about not

knowing how to use the technology in the math classroom and make it meaningful

towards curriculum and for students. These feelings are what drove me to want to create a website to help not only myself, but other teachers that do not feel equipped to handle the new technology.

My goal with the creation of my website is that teachers will begin to use the website for themselves to explore different digital math tools. I wanted to provide teachers with one place where they can access many useful digital tools for the math classroom. As teachers become familiar with the different resources, my goal is that they will begin to share those resources with their students. While my website can be very helpful and useful for both teachers and students, there are some limitations of the project as well.

Project limitations

In a perfect world, my website would be able to be accessed by all teachers and all students. However, the accessibility is one of the limitations of my project. While I plan on sharing my website with my school district and friends who are math teachers in other districts, I do not know how many other people will easily access my website. Another limitation of my project, is that users need to have internet access to use the website. If a student does not have access to internet at home, they will not be able to access the website. Lastly, teacher willingness to use the website can be a limitation of the project. If a teacher is not willing to use technology in their classrooms, they are not likely to use my website. Looking at some of these limitations made me ponder what a future similar project could look like and what changes might need to be made.

Future similar projects

After I share my website with teachers and students, I would like feedback on what is missing and what could be added to help teachers and students. One way to gather feedback would be through an anonymous survey, allowing users to share their honest opinions. Based off of the results, changes could be made to help tweak the project. Some future similar projects could be websites geared for different subject areas and different grade levels. Other teachers could create their own website, based off of their needs within their classroom. These future similar projects will only happen if I communicate and share my website with others.

Communication and benefit

Communicating and sharing the website will be important to help teachers and students reap the benefits of the website. At the beginning of the school year, I plan on sharing the website with the other six mathematics teachers in my building. I also plan on sharing it with all teachers in our building as all teachers teach mathematics at some point through the year during our Individual Skill Building (ISB) time. I also have a handful of other friends who teach mathematics in other districts that I will share the website with. I am going to encourage them to share the website with their coworkers as well.

The website will benefit the mathematics teachers in our building that may not feel comfortable integrating technology into their classrooms. It will provide them a variety of resources in one location. The website will also greatly benefit our teachers in our building that teach mathematics during ISB time that may not feel comfortable teaching math. It will provide them with a variety of digital math tools that hold a high

mathematical fidelity and are appropriate for the middle school mathematics classroom.

Not only will the website benefit teachers and allow teachers to feel more comfortable integrating technology into their mathematics classrooms, but the website will also greatly benefit students. When teachers feel comfortable about using the website and the different resources it has to offer, students will benefit from direct feedback and differentiated instruction. It will allow them to learn mathematics through another form, in addition to paper and pencil. The website will also be available for students to use on their own. This can benefit students who want to stay caught up and fresh on their math over the summer, or students that want to work on extra skills at home.

Summary

When I was completing this project, my main goal was to answer the question: *How can meaningful technology resources be integrated into the seventh grade mathematics classroom to ensure a positive impact on student learning and engagement?* Through my completion of the Capstone and my project, I was able to understand what digital tools best fit students' needs in the mathematics classroom. From that understanding, I created a website that provides teachers and students with many different digital tools for their mathematics classrooms that hold a high level of mathematical fidelity. While this Capstone and project are now complete, I can see myself adapting the website in the future as I receive feedback from users. My goal is also to keep it up to date with the most relevant resources. As new resources come

out, I want to make those available to users on the website. Completing this website

has been extremely rewarding and I look forward to using it with my students this

school year.

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