Technology Enhancing Kindergarten Students’ Literacy Skills in Math

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Technology Enhancing Kindergarten Students’ Literacy Skills in Math

By

Alannah N. Heale
August 2015

A capstone project submitted to the Department of Education and Human Development of The College at Brockport, State University of New York in partial fulfillment of the requirements for the degree of Master of Science in Education
Abstract

I planned my methods and procedures in an effort to gain understanding of how technology affects instruction and learning of reading and writing in mathematics. I also focused my research on determining the impact that incorporating technology into mathematics can have on motivation in learning. In order to explore the impact technology can have on math instruction; I randomly selected three five year old students from my kindergarten classroom for a six week time frame during the Fall of 2014. I collected data through use of a variety of observations, audio tools, assessments, and interviews, as participant’s utilized technology in a consistent approach during mathematics instruction. Several findings were determined based on the research from this study. It was found that IXL, an online resource allowing students to practice specific mathematical practices, allowed for read aloud accessibility and positively enhanced independence and excitement among learners. Students used a variety of strategies that differed from their peers, to communicate problems to their solutions. Each learner modeled growth in a variety of ways. Literacy skills are able to flourish with consistent use of technology to enhance young learners and their exploration of its correlation to mathematics. Results from this study may assist educators in the importance of use of technology in mathematics, and its significant role in literacy practice.
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Chapter One: Introduction

As I prepared the materials for our math lesson, I overheard two Kindergarten students discussing their thoughts on using the ipads. “I like it because it’s fun, and the math games are so cool, especially the roller coaster counting by tens game,” exclaimed Alex (all names are pseudonyms), a six year old in my Kindergarten classroom.

Kyle, also six years old, shared his excitement, “I like them too but that’s because its math. I don’t like reading! The computer lets me play games with shapes and things. It’s not fun when I have to read the words. I just cannot do it.”

“Oh I know! Some of the words and sentences are so long. I could score way better if I could read the words. I can never even read the directions,” claimed Alex.

I was astonished by their conversation. As five and six year olds in my classroom, sharing thoughts on how technology helps them, identifying their likes and dislikes, I was intrigued. My students requested that if they could read the harder words, they would be even better mathematicians. As I let this scenario sink in, I was determined to ensure I wouldn’t have a student in my class be held from reaching their full potential because of something that I had the ability to enhance. It was then that I decided to reach out to a colleague in my district for assistance on utilizing the online computer resource known as IXL for mathematics.

Problem Statement

The purpose of this research was to better understand if technology can be utilized to enhance knowledge of reading and writing within mathematics specifically. Literacy and Mathematics have become our focal points in academics, and as changes continue to occur, these subject areas go hand in hand. In a study investigating mathematical understanding, Miller & Koesling (2009) discuss the role that literacy plays in certain aspects of mathematics instruction,
teaching for understanding by solving complex word problems, reading mathematical text, and assessing student understanding. Literacy carries the key to success among the complex expectations within our mathematics programs. After examining the variety of ways students misinterpret the language utilized within mathematics, teachers are provided with ways they can assist their students in becoming fluent readers to excel within mathematics tasks presented (Kenney, 2005).

In 2009, Miller and Koesling highlight the idea that, “Teachers at Fenway believe that problem-solving and reasoning skills, as well as content skills, can be taught best in the context of a literacy-based math curriculum” (p.65). Thus, an underlying connection between the completely abstract and the utterly pragmatic sides of mathematics exists (Engelward, 2012). My goal was to better understand how technology can be utilized to enhance knowledge of reading and writing within mathematics specifically in Kindergarten. With the changes in expectations brought on by the Common Core Learning Standards, students are striving for a new level of rigor in mathematics. The intensity of the curriculum requires students to be able to read and comprehend lengthy tasks through word problems tailored to mathematics. The expectations have also risen when looking deeper at answering a mathematical task, encouraging students to record their answer in sentence format, providing the answer explicitly in a formal manner. At the kindergarten level, my students are working to gain confidence in being able to read the word problems presented, along with providing the appropriate answer.

Significance of the Problem

Utilizing technology in math classrooms plays a role in academic learning and progress. Can technology be utilized to enhance reading and writing necessities within mathematics? My goal was to better understand how technology can be utilized to enhance knowledge of reading
and writing within mathematics specifically. Teachers utilizing technology in kindergarten can also start a child on the road to technological literacy: knowing to use tools to solve problems (Great Schools, 2014). The significance of the problem is how utilizing technology in my math classroom plays a role in academic learning and progress. In this digital age, we have access to a variety of technological tools to enhance education in multiple ways. Professionals in an educational setting can use technological resources to construct children’s knowledge, and strengths. According to Dunlosky (2013), “Teaching practices should surround children’s development both cognitively and linguistically to enhance development and build on previous strengths in each learner” (p. 7). Mathematics should be integrated with other activities, assembled in ways learners are actively exploring their surroundings, working through and engaging in manipulation of real-world tasks, as told by Carr (2012) while achievement was explored in a game-based learning environment.

Creating an appropriate combination of an engaging and entertaining interactive opportunity with educational objectives and goals is a challenging but valuable process creating the path to learning success. The great significance of using technology in math can assist learners in maintaining proactive reading and writing skills. Technology contains the power to have a huge effect on student attitude and behavior, in addition to increasing student engagement and motivation. Utilizing this type of online resource and setup in a math classroom has the potential to enhance the learning and growth of all types of learners.

**Purpose**

The purpose of this research was to better understand if technology can be utilized to enhance knowledge of reading and writing within mathematics. I explored learning in a six week time frame to determine the effects of incorporating technology on math instruction in relation to
enhancing student literacy skills. It was my hope to determine the impact technology can have on students’ attitudes and behaviors towards literacy within mathematics.

As education has changed immensely over time, we currently have turned pages in the expectations within each subject area at every grade level, building a population of learners using real-life experiences to better the future of our students. A workshop model classroom approach has the ability to create a pool of learners that absorb and explore information in a transitional environment involving mini-lessons aligned to the learning target. This model breaks apart focused instructional time by enhancing learning through hands-on math stations, addressing an array of mathematical standards. I utilized this type of classroom approach with my Kindergarten students ensuring technology is integrated within both the mini-lessons and the math learning stations.

**Rationale**

Technology can change the nature of school mathematics by engaging students in more active mathematical practices such as experimenting, investigating and problem solving that bring depth to their learning and encourage them to ask questions rather than only looking for answers (Farrell, 1996). We are surrounded by a variety of forms of technology, accessible within my district, that play a huge role in student engagement, motivation, and learning success. Students must be able to read and write to persevere through the lengthy tasks provided and expected of our kindergarten students in mathematics. I hoped to determine whether the technological resources that I have access to make a difference in student literacy skills to utilize in mathematics. Changes occur as technology is integrated in the elementary classroom, both with the teacher and student.
I believe that technology has the power to get students to become active thinkers, questioning tasks at hand, and searching for answers prior to seeking teacher assistance right away. As students are working independently on a computer or iPad, they naturally are forced to make decisions and assess their options, encouraging self-determination. The teachers’ duties also shift, as they are no longer consistently the center of attention; whole-group teacher-led instruction for the entire lesson has become less common. Teachers are more so the facilitator of instruction and learning, floating between students and cooperative learning groups, to scaffold instruction and provide support where necessary.

Study Approach

I used a template weekly to collect data observations. The template allowed for me to record my daily objective or learning target for each student, along with the activity at hand, technology device being utilized, and my findings. I created a benchmark assessment based on the Common Core Learning Standards, and expectations of Kindergarten students within my district. The benchmark assessment was given once at the beginning of the study, and once again at the end of the study. The first assessment was given without the use of student computers or ipads. When the assessment was given at the end of data collection, technology had been utilized consistently throughout our exploration of learning time. By building technology into instruction as a natural aspect of learning, teachers have the ability to enhance learning in ways unimaginable cross curricular. When looking specifically at reading, learners are able to gain in areas of fluency, phonemic awareness, phonics, vocabulary, and comprehension. According to Vesel & Robillard (2013), “Research in support of the use of technology as a promising practice indicated that technology could be used to increase students’ comprehension in the content
areas” (p. 385). The forms of technology being included in the study are represented by the apple iPad, student computer, and smart board.

I have created a structure that breaks up our instructional time with two mini-lessons accompanied by a station approach for allotment of interactive mathematical learning, which is where I integrate the largest aspect of technology. The two mini-lessons are shortened lessons; the first addressing daily learning targets and skills through modeling and clear expectations. The second mini-lesson is a longer time allotted for guided practice. Teachers are encouraged to explore the technological tools that are available, by introducing students to the math that surrounds them, to foster excitement and curiosity. This is my goal as an educator and facilitator to create within my Kindergarten classroom. Beth Newingham (2010) informs of her mathematics station approach within her classroom and shares her excitement. “I am so passionate about Reading and Writing Workshops because I can provide my students with the differentiated instruction that is so important in elementary school. Math Workshop now allows me to do the same thing, as I use developmental grouping to differentiate my daily instruction” (p. 2).
Chapter Two: Literature Review

As addressed in the previous chapter, technology is an essential component of education. Integrating technology into the classroom allows for the ability to assist in the success of learners in a variety of ways. In this chapter, I explore how technology provides practice that enhances literacy skills within mathematics, in addition to student engagement and motivation. I investigate how technology can be utilized to enhance knowledge of reading and writing within mathematics, along with literacy’s intricate role in mathematics. In this chapter, I also look into the opportunities that technology allows for customized student learning.

Technology Enhancing Kindergarten Students’ Literacy Skills in Math

Technology has become an essential aspect of education, yet researchers haven’t focused as much on the effect in an elementary setting. Research exists with improving student learning and creating differentiated instruction through use of technology. This research, presented by Steffani and Sylvester (2009), and Snow (2012), concluded that students in online-only instruction performed discreetly better than students in face-to-face meeting opportunities. Students in classes who participate in both face-to-face and online instruction achieved greater advances than those in exclusively online or face-to-face instruction. However, the researchers (Steffani, & Sylvester), cautioned that the majority of the studies in the meta-analysis were from students in higher education, and as a result, the conclusions gathered may not be applicable to K-12 education.

In this literature review, I address the ways technology plays a role in student learning specifically among literacy skills in mathematics. I also examine the effects technology can have on student motivation and engagement in learning.
Carr, 2012 concludes, “Technology has become almost second nature to many students” (p. 3). After investigating the advances being made in the world of technology, especially amongst the vast amount of interactive learning opportunities now available, Jennie Carr chose to explore how these advances play a role in student success. The purpose of this measureable, simulated, investigational study was to examine the effects of iPad use as a one to one computing device on math achievement in two rural elementary schools. Among 104 fifth grade students, an experimental group used ipads as their one on one computing device for nine weeks during mathematics while the control group did not use them. Through use of a pretest and posttest being administered, results showed that the transformation was not as significant as suspected between the two groups in the approach that this framework was administered.

**Student Engagement and Motivation**

In 2010, Goos stated, “Learning mathematics is as much about doing as it is about knowing. When these concepts adjoin, success is evident in the mathematical practices of the classroom” (p.68). I feel that technology is a successful tool to use as an incentive to work through lessons and instruction while utilizing the smart board, to have access to technology during station work time. As part of the push to keep students motivated and to provide them with cutting-edge math instruction, school systems have been turning increasingly to technological aids (Engelward, 2012).

A study conducted in 2013 by Vesel and Robillard, investigate the use of an interactive math dictionary and its affect on teaching mathematical vocabulary. This research discusses the importance of offering students opportunities to work in ways self-selected that make sense to them sparking their motivation. Researchers included the idea of student engagement instilled by
allowing students choice in a computer created avatar; selecting the ethnicity, gender, age, etc. to utilize while on the interactive program.

My Kindergarten learners thrive in a setting in which they’re able to make any form of choice, such as apps on the iPad, or even the location within the classroom they are able to use the apple iPad. A variety of apps are available to choose from on the district iPads we use, enhancing mathematical concepts, also practicing both reading and writing standards. Apps are accessible that help my students not only count the numbers, but spell, sound out, read, and sort appropriate objects in their designated areas. The apps and interactive resources provide clear direction on a user-friendly device with colorful vivid graphics, and age appropriate imagery.

“Mathematics games can be used to increase engagement, motivation, and student learning,” (Clark & Ernst, 2009). These researchers examined ways gaming could be used to enhance student learning amongst technology, zooming in on the area of integrated curriculum. In this article, the authors talk about gaming and its effects in technology education classrooms.

Mathematics Instruction at the Kindergarten Level

According to Groth (2013), when presented with an activity that is of interest to young learners, engagement can occur simply because the activity is self-motivating. At the end of the school year, expectations of Kindergarten students have risen greatly. Much research points in different directions whether this change is positive or negative, however, as a teacher, these changes are here to stay for a little bit of time to say the least. We have to adjust and do our best to get our students to the level anticipated of them. In 2014, Mongeau shared that, “The new standards, adopted in California and 44 other states, have brought on a whole new set of academic standards for math, with significant changes in the early grades – kindergartners must now be able to count to 100 by the end of the year, for instance, rather than 30” (p.1). Students
are required to think deeper, and develop conceptual understanding, rather than memorizing information to become fluent mathematical thinkers. Ultimately learners are probed to absorb deeper meaning within math instruction. Kindergarten students are learning through a more interactive age, with a balance built into technology use, and through hands-on activities involving math tools such as unifix cubes, and real-life objects.

**Literacy’s Role in Mathematics**

Students’ reading and writing abilities develop as their visual and motor skills develop. Young learners are still developing their fine motor skills, specifically letter writing and letter identification, which represent more demanding and complex tasks, as stated by Steffani & Selvester in 2009. This is a study that extends on previous research suggesting there is a relationship between naming pictures and a variety of other factors impacting early literacy. Researchers within this study explore the picture naming ability of kindergarteners, their ability to name and draw pictures of objects they were able to identify. Results were found for drawing and alphabet writing, and shape sorting, and rhyming.

With prompting and support, Kindergarten students are expected to describe the connection between two individuals, events, ideas, or pieces of information in a text. This reading standard goes hand in hand with those outlined in mathematics. Students must be able to depict connections and questions from information provided in mathematical tasks. Within requirements of concepts of print, learners must demonstrate understanding of the organization and basic features of print.

Phonics and word recognition: Know and apply grade-level phonics and word analysis skills in decoding words. Kindergarten students are held accountable in both fluency and speaking, which is addressed in both literacy and mathematics. Students must participate in emergent-reader texts
with purpose and understanding, along with speaking audibly and expressing their thoughts, feelings, and ideas in a clear manner. From the New York State Education Department, through Engage NY, two Common Core Learning Standards stood out to me that address requirements within Literacy expectations. With guidance and support from adults, explore word relationships and nuances in word meanings (CCSS.ELA-LITERACY.L.K.5). Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent (CCSS.ELA-LITERACY.L.K.5.A). I’m eager to see these standards implemented in my classroom!

**Customized learning**

All educators and parents can agree, students learn at different paces and through different learning styles. A group of instructional coaches employed by Silvia Rosenthal Tolisano pose some great questions such as, what are some of the workflows your students are becoming fluent in? How are you connecting skills and literacies of a modern learner to transforming activities in the classroom?

It is particularly important during those formative years in elementary school learning the basics, that students get the personalized learning they need, which is where the iPad comes in. Teachers can reinforce what is being taught with the iPads allowing students to practice certain skills at their own level and pace. Young kids who use computers as a learning aid get early practice in keyboarding as well as refining their literacy skills (Great Schools, 2014). I also utilize and create SMART lessons that are available through an online resource referred to as smart exchange, offering an interactive way to present material within instruction, integrating technology through use of the classroom smart board. Lessons on our classroom smart board are
engaging, inviting, and encouraging for all types of students, motivating learners to get involved, and participate in the lesson at hand.

The variety of iPad apps available are changing the way students grasp new concepts and allow them an infinite amount of opportunities to learn. Fun educational games can really take learning to a whole new level getting students more excited than ever!

Summary

One of the most important aspects in educational success as a teacher is to create an engaging learning environment. Technology brings to education a new tool that has the potential to strengthen student skills across subject areas and age groups. The possibilities are endless for student learning, adapting to student needs, integrating more practice opportunities for learners, opening the door to new ways of thinking. Websites, applications, and programs are reachable to allow students practice within specific areas of need such as in reading and writing. These specifications allow a targeted, fun way to further develop and engage a math classroom. With the integration of more consistent technological tools, students are able to acquire and enhance their skills for everyday life. Their real-life skills are being built upon through computer software programs, apple products, and varieties of forms of technology. Students are able to tackle more complex tasks practicing higher-order skills, because of the support provided through technology. Students are able to gain a sense of empowerment, as the transfer occurs between computer aided programs and real-life.

The most common effect on student progress utilizing technology is the increase in motivation. The boost in motivation can be traced to the satisfaction and excitement tied to the vast variety of technology tools available. The answers, and guidance provided immediately host
endless possibilities. Students are able to work cooperatively amongst peers, to pursue success in mathematics.
Chapter Three: Study Design, Methods and Procedures

The research existing on enhancing literacy skills in mathematics guides ideas in a variety of directions. This study was designed to explore how technology can be utilized to enhance knowledge of reading and writing within mathematics specifically. In this chapter I discuss the participants, procedures, and data collection methods I used. I analyzed the data I collected, and described the limitations this study may have had. In this chapter, I describe the research that the purpose of the study was built around.

Questions

I planned my methods and procedures in an effort to answer the following research questions:

- How does technology affect instruction and learning of reading and writing in mathematics?
- What impact can incorporating technology into a math classroom, have on student attention and motivation in learning?

Participants and Context

I conducted this study within my Kindergarten classroom utilizing three randomly selected five year old students. This school is located in a rural area of Western New York, with a class made up of 9 girls and 7 boys. The district is made up of a population that is mostly Caucasian. The research within my study included one female student who is African-American and one male student who speaks English as a second language, but displays strong English skills.

Procedures

This study was conducted over a period of six weeks, during November and December of 2014. I implemented the study during the five day per week math session time built into our
Kindergarten classroom schedule. In our time together, three randomly selected students completed the teacher created benchmark assessment twice; once at the beginning of our time together along with at the end of our time together. Students completed the assessment in approximately ten minutes during regular provided class time and were not given time constraints. During the first through sixth week, iPads were available to each student throughout each class session, along with the student computers. Students were aware of how to appropriately use an apple iPad prior to this research being conducted.

Students within the classroom were involved in the use of the smart board utilized during whole-group mini-lesson opportunities. Students were selected to actively participate consistently to get them engaged and involved in the learning target for that day. Students were also able to utilize the iPad or student computer a few times per week during math stations, dependent on the classroom rotation. They were able to practice fluency activities and work on skills that we had covered and were able to review using the online resource, IXL, allowing students to sign in to their own personal account, to target specific mathematical practices, organized by each standard. I was able to log in and print reports of each student and their progress, through graph and table formats. The three randomly selected students were able to utilize technology in a more consistent approach during math station rotations. They had a choice whether to use the iPad or student computer during this time. They remained on IXL during time provided during stations, with opportunities for choice on the applications available. Students were able to practice their mathematical word problems, listening and sounding out their words to strive to solve the underlying math task. I consistently observed my students as I was able to facilitate and explore things occurring during their mathematical thinking and station work time.
I also met with each student individually to confer and share thoughts on the technological piece of our classroom math setup, recording data and observations taking place.

**Data Collection Instruments and Analysis**

I collected data by observation in conversation with each student one on one during mathematics instructional time provided. Data collection was recorded using Appendix A. I also maintained appropriate records in a table format so it’s readily available and accessible. I reflected on conversations with my students post conversation, and recorded my takeaways and observations of behaviors during math stations and our interactive mini-lesson. The notes section of my data collection template was for me to record any observations I felt must be recorded immediately. Refer to Appendix A. I also utilized a written benchmark assessment to assess student growth from our start to end date. Attached is an exemplar (see Appendix B) that I provided two times during our time together. Students completed this same assessment at the beginning of our time together, and again at the end of our time together. My third strategy for data collection involved the use of student growth and progress through an online math program, purchased as a resource by my district, known as IXL.

I consistently strived to maintain records through anecdotal notes through a small group setting, to ensure conferencing with my learners. With my three selected students, I met individually to track their progress and observe their mathematical thinking while using the iPad or computer. I interjected while students solved tasks on each device to seek the same destination or answer, but also on paper. I questioned tasks such as, “Can you show me how to break apart five using your choice of strategy?” This type of task occurred after seeing this same standard being evaluated on the iPad using multiple choice format provided pictures of farm animals to sort or break in two groups totaling five. I aimed to see the transfer in action of learning through
active practice on paper, being able to model familiar learning through student chosen strategies. Students were provided with an imaginary “math toolbox” with choices for them to strategize with, such as drawing a picture, using a ten frame, using counters, etc.

**Limitations**

Limitations within my research play a role in the data collected in the structure of the created plan. For the technology tools included in the research, students had to be well trained and prepared on how to appropriately use them within the classroom. I spent a great deal of time practicing transitions and how to get to work on these tools the minute we start technology time with my students. After weeks of practice, rules, and reminders, we actively utilized the iPads and computers at the Kindergarten level. Implementing the use of technology requires a lot of preparation and rules presented slowly for learners to work independently. These tools required trust that students are staying on the task that’s expected of them, minimizing distractions for them.
Chapter Four: Results/Analyzing Data

I planned my methods and procedures in an effort to identify how technology can affect instruction and learning of literacy in mathematics. I worked to collect quantitative data from the start to the end of the six week research time frame from November 14, 2014 through January 9, 2015, through use of a benchmark assessment to score student growth. I also collected quantitative data as I observed and recording my findings based on student actions and comments made to learn what impact technological tools may have on the reading and writing skills that are required of Kindergarten students in mathematics specifically.

Findings

Five findings were determined based on research from this study. I determined that IXL allowed for read aloud accessibility. Utilizing IXL positively enhanced independence and excitement among learners. Students used a variety of strategies that differed from their peers, to communicate the problems to their solutions. Progress was shown within each learner and their growth in scores on the benchmark assessment. The final finding presented is the literacy strategy for mathematical problem solving.

Read Aloud Accessibility through IXL

Through use of the online resource IXL, students were able to gain practice and comfort with a variety of word problems. This resource allowed each problem along with each answer to be read aloud as many times as a student needed, to choose the best answer. IXL is accessible as an app, allowing read-aloud of the text, while many other apps do not offer this for learners. When using the iPad, not all of the apps being utilized provide this read aloud opportunity. There’s a consistently clear use of gradual release occurring among learners as they must determine when necessary to employ this option or when it’s appropriate to self-assess,
identifying when they truly don’t need it anymore. Having this read-aloud opportunity pushes students to use their knowledge of phonics, letter identification and sounds, and blends to determine what the question is asking. For students who were higher level readers, their ability to go beyond the use of IXL was astonishing. These were students who required the use of IXL to assist them in reading aloud any word problem tasks challenged in their direction in the beginning of our time together. By midway through our allotted time frame, these same students were using IXL not requiring the use of the read aloud clickable option.

As I observed, select students slowly used their mouse as a pointer, to follow along, making letter to sound connections to decipher the words on their monitors or screens. I was able to see some students use their mouse only to click a few select words that they were unsure of, such as words beyond our current Dolch Word List that we follow within our classroom. Some sight words that I noticed were consistent that these students did not require the use of the read aloud tool were: is, for, in, and, the. Among this type of higher-level reading ability, IXL was not just a tool to get learners geared to tackle word problems in math, but an opportunity to push learners for more. These learners had more leeway to move forward in the math world by exploring a variety of math apps and resources online, even tools that didn’t allow for read-aloud opportunities. It’s evident that through practice with technology and utilization of the opportunities within, higher level readers were able to apply their practices and knowledge of reading words and sentences, modeling a gradual release among technology and learners. Students may become too reliant on the read-aloud capabilities, not putting forward enough effort to try to utilize their reading strategies to sound out each word prior to selection the read-aloud icon to assist them.
The auditory option within IXL allowed an ability to check the accuracy of their task, along with the choice that targets the answer to that task. It was clear that students relied on IXL to provide assistance in reading aloud the problems for them. Students were able to click the volume button for each problem to be read aloud to them. Some students chose to click individually each word presented with the task, while others chose to click the icon at the beginning of the problem, to hear the entire sentence read to them. A few select students clicked on the icon at least three times to hear the problem read aloud to them before they attempted to solve. Once of the students clicked only the numbers or symbols to be read aloud to them, showing me that his ability in reading the words even beyond the sight words was at a more advanced level than most other students. If a problem with multiple choice answers was included, students had the ability to hear each choice read aloud to them, eliminating the opportunity for learners to select the incorrect choice. “There’s a bunch of reading and even some writing you do in math. It’s crazy. I like the IXL thing; it helps me read the words,” a kindergarten student involved in the study shared his thoughts.

**Independence and Excitement among Learners**

I was able to see a new level of independence forming in my students as they gained practice and comfort in using this read aloud tool. It was clear to see who needed more assistance in the math realm of the task, versus who modeled challenges reading the problem. By promoting this new independence in math, I found that students shared more excitement as they were eager to experience the online program, exhibiting more confidence in the challenging aspects of math.

I was able to see students at the kindergarten level making connections between literacy and mathematics, identifying the similarities. “I get to read a lot in math now, there are a lot of
words and I’m great at reading the words.” I overheard a student share their thoughts on using technology during math time. “It’s way more fun to do math on the computers. The pictures are fun.” Another kindergarten student shared, “I guess we do reading and writing in math too way more times than I think we do! I did a lot of stretching my sounds even during math. I like the iPad because there are boy problems on there too, like tractors and trucks.” Based on verbal student feedback, technology is a contributor of student success as an engagement tool. Some students were able to notice the reading that must be done to be successful as a math learner.

Another student involved in research was a completely different type of learner; one who prefers math, is self-motivated, and always eager to learn more, thinking beyond the task placed in front of them. This student began and ended our research time together scoring a five out of five possible points on the benchmark assessment. This learner expressed their excitement of the vivid opportunities the iPad brought to learning, with colorful images, and “boy things that I like,” such as tractors and trucks. For a student who already puts forth much effort and continues to exceed expectations, it’s enlightening, a great reminder that these students especially require that same engagement mechanism, and fun brought to learning to reach for more. It’s not just the students who are below grade level or lack motivation to learn that need any and every technology tool to enhance and lace learning in fun.

**Using Math strategies to Communicate Solutions**

Students used a variety of online and offline tools to communicate their answers. Kindergarten learners are not only expected to complete a word problem and reach an answer, but also must show their thinking. The expectations and requirements of kindergarten learners highlight the need for students to show how they arrived at their answers, clearly communicating the processes that are being utilized. We strive to gain comfort and confidence in creating models
as a math strategy to reach our answers. I was able to see students drawing math linking cubes on scrap paper in front of their computer screens while working. I also saw students using the “paint” option on their computers or ipads. This is a tool offered that allows students the use of a technological marker, to draw and express their mathematical thinking online. This is a tool that suggests a wide variety of strategies to show their thinking such as drawing pictures of the math stories and the characters within each story, or with use of models.

The online program IXL includes math tasks that stress the need for providing labels on word problems, which is a huge contributor in finding solutions in math. Labeling requires students to reread the question two to three times, gaining confidence in understanding what our answer should address, whether it was flowers, dogs, burgers, or money. This way, students know as they reread the problem, if they have answered the question. For a few select examples of the types of problems students are completing, see Appendix C. If a task is asking learners for how many pets Tyler should have (question 2), rereading encourages students to check to make sure they have appropriately solved the task. On question 3, students are asked to compare objects, searching for the longest item from the three choices provided. All three students consistently answered this problem correctly without hesitation, after rereading the question and determining whether they were searching for the shortest or longest object.

Progress

A benchmark assessment (see Appendix B) was given to the three participants once at the beginning of the study, and again at the end of the study. Progress was shown within each learner and their growth in scores on the benchmark assessment from beginning to end of our six week time frame together. One student gained two points from start to finish of research on the assessment, increasing from a score of one out of five possible points, to scoring three out of five
points. Another student made similar gains scoring one point higher the second time assessing. Included in research was one student who did not make any gains on their score, but did however maintain the same score from start to finish. All three students utilized similar strategies to solve the word problems provided on the benchmark assessment by drawing pictures, models, or diagrams of some sort.

A particular student showed growth by gaining one point between the start and beginning of our research time together on the benchmark assessment. This was a student who prefers writing much more so than mathematics, who was frequent to share this information. This student is below grade level in math but absolutely loves to read, working well above grade level in Language Arts. “Math makes you count and do shapes, it’s harder than writing” (Student three describes). Towards the end of data collection, as I worked with this student, I was made aware that they enjoyed the pictures the computers and online resources brought to the learning process, and as surprised as they were, reading is a big part of math. This student expressed their new realizations regarding how many words they actually read when doing math problems, “Thank goodness I’m a super reader,” (Student three exclaims).

Each student commented on how the use of IXL has made a difference for them, helping them to read aloud the tricky words they were unfamiliar with. IXL is a resource that has become an integral part of math for all three Kindergarten participants. They’ve gained self-assurance and comfort in being able to tackle reading word problems, problem solve, and use their literacy skills to complete grade appropriate math tasks aligned to the Common Core Learning Standards.

**Literacy Strategies for Mathematical Problem Solving**

I was able to see learners quietly asking themselves what they’re seeking, checking in to determine not only if they comprehend the task, but if they answered the question using
appropriate labeling. I was excited to see my math students monitoring their reading, along with checking for understanding. Evidence of students utilizing effective questioning strategies as they monitored their reading and understanding was exposed. I was able to see learners stop and hear them remind themselves out loud of their focus points, or their outcome. Students showed evidence of visualizing each problem along with the solution in a variety of ways, both technologically and without the use of any technology tools. Students chose to persevere in their thinking process by using scrap paper or referring to their math journals to record important information, such as the appropriate labels at the bottom of the paper. With consistency and high expectations, I was able to promote independence and encourage students to utilize the array of strategies available for them on the path to success.

The chosen strategies utilized by the students offered interesting variety. Two students created drawings of the actual question at hand such as legs on a cow, with pencil markings highlighting that the student had counted each leg twice for two cows (question 1). One student used models to count the number of legs required to fulfill the question correctly, with math cubes along with recording counting numbers one through eight, which was the answer. As I observed during station opportunities while students were using the iPads, all three students continued sounding out letters and blending, appropriately practicing their knowledge of phonic practice to assist in reading the math tasks at hand.

In the beginning of our time together (week one), my three Kindergarten students who participated in the study expressed in conversation one on one with myself, “math is way different than reading, you use numbers not letters!” Many students in my classroom continue to believe that mathematics and reading are separate worlds! Many of them can express which subject they prefer, or which of the two they are “better at,” however, my three participants have
shown much growth in being able to see how reading is a huge part of math. After having to sound and stretch out their words just to see what certain mathematical tasks are requiring young mathematicians to do, these students shared their thoughts on reading and math (see Appendix A).

From a young age, students are building on their knowledge, experiences, and confidence as they prepare for the future. At the middle school level, learners are able to see the connections between subject areas and the active transfer of the information. Even though my students are at a much younger age range, they are showing evidence of understanding that transfer between mathematics and literacy skills. I determined that with explicit teaching and modeling, even a Kindergarten student can benefit from being taught to identify the connection cross-curricular, identifying how subject areas are interrelated.

Professionals in an educational setting can use technological resources to construct children’s knowledge, and strengths. Teaching practices surround children’s development both cognitively and linguistically to enhance development and build on previous strengths in each learner. Mathematics should be integrated with other activities, assembled in ways learners are actively exploring their surroundings, working through and engaging in manipulation of real-world tasks. With the necessary resources available in education, students are able to become proficient in literacies tied to math.

For students to develop new content knowledge, they must be provided consistent opportunities to process their ideas throughout all aspects of learning, which can be targeted through writing practices in mathematics. It’s so important for all mathematicians to be able to write clearly and effectively, and communicate their results effectively regardless of their educational level. Students must be asked to practice demonstration of content knowledge in
mathematics. Instructors of mathematics may find that students must be taught explicitly how to apply the information they’re acquiring within English Language Arts to transfer and utilize in mathematics. This must be done with appropriate scaffolding of the strategies students are encouraged to implement.

The focal point of mathematics is being able to persevere and problem solve. Reading comprehension is a huge factor in this aspect of math, along with students being able to monitor and reflect within their problem solving process. Enabling students to communicate their findings is an important aspect on the path of success in mathematics, by being able to explicitly show their thinking regarding the answer they’ve reached.

Steps to understanding the task at hand center on a list of requirements. Students must understand the problem, identifying the unknown, create a plan to assist in solving the problem, and then carry out the plan, looking back to inspect the results fit the unknown they may be searching to solve. For strategies in reading and writing to carry over in mathematics, students must be taught when the appropriate time to utilize them is, along with how utilization occurs.

Summary

By allowing my Kindergarten students to have access to resources providing read aloud opportunities, I’m able to assist in successfully completing mathematical word problems. It’s interesting to look deeper into the personalities and beliefs of each student regarding school, mathematics, reading and writing. IXL practice tasks allowed for read aloud abilities among learners who needed extra support to excel, as independence and excitement among learners was occurring. Students utilized chosen math strategies that differed among learners to communicate solutions. The literacy strategies for mathematical problem solving were clear as progress among learners was evident.
I've found that using an instructional framework that requires appropriate support for each learner to process the information provided within IXL has been greatly beneficial. We also utilized math discussions allowing for my students to share their ideas in their learning at the end of each lesson. Lessons were included in which some students did not have much to share but did have an abundance of questions for their peers which allowed for my other learners to share what worked and what did not work for them during their time within the lesson that day. To ensure the appropriate amount of opportunities for students to be reading within mathematics, I worked to hand select apps and online resources with a vast amount of applicable literature and information that is of interest to my learners. My students involved in research were eager to start math each day, as they knew they would have an opportunity to partake in technology. They loved having the chance to work through their tasks in a different manner.
Chapter Five: Interpreting the Research

Technology has the capability to empower in ways beyond student engagement and excitement in learning. After consistently providing mathematical time to practice and attain concepts through use of classroom iPads and student computers, my three Kindergarten students responded in a successful but diverse manner. Mathematics assists children in creating and finding sense in the world, constructing foundational pieces of the world around them. At the elementary level, learners require skills in reading and writing to persevere in mathematics. Proficiency in literacy contains the building blocks for initial success in math. Students must be equipped with the tools necessary for achievement to meet the challenges that are presented to them. Utilizing the array of options that technology may bring to accompany learning can benefit only if introduced and operated in an appropriate manner.

Technology isn’t just encouraged to enhance student learning, but consistently influences curriculum across subject areas, relevant to all grade levels. However, for my specific research purposes, technology was found especially effective in an elementary classroom setting. Success occurs when clear, high expectations have been set, and the appropriate supports are provided consistently for all learners. Effective teaching requires strong understanding of student needs and focused learning targets. Teachers must know their learners and how to best assist them in the learning process to attain maximum potential of each student. Technology may not be the best enhancer for all students but with the appropriate tools and resources, to benefit in the learning process it’s important to know how and when to utilize. Although technology allows a variety of opportunities for students, implications do occur when integrating student computers and iPads into your classroom.
Literacy Tied to Mathematics

Literacy is directly related to mathematics in education, as they are two areas that must be focused on and practiced consistently to excel. It’s critical that they be presented with a variety of meaningful experiences in reading and writing to theorize the mathematical concepts. Literacy was incorporated into the teaching practices and math concepts provided within the mini-lessons, in addition to the technological tools incorporated into the research. I incorporated some form of technology within each lesson.

Teaching Practices Engage all Learners

Students learn in a variety of ways, and it’s our job as educators to ensure progression is occurring. For students to flourish in education, they must be provided with multiple ways to learn that ensure engagement of activities and concepts regardless of the subject area. Enabling students to reach their potential through increased access to educational resources and also extend on student learning to strive beyond that which is anticipated of them. Teachers are working to engage students in rich, gripping learning experiences that develop deeper knowledge and skill development especially among problem-solving, creativity and critical thinking skills so highly required within our advanced world today.

Changes in education are consistently occurring, as new practices become encouraged or in some cases forced, and demands continue to rise. Curriculum has become rigorous, and expectations continue to skyrocket across all subject areas, at any grade level. Young students benefit from learning through exploration of their surroundings. At the Kindergarten level specifically, retention of mathematics information can best occur by allowing learners to explore the world through deepening their knowledge of mathematical concepts and skill building.
Students learn by doing! My Kindergarten students are expected to grasp and master a skill or concept when provided instruction in a variety of ways, using a collection of technological tools.

**Implications/ Teaching Practices Decided upon by my Beliefs**

Starting at a young age, confidence in education is crucial for students to be working to build, especially in mathematics, as we are surrounded by number sense, geometry, measurement and more. For progress to be made and students to feel successful, comfort in math must be built and this begins with literacy. Learners must be able to read and write to excel across subject areas. To flourish mathematically, a clear connection must be made between both subject areas, as blending occurs in students’ everyday lives.

Success lies in differentiating, providing multiple types of instruction with the appropriate supports. It is our job as a classroom teacher to ensure all learners are being provided with instructional strategies that maximize learning and ability, tailoring to the needs of each and every child. My Kindergarten students enjoy the use of technology in math if given the opportunity. Learners communicate that they look forward to utilizing the classroom iPads or student computers, and have fun while learning (refer to *Appendix A*: student comments).

It’s concerning that at such a young age, students tend to be “click happy,” portraying impulsive behaviors that may deter productivity and hinder learning. Maximizing learning requires constant oversee for professionals to be able to monitor and guide students when using IXL or an app of their choice on the iPad or student computer. This type of monitoring required for success isn’t as realistic in a classroom of twenty students. I utilize a station approach, to target my learners in a variety of ways, differentiating instruction, placing students in groups based on their needs. Even in mathematics, I have a station created that reinforces reading fluency, accompanied by math tasks encouraging practice of word problems. Accessibility is a
factor concerning me, as not all districts are able to utilize similar tools. With the recent changes in curriculum and high demands of the educational system, it’s hoped that classroom teachers have access to these resources, but unfortunately isn’t reasonable for all schools to ensure.

**Recommendations for Future Research**

I would suggest comparing the differences in each technological tool in a different way, such as utilizing three students, but having one participant work only on the iPad, one assigned strictly to a student computer, and the third participant only using the general technology piece built into the mini-lessons that students already benefit from in my Kindergarten classroom. It would be a learning experience to be able to compare the changes in growth of these three different learning strategies that surround skill development.

The level of independence increases as students get older. I would be interested in comparing the growth and progress with similar settings, with alterations of the age groups. Selecting participants from a variety of grade levels to compare, may lead to a clear layout of effectiveness. Would this use of technology assist in literacy growth specifically in mathematics more so in the upper grades than the lower grade levels? It would be motivating and insightful to compare the results and weigh its effectiveness on education and learning.

**Final Takeaways**

It is our job to build and empower our students to take responsibility for their educational path, wanting to explore and meet their needs in curiosity. As a classroom teacher, especially at the Kindergarten level, I must ensure an environment of exploratory learning, building a classroom of learners sharing in authentic tasks enhancing skills in reading and writing who are required to persevere not only in mathematics, but in life. Students need strategies and resources to consistently practice having to do a close reading with mathematical tasks. Being familiar with
how to infer and make predictions about the task and its purpose are important tools that we had to continue practicing to be able to apply to our math lessons. My students were able to interact with the text provided in each task, by using each reading strategy to find its purpose. It was clear that IXL forced my students to point to each word, identifying it, and processing the meaning of it to assist them on the path to solving the problem. This resource enforces readers to stop, go back and reread, and ask them if they know what they’re searching for.

Technology contains the tools to assist in getting students to become active thinkers, questioning and exploring the world around them, while gaining practice and comfort in reading, contributing to success in mathematics. With a vision focusing on success, keeping the best in sight for each student, deep understanding of concept knowledge and mathematical growth is possible when utilizing the appropriate tools. Literacy skills are able to flourish when consistency is maintained, and connections are created between literacy and math. Proficiency in mathematics can be enhanced through use of technology, allowing young students to explore learning in a variety of settings and strategies.
References


Appendix

Appendix A:
Capstone Project Data Collection: Observation Notes

<table>
<thead>
<tr>
<th>Student: #1</th>
<th>Grade: K</th>
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<table>
<thead>
<tr>
<th>Objectives</th>
<th>Date</th>
<th>Activity</th>
<th>Data</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use current focus math standards we are targeting to guide students</td>
<td>Nov '14</td>
<td>Technology Choice: IPad</td>
<td>Benchmark Assessment Score 1: 1/5 pts.</td>
<td></td>
</tr>
<tr>
<td>through consistent use of a technological tool</td>
<td></td>
<td></td>
<td>A Student who lacks enthusiasm to learn,</td>
<td></td>
</tr>
<tr>
<td>K.CC.6 Identify whether the number of objects in one group is greater than</td>
<td>Dec '14</td>
<td>Student Computer, IXL</td>
<td>requires extrinsic motivation especially</td>
<td></td>
</tr>
<tr>
<td>less than, or equal to the number of objects in another group, e.g., by</td>
<td></td>
<td></td>
<td>during mathematics.</td>
<td></td>
</tr>
<tr>
<td>using matching and counting strategies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K.MD.1 Describe measurable attributes of objects, such as length or</td>
<td>Jan '15</td>
<td>IPad, IXL &amp; student chosen</td>
<td>Benchmark Assessment Score 2: 3/5 pts.</td>
<td>Score progress: increased by 2 points</td>
</tr>
<tr>
<td>weight. Describe several measurable attributes of a single object.</td>
<td></td>
<td>apps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K.G.1 Describe objects in the environment using names of shapes, and</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>describe the relative positions of these objects using terms such as</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>as above, below, beside, in front of, behind, and next to.</td>
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Conversation and reflection:
Student one insists, “Math is way different than reading AND writing! They are not at all the same thing!”

“I guess there’s some reading I have to do while I do math too, oh boy.”

“There’s a bunch of reading and even some writing you do in math. It’s crazy. I like the IXL thing, it helps me read the words.”
## Student: #2  Grade: K

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Use current focus math standards we are targeting to guide students through consistent use of a technological tool. <strong>K.CC.6</strong> Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.</td>
<td>Nov ‘14</td>
<td>Student Computer, IXL</td>
<td>Benchmark Assessment Score 1: 5/5 pts.</td>
<td><em>Conversation and reflection:</em> “No way. Math is way more fun. You have to switch numbers around and count them and make groups. You don’t use letters, they are for reading, and even sometimes writing.”☺</td>
</tr>
<tr>
<td><strong>K.MD.1</strong> Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. <strong>K.G.1</strong> Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.</td>
<td>Dec ‘14</td>
<td>iPad, IXL &amp; student chosen apps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan ‘15</td>
<td>Technology Choice: Computer</td>
<td>Benchmark Assessment Score 2: 5/5 pts.</td>
<td></td>
<td>“I guess we do reading and writing in math too way more times than I think we do! I did a lot of stretching my sounds even during math. I like the iPad because there are boy problems on there too, like tractors and trucks.”</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Score progress:</strong> remained the same</td>
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### TECHNOLOGY ENHANCING LITERACY SKILLS IN MATH

**Student: #3  Grade: K**

<table>
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<th>Objectives</th>
<th>Date</th>
<th>Activity</th>
<th>Data</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use current focus math standards we are targeting to guide students through consistent use of a technological tool.</td>
<td>Nov ‘14</td>
<td>IPad, IXL &amp; student chosen apps</td>
<td>Benchmark Assessment Score 1: 2/5 pts.</td>
<td>Conversation and reflection: “I guess maybe you have to read but probably not. Math makes you count and do shapes, it’s harder than writing.”</td>
</tr>
<tr>
<td><strong>K.CC.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.</strong></td>
<td>Dec ‘14</td>
<td>Student Computer, IXL</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>K.MD.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.</strong></td>
<td>Jan ‘15</td>
<td>Technology Choice: IPad</td>
<td>Benchmark Assessment Score 2: 3/5 pts.</td>
<td><strong>Score progress:</strong> increased by 1 point</td>
</tr>
<tr>
<td><strong>K.G.1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.</strong></td>
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Appendix B : Sample of Benchmark Assessment

Name: _____________________
Date: _____________

Math Common Core Benchmark Assessment
Thesis Project Data Collection: Created by Alannah Heale

Try your best, and show your thinking! 😊

1. A cow has 4 legs. How many legs do two cows have?

2. Tyler has 2 dogs and 1 cat. How many pets does Tyler have?
1. \[\_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_\_\_ pets\]

3. Which is the longest? (Circle your answer)

4. Jim picked 6 apples. He ate two. How many apples does Jim have left?

\[\_\_\_\_\_ - \_\_\_\_\_ = \_\_\_\_\_\_\_\_ apples\]

5. Which group has less? (Circle your answer)
Appendix C: Sample of IXL Problems

Look at this group of kangaroos:

Now select the group that shows fewer.

Submit
Sort the buttons.

Stars

Circles
Look:

Is the pencil inside or outside the box?

- [ ] inside
- [ ] outside

Submit
Appendix D: Sample of student progress on benchmark assessment, shows strategies students chose to utilize to solve mathematical tasks.

*Student One*

1. A cow has 4 legs. How many legs do two cows have?

![Cow illustration with 8 legs written below]

2. Tyler has 2 dogs and 1 cat. How many pets does Tyler have?

![Three pet illustrations with 3 pets written below]
3. Which is the longest? (Circle your answer)

4. Jim picked 6 apples. He ate two. How many apples does Jim have left?

2 \[ \xrightarrow{\text{apples}} \] 4

5. Which group has less? (Circle your answer)
Student Two

1. A cow has 4 legs. How many legs do two cows have?

2. Tyler has 2 dogs and 1 cat. How many pets does Tyler have?
Student Three

2. Tyler has 2 dogs and 1 cat. How many pets does Tyler have?

\[ \underline{2} + \underline{1} = \underline{3} \text{ pets} \]