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Implementing Technology in the Primary Montessori Classroom

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in fulfillment of final requirements for the MAED degree

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Abstract

The purpose of this research was to find out if implementing technology that parallels the Montessori language sequence would increase student engagement with literacy work. Would an increase in student interest facilitate the potential for them to meet the expected goals for alphabetic knowledge? This study was conducted in a primary Montessori classroom consisting of four year-old students identified as being “at risk” for school readiness. Prior to beginning the project, observations of student work with the language materials was conducted to create a log of lessons completed by each student. An assessment of student knowledge of upper and lower case letter names and sounds was also completed. Daily activities to increase phonological awareness were implemented by utilizing the classroom Smart Board and iPad over a six week period. Post assessments revealed an increase in language lessons completed each day and an increase in knowledge of letter names and sounds by most students.

Keywords: Montessori, school readiness, phonological awareness

One of the most pressing issues in Montessori today is the debate as to whether or not children should have access to technology in the primary classroom. Primary Montessori teachers in my school were appalled when Smart Boards were first installed in every classroom. They argued there was no place for them in the classroom because Smart Boards did not fit with Montessori pedagogy. For the first year the Smart Boards sat blank and collected dust. The second year, the principal said the district was requiring some form of technology to be used in the classroom at all times.

In order to meet district requirements, the teachers quickly created activities that could be implemented with the Smart Board such as playing videos during indoor recess times, showing pictures of places around the world for cultural studies, and choosing the daily lunch options. While these are great uses, I feel the Smart Board and iPad, as well as other technological devices, can offer more meaningful experiences in our classrooms. If incorporated carefully into the Montessori environment, I believe technology can be used as a tool to engage students who are uninterested in the Montessori materials.

I currently teach in a child development center that is operated by our local school district. The preschool students attending our Montessori program have been identified as “at risk” for not being ready for kindergarten. Student records of the 13 students in my class indicate that a majority of the students are from low income homes. Of the five boys and eight girls in my class, nine students are African American and four are Caucasian.

The term “low income” means the students qualify for free or reduced lunch and/or receive state or federal assistance due to their annual household income. Additionally, many of the students have never attended any type of school or care outside

of the home in which educational instruction was provided. Taking these factors into consideration along with the direct correlation between poverty and school readiness, it was my goal to investigate ways to enhance learning in these children with little or no literacy exposure.

Fall assessments of the four year-old students in my class revealed that most of the children have little, if any, knowledge of alphabetic letter sounds or names. This year my district implemented the Student Learning Objective (SLO) process which requires preschool teachers to support student growth in the following areas: upper and lowercase letter knowledge, uppercase letter sounds, print awareness, and rhyme recognition. Lowercase letter sounds are not included in the SLO, however, lowercase letter sound knowledge is an important element of learning to read. In addition to meeting the targets outlined in the student learning objectives, my goal is to foster a strong foundation of early literacy skills among my students. Letter and sound knowledge are key elements to building this foundation.

Over the past two school years I have taught “at risk” students. I observed that both years the students seem uninterested in independent work with the Montessori language materials. When working with the students I have observed there is a lack of understanding of the concept that letters make sounds. Also, students have a lack of vocabulary and have trouble identifying the objects in the Montessori sound baskets.

I explored strategies as to how to engage my students with learning the letter names and sounds. As I got to know them I discovered they all share an interest in using technology. Whether it’s playing games on mom or dad’s smartphone or their own digital notebook, they all seem to have this common interest.

My observations led me to pose the question, would implementing technology that parallels the Montessori curriculum in the classroom increase student interest in the language materials? Would students become more engaged with literacy work in the classroom thus facilitating the potential for them to meet their expected literacy goals?

Review of Literature

The following is a literature review on the negative impact of poverty on school readiness and how the implementation of technological innovations can be used to make up for deficits in literacy skills experienced by socioeconomically disadvantaged preschool students.

Recent studies have revealed that one in three African-American children are living in poverty, and one in six of all children live below the poverty level in America (Cuthrell, Ledford, & Stapleton, 2010, p. 104). Researchers have linked living in poverty to a negative impact on a child's growth and development. Income, education, occupation, welfare recipient, or some combination of these factors determines the socioeconomic status (SES) of families (Dotterer, Iruka, & Pungello, 2012, p. 657-658). Research has revealed that children from low SES households have lower school readiness than their peers from higher SES homes (Dotterer et. al., 2012, p. 658).

School readiness is defined in many ways, but most researchers agree that school readiness involves a child's cognitive skills, socio-emotional skills, and attentional skills (Dotterer et. al., 2012, p. 657-658). Numerous studies have provided evidence that links socioeconomic status with the development of these skills in young children (Dotterer et. al., 2012, p. 658). Children who live in poverty experience increased disabilities in learning and developmental delays as well as decreased socioemotional development

(Cuthrell et. al., 2010, p. 104). Socio-emotional effects of poverty on children include lower self-esteem, lower popularity, and conflictual peer relationships which lead to emotional and behavior problems (Cuthrell et. al., 2010, p. 104).

Children from lower SES homes have a lower performance on cognitive and language assessments at kindergarten entry compared to children from higher income homes (Dotterer et. al., 2012, p. 658). Many impoverished children enter school as linguistically disadvantaged because they have not had experiences that promote literacy and reading readiness which places them behind middle and upper-class children (Cuthrell et. al., 2010, p. 105).

Children from low-income families may acquire language skills more slowly, exhibit delayed letter recognition and phonological sensitivity, and are at risk for reading difficulties (Chin, Hutchinson, Reed, & Xu, 2013, p. 296). When children enter school, gaps in literacy abilities are already evident between children of lower SES and their peers from higher SES backgrounds (Beaman-Wheldall, Buckingham, & Wheldall, 2013, p. 193). Children from lower SES backgrounds tend to possess less knowledge of phonological awareness and vocabulary/oral language skills (Beaman-Wheldall et. al., 2013, p. 193). Early literacy ability is a strong predictor of a child's literacy performance throughout their school life (Beaman-Wheldall et. al., 2013, p. 193). Educators feel the most effective intervention for closing the achievement gap is early childhood education (Cuthrell et. al., 2010, p. 105).

The goal of early childhood education is to provide a strong foundation for young children. Early childhood education encompasses educating the "whole child" which means educators also must be knowledgeable of the cultures in which students live to

have clear expectations in the classroom (Cuthrell et. al., 2010, p. 107). Educating the “whole child” involves promoting the child’s cognitive, social, emotional, and physical growth and development.

The Developmental-Ecological Systems Model, a theory in child development proposed by Urie Brofenbrenner, describes the relationship between influential factors that exist within families and the social system in which the family is embedded (Chin et. al., 2013, p. 296). These factors can either positively or negatively impact a child’s development. Risks that children experience due to low economic resources can be offset by protective influences, and these protective influences can be compounded across environments to increase positive outcomes (Chin et. al., 2013, p. 296).

Teachers should celebrate the differences and show respect for all families and appreciate what families know and can do (Cuthrell et. al., 2010, p. 107). By believing in a child and cultivating positive relationships, teachers can build positive classroom experiences and relationships with students and their families (Cuthrell et. al., 2010, p. 107).

Strategies for working with students living in poverty encompass the school environment, the classroom environment, and family involvement. Cuthrell et. al. (2010, p. 106-107) reported that teachers can promote positive experiences for students in several ways:

- Set high expectations for all students
- Value and assure the child of his or her importance
- Create meaningful learning experiences

- Don't expect less; focus on learning and overcoming the challenges associated with poverty

Early childhood researchers and practitioners have identified key foundational skills that are necessary for children entering kindergarten to succeed in learning to read. These skills include oral language, phonological awareness, print knowledge, and alphabet knowledge (Chin et. al., 2013, p. 295).

Considering the lack of literacy abilities in socioeconomically disadvantaged children, educators are challenged to provide meaningful learning experiences in the classroom. Educators are continuously researching ways to provide innovative ways to engage their students. How can teachers use technology to support children's interests and address early learning standards and accountability measures (Lisenbee, 2009, p. 92)? Findings in research have revealed the importance of early childhood computer use in the development of minds and bodies of children from socioeconomically disadvantaged families (Atkins, Li, & Stanton, 2006, p. 239).

The potential value of personal computers in early childhood development has been debated constantly among parents, school teachers, and researchers for decades (Atkins et. al., 2006, p. 240). Initially, early childhood educators feared the use of technology would replace other early childhood activities (Clements & Sarama, 2002, p. 340-343).

Researchers Atkins, Li, and Stanton conducted a study involving 122 Head Start students to investigate the use of the computer in the classroom (Atkins et. al., 2006, p. 239). One of the main research questions was, "Does adding a computer to a preschool environment enhance children's education experience (Atkins et. al., 2006, p. 243)?"

The study consisted of children in an experimental group working on a computer for 15-20 minutes per day with their choice of developmentally appropriate software, while the control group received the standard Head Start curriculum (Atkins et. al., 2006, p. 239). As part of a research study, a Head Start classroom integrated a structured computer curriculum in three developmentally appropriate content areas of early childhood (cognitive, motor, and language development). Data from the study concluded that implementing the computer curriculum increased cognitive, motor, and language scores among the students (Atkins et. al., 2006, p. 241).

Although every use of technology is not appropriate or beneficial for young learners, research indicates that children who use practice software about ten minutes a day increase their scores on achievement tests (Clements et. al., 2002, p. 340-343). Children exposed to developmental software alone showed gains in intelligence, nonverbal skills, long-term memory, and manual dexterity (Clements et. al., 2002, p. 340-343). However, research shows that computer activities yield the best results when coupled with suitable off-computer activities (Clements et. al., 2002, p. 340-343).

Why is technology such a powerful educational tool for children (Lisenbee, 2009, p. 92)? According to the Common Sense Media study of children in the United States, three-quarters of the children ages zero through eight years old studied had access to mobile digital devices such as tablets and smartphones at home (Wong, 2015, p.76). Many preschoolers are surrounded in their home environment by multimodal communication tools and digital media, including laptop computers, handheld and console video game players, and mobile touch screen devices such as smartphones and

tablets (Wong, 2015, p.77). It is hardly surprising that many preschoolers are eager to master the use of these new technologies (Wong, 2015, p.76).

Suzanna So-Har Wong conducted a study to examine the impact on young children's multi-literacy practices with digital devices, in particular, the iPad (Wong, 2015, p.75). Although there is a lack of research incorporating the iPad as a literacy teaching tool in the early childhood classroom, previous research supports the developmentally appropriate use of other forms of technology with young children promotes both cognitive and social learning (Beschoner & Hutchinson, 2013, p. 17). Toddlers and preschoolers naturally are attracted to the use of digital devices (Wong, 2015, p.75). Mobile touchscreen devices, such as iPads, provide opportunities for young children to engage in digital technologies in ways that previously were not possible (Wong, 2015, p.76). iPads can deliver content in an interactive way, but on a one-to-one level just like the electronic whiteboard which means they hold an amazing potential for classroom use (Bennett, 2011, p. 23) They offer easy access to the web, just like the laptop, but the apps work as instructional modules, so you're getting access to the internet, plus a multitude of activities (Bennett, 2011, p. 23). The interactive aspect of the iPad appeals to the kinesthetic learner because the apps motivate students to manipulate the content (Bennett, 2011, p. 23). It is so intuitive that even kindergarten students need little or no instruction on how to manipulate the device (Bennett, 2011, p. 23). Wong's study concluded the use of the iPad engages children in multimodal literacy practices, motivates literacy learning and provides opportunities for independent exploration and creation (Wong, 2015, p.75-77).

“There are many advantages to using technology in our early childhood classrooms,” states Nancy Hertzog and Marjorie Klein in their article titled *Beyond gaming: A technology explosion in early childhood classrooms*. Research indicates when technology is used effectively it creates an active interaction between the learner and the content (Hertzog & Klein, 2005, p. 29). Studies show that technology use by young children can add value in the following areas: social, emotional, and cognitive development (Hertzog et. al., 2005, p. 29).

As teachers, we need to capitalize on children’s fascination with technology by embedding technological tools in the curriculum to extend children’s interaction, exploration, and perspective (Lisenbee, 2009, p. 93). In addition to the iPad, SMART Boards are a novel way to engage students in learning. The SMART Board, introduced in 1991, was the first interactive whiteboard available for educational use (Lisenbee, 2009, p. 93). The digital whiteboard is a large interactive display-like, wall-size version of a computer monitor with a touch screen connected to a computer and projector (Lisenbee, 2009, p. 93). Even with the popularity of schools implementing SMART boards into early childhood classrooms, its use as an instructional tool in curriculum is still often considered an innovative way to engage young children in learning (Lisenbee, 2009, p. 93). The use of technology to implement curriculum supports new ways of teaching and learning (Lisenbee, 2009, p. 93). “By incorporating appropriate technological tools into my curriculum, I found that the children were more engaged and enjoyed the learning process,” says Lisenbee (2009, p.93).

Considering the increased influence of digital technologies on daily life and young children’s increased use of interactive technologies, early childhood educators are

beginning to think about the role of technology in their classrooms (Beschoner et. al., 2013, p. 16). It is important to consider how technology can be used in a developmentally appropriate manner with young children (Beschoner et. al., 2013, p. 16). Working with children from socioeconomically disadvantaged backgrounds provides a strong sense of purpose to utilize every available tool to assist children with building a strong foundation for reading. Research indicates the purposeful use of technology can encourage the cognitive and social growth of young children (Beschoner, et. al., 2013, p. 16).

Methodology

The purpose of this action research project was twofold:

1. To establish methods of implementing technology into the early childhood classroom that parallel the Montessori language sequence
2. To increase student interest in the Montessori language materials with the purpose of increasing their knowledge of upper and lower case letter names and sounds

Prior to implementing the technological devices into our daily work cycle, I spent two weeks observing and documenting student work with the language materials in the classroom (see Appendix A). During this time frame between the dates of January 5, 2016 through January 19, 2016, I also completed assessments of student knowledge of the upper and lower case letter names and sounds. These assessments consisted of students identifying letter names and sounds as I pointed to them on a piece of paper (see Appendices B-C).

The first assessment consisted of the student identifying the upper and lower case letter names. If he or she identified the letter name correctly when I pointed to it, I highlighted the letter on my record sheet (see Appendix B). The second assessment I administered was to record student knowledge of upper and lower case letter sounds. If the student identified the letter sound correctly when I pointed to the letter, I highlighted the letter on the record sheet (Appendix C).

One aspect of Montessori pedagogy is the Montessori guide follows the child and individualizes instruction based on his or her needs. Because of this, language groups are based on student mastery of letter knowledge, beginning sound awareness, ability to match object names to the corresponding beginning letter sound, etc. Regular assessments of student progress keeps these groups fluid because all students do not learn at the same pace. I continuously monitor their progress and rearrange the structure of the groups. Furthermore, sometimes instruction may need to be differentiated based on the individual needs of the student.

I have students divided into four groups based on their current mastery of the language materials. Monday through Thursday I work with each small group. Fridays are set aside for revisiting materials and working with students who were absent during their group time. Prior to introducing the technology into our work cycle, I observed and documented student engagement as they worked on the language materials I had introduced (Appendix D). These lessons include The Three Period Lesson with the Sandpaper Letters, I Spy Sound Baskets, Matching Objects to Beginning Letter Sound, Matching Picture to Beginning Letter Sound, and the Moveable Alphabet.

After collecting the baseline data I began the interventions. Each morning the students entered the classroom following breakfast and a restroom break. During this time I led our whole group language instruction utilizing the classroom Smart Board as part of the technology intervention. Because young children cannot sit still for very long, I tried to keep this activity between ten and twelve minutes. Each day I recorded our lesson on the Smart Board Activities Log (Appendix E).

First, I displayed the alphabet via the Starfall.com website (Starfall Education Foundation, 2002). As a group we recited the alphabet song as I pointed to each letter. We recited the song again but rather than singing the names of the letters, we sang the sounds of the letters as I pointed to each letter.

Next, I displayed the ABCMouse.com (Age of Learning, 2007) website on the Smart Board. Each morning we practiced three letters using the following format:

1. Displayed upper and lower case letter (Ex. I, i)
2. Displayed three pictures that begin with I,i – igloo, iguana, insect
3. Repeated a letter chant for the letter I,i:
I, i makes the sound i
I, I makes the sound i (students repeat)
i, i, i letter I
i, i, i letter I (students repeat)
igloo, iguana, insect
igloo, iguana, insect (students repeat)

While reciting the letter chants, the students stood up to incorporate movement into their circle time. After circle time the students were dismissed to begin their individual work.

This is also the time when I invited students to participate in small group work.

Prior to allowing students to work independently with the iPad, I had to set aside time to model a few ground rules which included: how to properly hold the iPad, appropriate places to work with the iPad, and how to access the apps. An important concept in the Montessori classroom is the student's freedom to choose the work of their choice. However, due to the nature of this research project students were assigned days and times to participate with iPad activities. Each student was allowed to use the iPad twice a week for ten minutes (Appendix F).

The following is the list of apps students were able to choose from during their independent work time:

1. ABC Alphabet Phonics by Innovative Investments Limited
2. EduKitty ABC – Free Letter Quiz, Flashcards, Tracing English Alphabet by Cubic Frog Apps
3. ABC Genius – Preschool Games for Learning Alphabet Letters by Innovative Mobile Apps
4. Monster Alphabet: Make Preschool Learning Fun by Mageeks Apps & Games
5. My ABC Preschool Alphabet Letters Phonics Academy by Andrea Perin
6. Alphabet Preschool Lunchbox Adventure by Mageeks Apps & Games
7. ABC Ninja – The Alphabet Letters and Phonics Slicing Game by Innovative Mobile Apps

During the intervention, I conducted individual observations of each student while working with the iPad (Appendix G). In order to give students time to get accustomed with using the iPad, these observations took place the week of February 15, 2016.

The last week of collecting data for my intervention of implementing technology in the classroom took place during the weeks of February 29, 2016 and March 7, 2016. During these last two weeks I collected data to conclude whether or not the goals of this intervention were achieved. First, I conducted observations of the student's literacy work with the Montessori materials (Appendix H) to compare with the data from the initial observation prior to implementation of technology. During this week I also observed and documented student engagement with the Montessori Language Materials (Appendix I) after the use of technology to compare with my prior observations conducted during small group time.

Also, I repeated the assessments I administered prior to implementing the technological devices into our daily work cycle (see Appendices K-L). Comparison of this data provided evidence as to whether or not implementing the use of technology in the classroom facilitated student growth in the area of letter and sound knowledge. Lastly, I invited the students to provide feedback for the iPad and Smartboard activities we utilized over the past six weeks (Appendix J) to find out how they enjoyed working with these materials.

Data Analysis

I began gathering data for this research project the week the students returned to school from winter break. Over a ten day period between January 5, 2016 and January 19, 2016, I collected the following data to establish a baseline for my project:

- Observation of student work with the Montessori materials
- Assessment of student knowledge of upper and lower case letter names and sounds

I observed and documented student engagement as they worked on the Montessori language materials (Appendix A). These lessons included: the Three Period Lesson with the Sandpaper Letters, I Spy Sound Baskets, Matching Objects to Beginning Letter Sound, Matching Picture to Beginning Letter Sound, and the Moveable Alphabet.

Table 1

Montessori Literacy Work Completed during 2 Hour Work Cycle

(Before the use of technology)

Observation Days (January 5-19, 2016)	Jan. 5	Jan. 6	Jan. 7	Jan. 8	Jan. 11	Jan. 12	Jan. 13	Jan. 14	Jan. 15	Jan. 19
Sandpaper Letters	2	0	0	0	0	3	1	1	1	2
I-Spy Sound Baskets	4	3	2	2	1	2	2	0	0	1
Object to Beginning Sound	0	3	0	3	0	4	2	3	2	2
Picture to Beginning Sound	0	0	0	0	0	0	0	0	0	0
Moveable Alphabet	4	0	4	1	1	1	1	2	1	1
Total Number of Language Lesson Completed Each Day	10	6	6	6	2	10	6	6	4	6

My observations confirmed the students' lack of interest with the Montessori language materials. While conducting small group work with the Sandpaper Letters and I-Spy Sound Baskets, students were disengaged and sometimes even disruptive. While working independently with the sound baskets that required students to match objects with their corresponding beginning sounds, I observed students playing with the objects and mixing the objects with other baskets. I also observed students turning the letter mats upside down. The Matching Picture to Beginning Letter Sound lessons consist of

envelopes with letters and pictures. The lesson requires students to match pictures to their corresponding beginning letter sound. During the ten day observation period, I did not observe any students choosing these materials during the morning work cycle.

Of the 13 students participating in this study, only seven had been introduced to the Moveable Alphabet at the beginning of this project. In order to increase student confidence with working with the Moveable Alphabet I introduced a preliminary tray consisting of the objects *rag*, *tag*, *ram*, *mat*, and *rat* and the necessary letters to spell each word. Despite several revisits of this work, students still seemed uninterested in choosing this work.

According to the University of Virginia's Phonological Awareness Literacy Screening (PALS Pre-K), four year-old preschool students should be able to recognize 12-21 upper case letters and 9-17 lower case letters by the end of the school year (University of Virginia, 2007). The January assessment of students' upper and lower case letter knowledge revealed eight of my students had not achieved this goal.

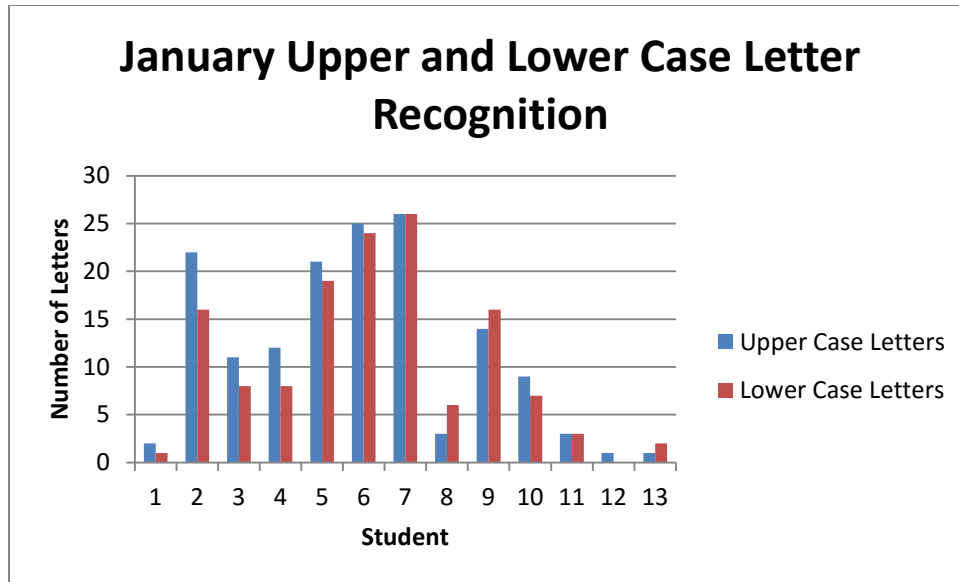


Figure 1. January Upper and Lower Case Letter Recognition

PALS Pre-K also recommends four year-old students master between four and eight upper case letter sounds by the end of the school year (University of Virginia, 2007). In a primary Montessori classroom, lowercase letters are taught first. Reading is phonetic and lower case letters are what words are mostly composed of (Just Montessori, 2016). The January assessment of upper and lower case letter sound knowledge revealed four students had not achieved this goal.

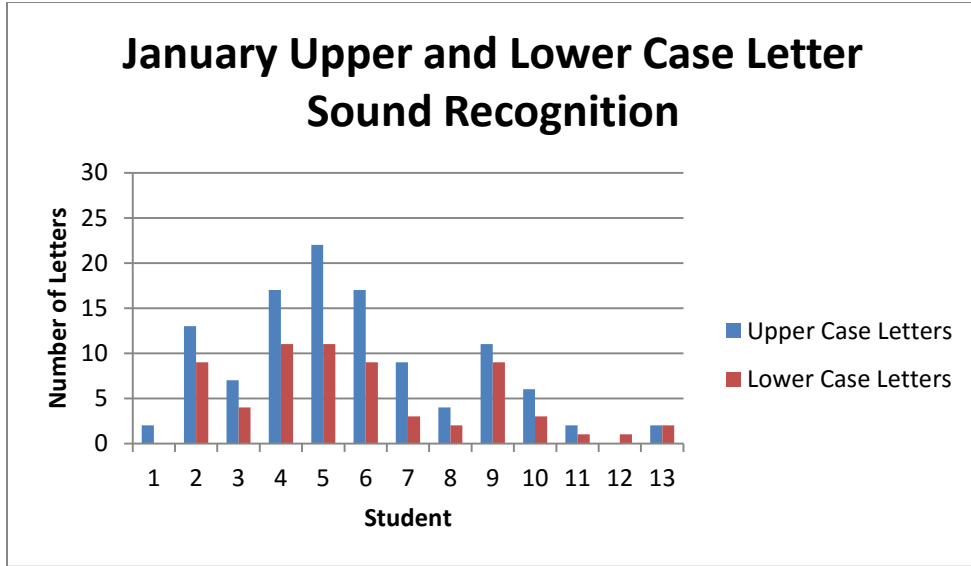


Figure 2. January Upper and Lower Case Letter Sound Recognition

Comparison of the students January and September letter assessments revealed students had shown little growth in recognizing upper and lower case letters and sounds.

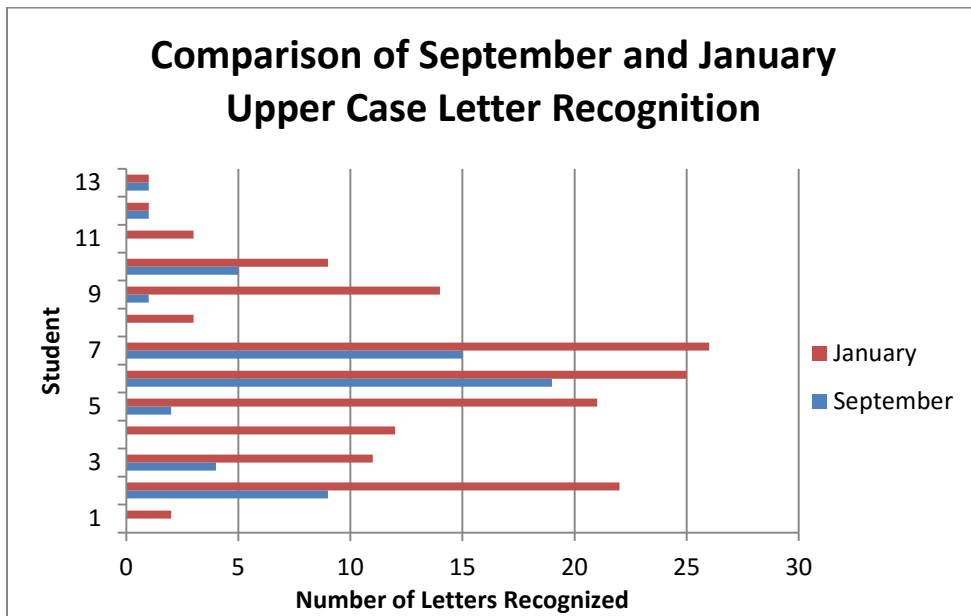


Figure 3. Student Growth of Upper Case Letter Knowledge between September and January

Overall there was a 27% growth in upper case letter knowledge between

September and January.

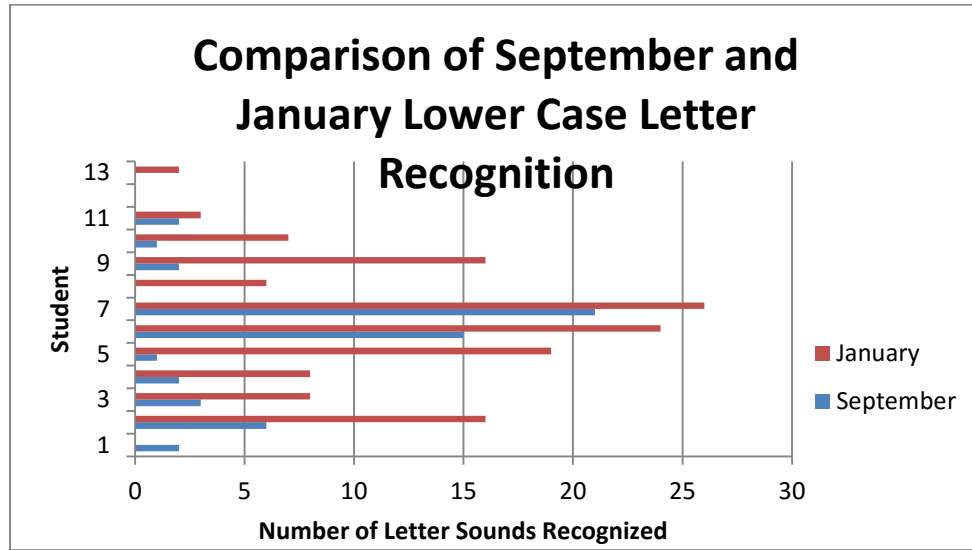


Figure 4. Student Growth of Lower Case Letter Knowledge between September and January

There was a 24% growth in lower case letter recognition between September and January.

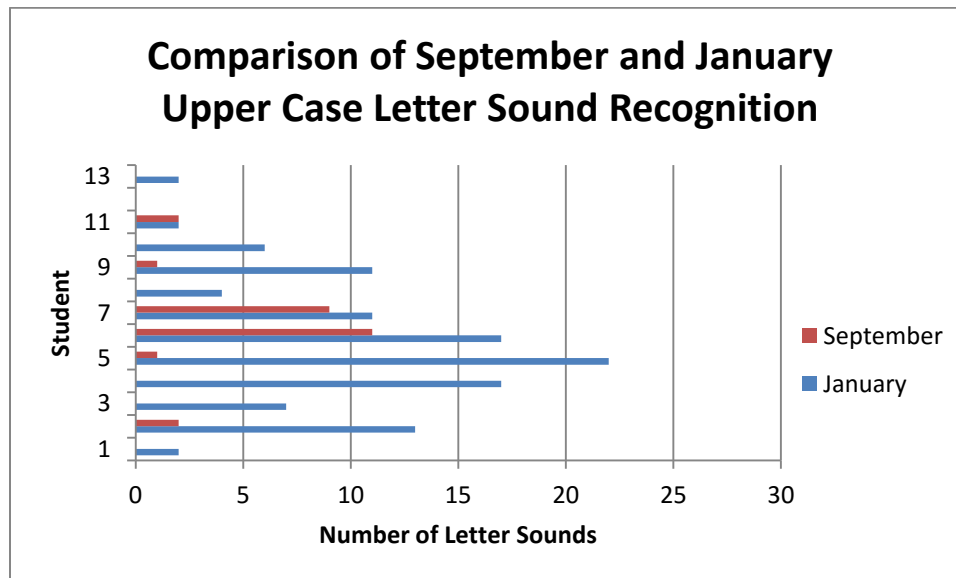


Figure 5. Student Growth of Upper Case Letter Sound Knowledge between September and January

Overall there was a 24% growth in upper case letter sound knowledge between September and January.

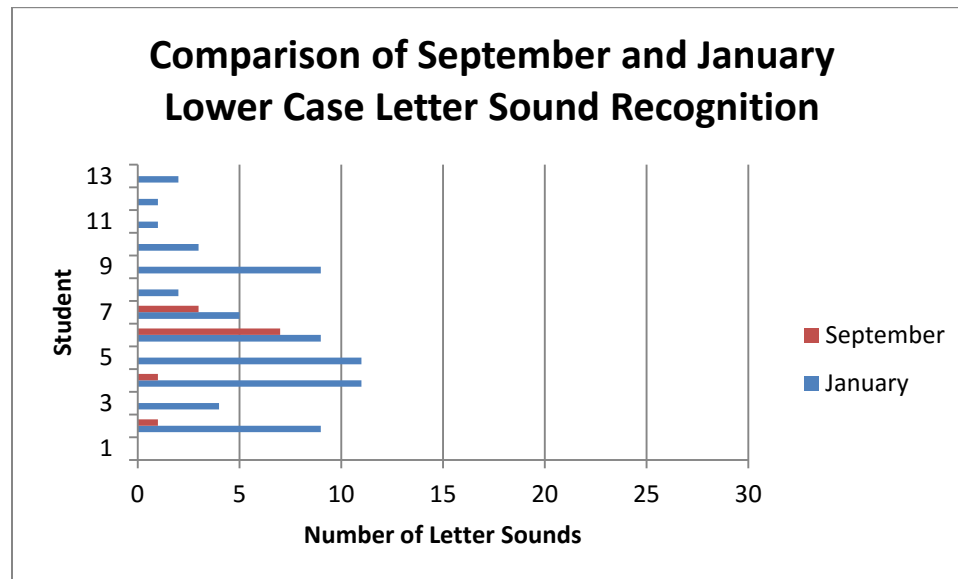


Figure 6. Student Growth of Lower Case Letter Sound Knowledge between September and January

Overall there was a 17% growth in student knowledge of lower case letter sounds between September and January.

On January 20, 2016 I incorporated the Smart Board and the iPad into our daily work routine. During our whole group language instruction I displayed the alphabet via Starfall.com on the classroom Smart Board (Starfall Education Foundation, 2002). The students recited the alphabet song as I pointed to each letter. We would recite the song again but rather than singing the names of the letters, we would sing the sounds of the letters as I pointed to them. Each day we practiced three different letters on the ABCMouse.com website (Age of Learning, 2007). First, we would identify the upper and lower case letter. Next, we would practice the letter's sound by naming three

pictures that began with the letter. We would wrap up each letter lesson by singing a letter chant.

Each day I kept an activities log to document student participation. Average student participation consisted of 70% of students engaging with the lesson each day. I labeled students as being distracted from the lesson if they were demonstrating any behavior that prevented either them or their classmates from participating in the lesson. These behaviors included speaking out of turn, talking or playing with another student, playing with their clothing, jewelry, shoes, etc.

It is common for my students to fall asleep when they sit still for any length of time. Many are at the bus stop as early as 6:00 a.m. For this reason, I tried to keep our time at the circle less than 15 minutes. I also incorporated movement into our letter chants. However, several students would fall asleep during our morning group lesson.

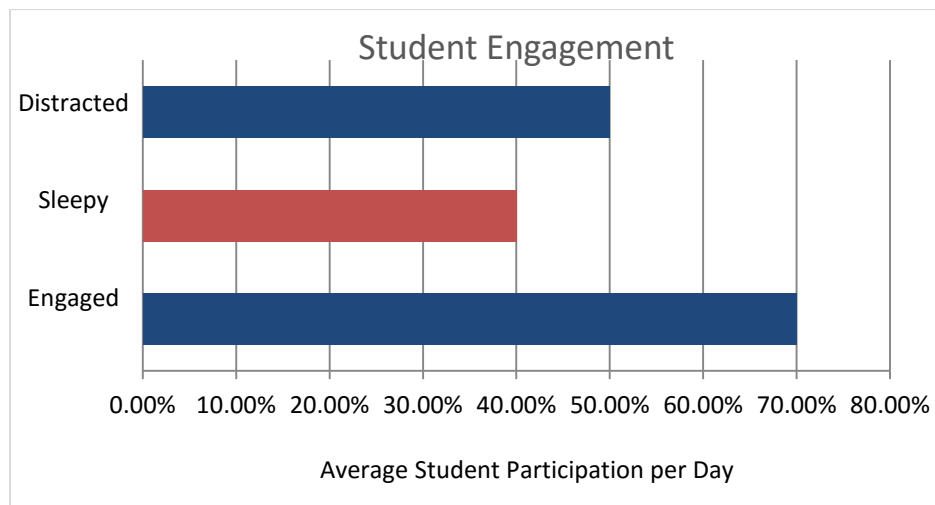


Figure 7. Average Student Engagement per Day

Each bar of the above graph represents the average level of student participation over a 14 day period.

Activities with the iPad included seven apps designed for phonological awareness for preschool students. The following is the list of apps students chose from during their independent work time:

1. ABC Alphabet Phonics by Innovative Investments Limited
2. EduKitty ABC – Free Letter Quiz, Flashcards, Tracing English Alphabet by Cubic Frog Apps
3. ABC Genius – Preschool Games for Learning Alphabet Letters by Innovative Mobile Apps
4. Monster Alphabet: Make Preschool Learning Fun by Mageeks Apps & Games
5. My ABC Preschool Alphabet Letters Phonics Academy by Andrea Perin
6. Alphabet Preschool Lunchbox Adventure by Mageeks Apps & Games
7. ABC Ninja – The Alphabet Letters and Phonics Slicing Game by Innovative Mobile Apps

Students were assigned days and times to use the iPad. Each student was allowed to use the iPad twice a week for ten minutes. At the conclusion of this project I asked the students which game was their favorite.

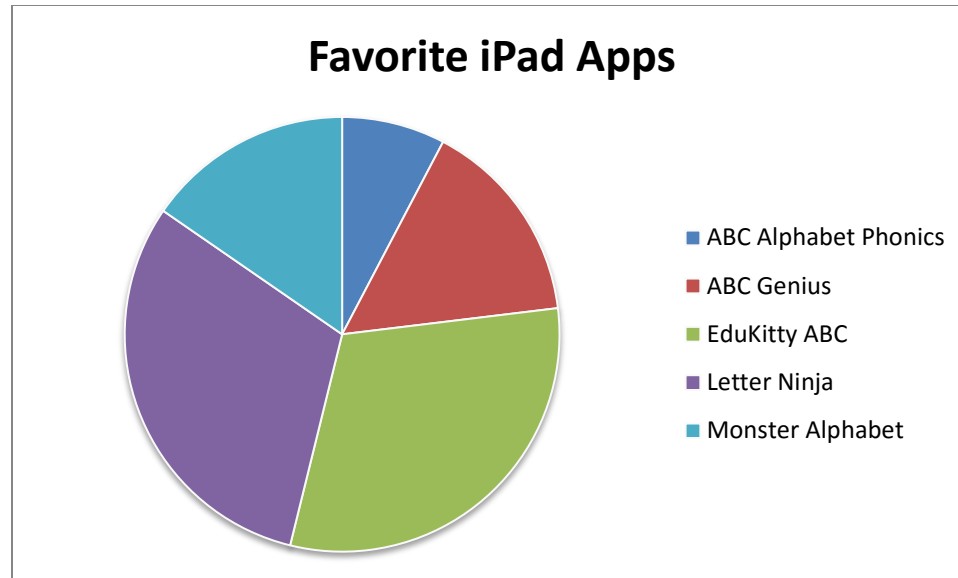


Figure 8. Student's Favorite iPad Apps

The last week of collecting data for my intervention of implementing technology in the classroom took place during the weeks of February 29, 2016 and March 7, 2016. I conducted observations of the student's literacy work with the Montessori materials to find out if there had been an increase in choosing these lessons.

Table 2

Montessori Literacy Work Completed during 2 Hour Work Cycle

(After the implementation of technology)

Observation Days (February 29- March 11)	Feb. 29	Mar. 1	Mar. 2	Mar. 3	Mar. 4	Mar. 7	Mar. 8	Mar. 9	Mar. 10	Mar. 11
Sandpaper Letters	3	2	3	1	0	1	2	3	3	2
I-Spy Sound Baskets	6	5	1	3	2	4	3	7	5	3
Object to Beginning Sound	3	2	4	4	1	5	1	2	4	6
Picture to Beginning Sound	4	1	1	2	1	3	6	4	1	5
Moveable Alphabet	6	1	4	3	4	1	3	5	6	3
Total Number of Language Lesson Completed Each Day	22	11	13	13	8	14	15	21	19	19

My observations concluded there was a 40% increase in student work in the language area of the classroom since the technology intervention. Furthermore, follow-up assessments revealed increases in the areas of upper and lower case letter and sound knowledge.

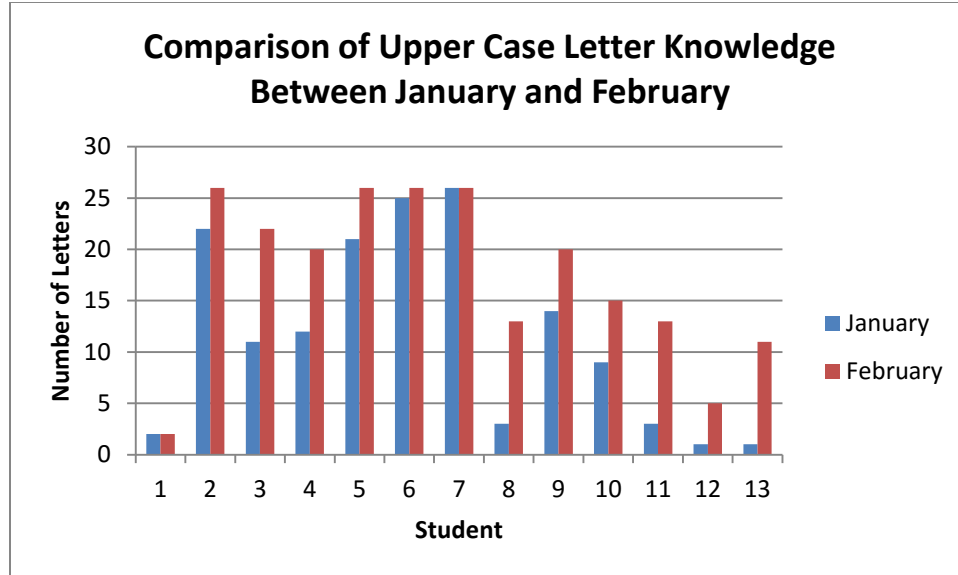


Figure 9. Comparison of Upper Case Letter Knowledge between January and February

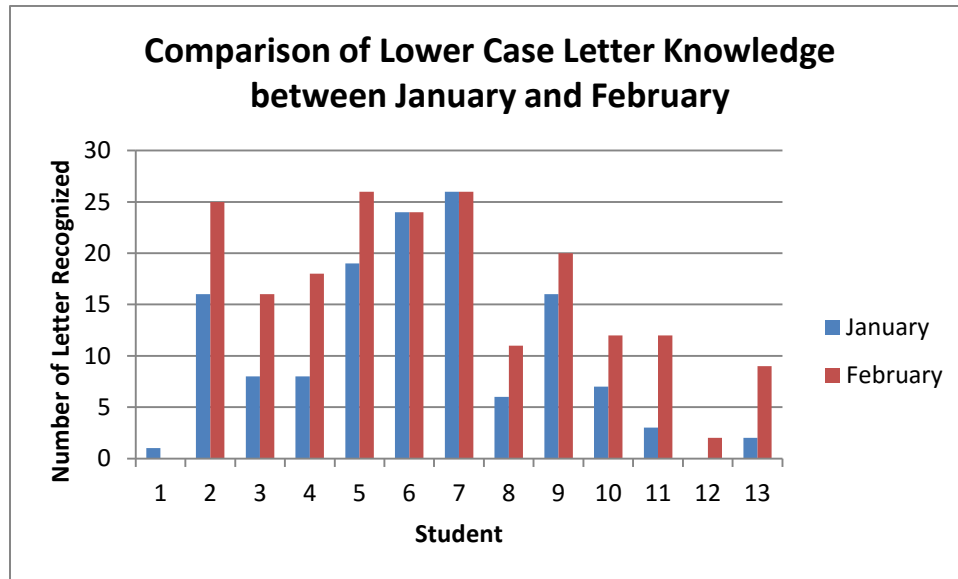


Figure 10. Comparison of Lower Case Letter Knowledge between January and February

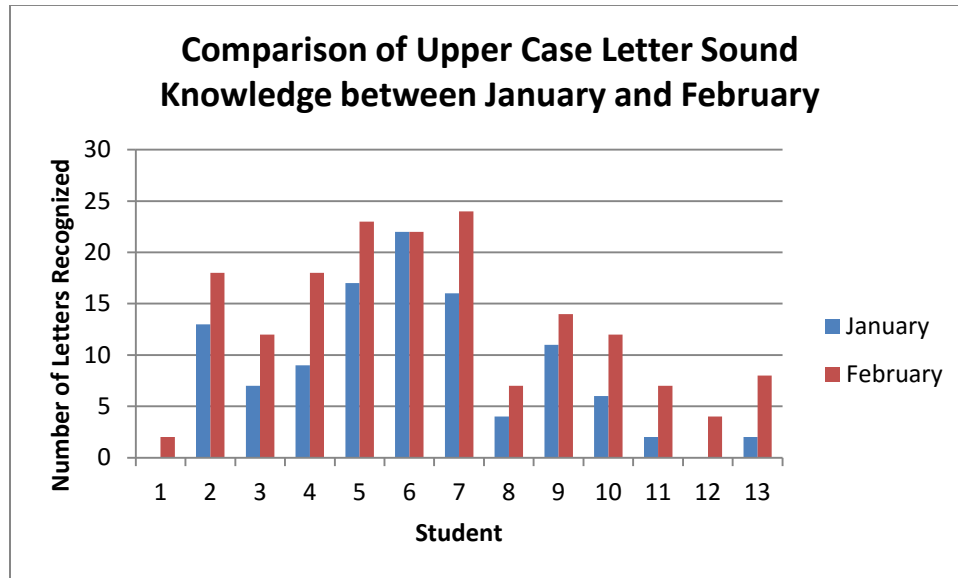


Figure 11. Comparison of Upper Case Letter Sound Knowledge between January and February

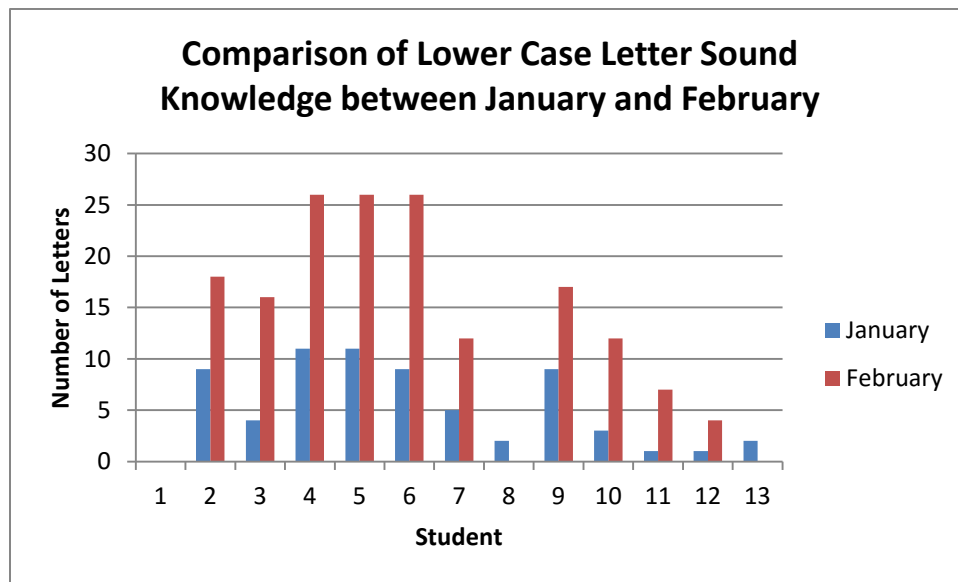


Figure 12. Comparison of Lower Case Letter Sound Knowledge between January and February

Between January and February students showed an overall increase in knowledge of letter names and sounds. Comparison of upper case letter knowledge between January and February showed a 22% increase. There was a 19% increase of knowledge of lower

case letters. Comparison of upper case letter sounds revealed student knowledge had increased 18% and lower case letter sound knowledge increased 29%.

In addition to the implementation of technology into the classroom there are several other factors that could have contributed to the increase in the students' phonological awareness. My work on this action research project placed an increased emphasis on letter knowledge which could have affected their interest in the language materials. Also, the daily practice of alphabetic activities may have increased student confidence with working with the language materials. Lastly, as we enter into the month of March students are revealing more knowledge due to the length of time they have been in school. Overall the implementation of technology in my preschool classroom had a positive impact on student learning.

Action Plan

The research project was a positive experience for both the students and me. The students showed continuing interest in the activities on the Smart Board and the iPad throughout the project. Each day they looked forward to practicing the letter names and sounds on ABCMouse.com as a group. The students would check the schedule to see if it was their assigned day to use the iPad to play phonics games. They seemed eager to participate in both activities. Comparison of the observations of student work completed before and after the intervention revealed students are completing more lessons in the language area each week. Assessments of upper and lower case letter knowledge and sounds revealed all but two students had increased their knowledge of letter names and sounds.

I believe there are several factors that contributed to the successful outcome of this project. It was easy to engage the students with the Smartboard and the iPad. Many of the students play interactive games on their tablets at home. Rather than viewing the phonics games I offered as lessons, the students perceived them with the same enthusiasm as they would a hobby. Their eagerness to work with the technology contributed to the project's success.

Prior to the intervention, I taught language lessons solely with the Montessori language materials. Following the sequence of lessons in my language album, I immediately dove into beginning sounds this past fall. The students seemed uninterested in the materials despite my efforts to make them fun. However, their attitudes changed once I began displaying the alphabet on the Smart Board each morning. Their willingness to participate in reciting the alphabet song by both letter name and sound resulted in their understanding of the connection between letter and sound. This seemed to spark an interest in working with the Montessori language materials, especially the sound baskets.

Implementation of this project placed more emphasis on literacy in the classroom. In the past I would work on language lessons in small groups or as individual lessons. Using data I obtained from assessments, I placed students in groups according to their abilities. Although I will continue this practice because it enables me to meet the individual needs of each student, offering whole group activities seemed to increase overall student confidence in literacy work.

Working on alphabetic knowledge during whole group instruction had a positive impact on my students. This revelation has challenged me to rethink our morning circle

time. Previously, I solely used our 10-15 minute whole group lesson time each morning to introduce new cultural studies or to practice the classroom ground rules. I have decided to divide our whole group lesson time into two small sessions: cultural studies at the beginning of our work time and language development at the end of work time.

I plan to incorporate technology into my classroom utilizing the methods used during this research at the beginning of next year. Using technology to practice phonics skills provided a resource to catch up students who had little to no previous language experience. However, the amount of time students spend using technology during the two hour work cycle should be closely monitored. In his book, *Basic Montessori: Learning Activities for Under-Fives*, David Gettman suggests Maria Montessori would have agreed that computers and other implements of high technology are tools of the modern times and that every child should be comfortable with their use and operation (1987, p.15). However, children do not have a complete understanding of what automated operations consist of. Rather than leap into advanced techniques, the Montessori method starts with the concrete and gradually builds up to the abstract (Gettman, 1987, p. 15). For this reason, Montessori would have agreed that computers should only be a natural occurrence in a child's general environment not as a means to educate four year-old children (Gettman, 1987, p.15).

This project was a great learning experience for me as a teacher. It revealed how the children I teach need a more basic understanding of the alphabet prior to introducing the Montessori lessons I began with in the past. Teaching children of poverty presents many challenges and I have to explore different ways to meet the special needs of my students. One of the basics principles of Montessori philosophy is to "follow the child."

Before the materials or the sequence of the materials, we must meet the child where he or she is in their development. I believe we have to use whatever resources are available to engage a child in learning. Technology, if carefully integrated, can be a useful resource in a primary Montessori classroom. It is the responsibility of the teacher to establish a rationale for its implementation.

The three to six year old learning environment should include purposeful experiences that permit the exercise and integration of the child's abilities (Gettman, 1987, p.12-13). The Montessori environment is a place that fully satisfies the requirements of the absorbent mind, the sensitive periods, and the three stage learning process outlined in Montessori pedagogy (Gettman, 1987, p.12-13). Teachers should be careful to only use technology as a supplement, not as a replacement for the Montessori materials.

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Appendix A

Montessori Literacy Work Completed during 2 Hour Work Cycle

(Before the use of technology)

Week of _____

E= Level of Engagement (Enthusiastic Indifferent Disengaged Disruptive Excited)

Student	Monday	Tuesday	Wednesday	Thursday	Friday
1	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
2	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
3	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
4	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
5	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

6	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
7	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
8	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
9	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
10	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
11	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

12	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
13	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

Appendix B

Letter Knowledge

Name _____

Date _____

A C O Q E W J

N V D G F H L

R P K U S T Z

I B Y M X

a c o q e w j

n v d g f h l

r p k u s t

z x

Appendix C

Letter Sound Recognition

Name _____

Date _____

A C O Q E W J

N V D G F H L

R P K U S T Z

I B Y M X

a c o q e w j

n v d g f h l

r p k u s t z

i b y m x

Appendix D

Observation of Student Engagement with Montessori Language Materials before the use of technology

Use the following word that best describes student's attitude while working with the materials after they have been presented:

Excited Indifferent Disengaged Disruptive

Student	3 Period Lesson with Sandpaper Letters	I Spy w/ Sound Baskets	Matching Object to Letter Sound	Matching Picture to Letter Sound	Moveable Alphabet
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

*To be completed prior to the implementation of technology

Appendix E

Smart Board Group Activities Log

Date_____ Time_____

Number of students present:

Description of Activity:

Describe level of student engagement: (What percentages of the students were engaged with the activity? Did students seem distracted?)

Date_____ Time_____

Number of students present:

Description of Activity:

Describe level of student engagement: (What percentages of the students were engaged with the activity? Did students seem distracted?)

Appendix F

iPad Groups

Monday – Students 2, 3, 4, 5, 6, 7, 9

Tuesday – Students 1, 8, 10, 11, 12, 13

Wednesday - Students 2, 3, 4, 5, 6, 7, 9

Thursday - Students 1, 8, 10, 11, 12, 13

Appendix H

Montessori Literacy Work Completed During 2 Hour Work Cycle

(After the use of technology)

Week of _____

E= Level of Engagement (Enthusiastic Indifferent Disengaged Disruptive Excited)

Student	Monday	Tuesday	Wednesday	Thursday	Friday
1	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
2	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
3	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
4	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
5	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

6	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
7	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
8	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
9	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
10	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
11	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

12	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=
13	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=	Lessons Completed E=

Appendix I

Observation of Student Engagement with Montessori Language Materials (after the use of technology)

Use the following word that best describes student's attitude while working with the materials after they have been presented:

Excited Indifferent Disengaged Disruptive

Student	3 Period Lesson with Sandpaper Letters	I Spy w/ Sound Baskets	Matching Object to Letter Sound	Matching Picture to Letter Sound	Moveable Alphabet
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

*To be completed at the end of the action research period

Appendix J

Student Feedback for iPad and SMARTBOARD activities

Do you like the games you played on the iPad? Yes or No (If yes, what did you like? If no, why?)

Do you like the games we play on the SMARTBOARD? Yes or No (If yes, what did you like? If no, why?)

Student	iPad	SMARTBOARD
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Appendix K

Letter Knowledge (Post Assessment)

Name _____

Date _____

A C O Q E W J

N V D G F H L

R P K U S T Z

I B Y M

a c o q e w j

n v d g f h l

r p k u s t

z

Appendix L

Letter Sound Recognition (Post Assessment)

Name _____

Date _____

A C O Q E W J

N V D G F H L

R P K U S T Z

I B Y M

a c o q e w j

n v d g f h l

r p k u s t z

i b y m