Winter 12-21-2018

The Effect of iPad Instruction on Capital Letter Recognition of Preschoolers

Jessica Adkins
adkinsje@mnstate.edu

The Effect of iPad Instruction on Capital Letter Recognition of Preschoolers

A Project Presented to

The Graduate Faculty of

Minnesota State University Moorhead

By

Jessica Adkins

In Partial Fulfilment of the

Requirements for the Degree of

Master of Science in

Early Childhood Special Education

December 2018

Moorhead, Minnesota

Abstract

The purpose of this study is to look at the effect of iPad instruction on capital letter recognition in preschool children between the ages of four and five. The study divided participants into two groups. One group received capital letter instruction with an iPad. The second group received capital letter instruction using letter manipulatives. Letter manipulatives were wooden puzzle letters. Baseline data was taken on capital letter recognition of all participants before this study began. At the end of the study, data was taken on capital letter recognition of all participants. Baseline and final data was compared to show growth. The data between students who received capital letter instruction on the iPad was compared with the data of students who received capital letter instruction with letter manipulatives to see which group showed the most growth.

Table of Contents

Chapter One

Technology plays a large part in society's everyday lives. Early childhood teachers are experiencing students entering their classrooms with more exposure to technology than ever before, (Radesky & Christakis, 2016). "Nearly all (98 percent) children age 8 and under live in a home with some type of mobile device" (Common Sense Census, 2017, p. 13). The American Pediatrics Association recommends that "children ages 2 to 5 years, limit screen use to 1 hour per day of high-quality programs" (American Pediatrics Association Online, 2016), yet children age eight and under spend an average of three hours and six minutes per day in front of a screen (smartphone/tablet, television, or computer/laptop). This is up from an average of two hours and forty three minutes per day in 2013 (Common Sense Census, 2017).

General Problem/Issue

Though there are potential educational benefits to using technology, there are also potential risks. Risks from long term exposure to too much technology can lead to obesity, sleep issues, and delayed development of the cognitive, social/emotional, and language development of young children, (Radesky & Christakis, 2016). Despite these risks, many teachers are integrating technology into their classrooms. A study by Kara, and Cagiltay (2017) looked at the use of technology in a preschool classroom and found that "12 out of 18 teachers said that technology allows visual learning of children" and 11 of 18 teachers thought technology helps permanent learning.

Studies by Phillips and Feng (2012), D'Alesio, Scalia, and Zabel (2007), Gray and Schlesinger (2017), and Folakemi and Adebayo (2012) provide evidence that students learn best when taught with multisensory instruction. These studies are discussed further in the literature review section of this paper. According to Howard Gardner's theory of multiple intelligences,

there are eight different intelligences a person could be strongest in. He lists the eight different intelligences as "Linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, interpersonal, and intrapersonal, naturalistic" (Martin & Fabes, 2006, p. 375). When teachers use multisensory instruction, they are able to engage a wider range of students based on these learning styles.

Even though there is overwhelming support for the use of multisensory instruction in classrooms, a 2016 study shows support of direct use of technology with students. D'Agostino, Rodgers, Harmey, and Brownfield (2016) studied the effect of an iPad app vs magnetic letters in the letter knowledge recognition of children ages six and seven. After analyzing the data, D'Agostino et al. (2016) concluded that students who were instructed with the iPad app achieved significantly higher on letter recognition skills than students who were instructed with the magnetic letters.

The study by D'Agostino et al. (2016) was inspiration for my research project. This topic was chosen because it goes against current research in the field of early childhood education that supports the use of multisensory instruction. I would like to test the hypothesis that students have higher capital letter knowledge recognition skills when instructed with an iPad than with the multisensory approach of wooden puzzle letters. The effect of an iPad vs the use of wooden puzzle letters in capital letter recognition in children four and five year olds will be studied and analyzed.

Early childhood teachers are always looking for different/more efficient ways to instruct students. If the results of my study support the same findings as D'Agostino et al. (2016), I will share those results with my colleges. Pulling out an iPad vs pulling out a set of wooden letters could make classroom instruction run more efficiently.

Subjects and Setting

This study took place at an Early Learning School in Southeastern Minnesota in room 205. This early learning school serves preschool children ages 3-5; both general education students and students on individualized education plans (IEPs).

Description of Subjects. Out of 21 potential participants, 17 parents/guardians returned the consent to participate in this study. There were 11 girls and 6 boys. The demographics of the participants are further broken down in tables 1.0 and 1.1

Table 1.0

Gender of Participants

Student Ethnicity	Girls	Boys
Asian	0	1
African American	1	1
Somalian	1	0
Caucasian	9	4
Total	11	6

Table 1.1

Demographics of Participants

Student Ethnicity	Students on Individual Education Plans	Students who receive free and reduced lunch	Students from a single parent home
Asian	0	1	0
African American	1	1	1
Somalian	0	0	0
Caucasian	10	1	0
Total	11	3	1

Selection criteria. This study took place in room 205. This site was best to complete the study because I teach as an early childhood special education teacher in that room. Room 205 is

an inclusive, co-taught classroom. This means we can have up to 16 students in our classroom. Eight students are on IEPs and eight students are typically developing, general education students. There are four staff members in my classroom who teach the PM session. We have one licensed general education preschool teacher, one licensed early childhood special education (ECSE) teacher, and two early childhood special education paras. A para is defined as "An individual who provides instructional or related support to students under the direction and supervision of a certified teacher" (Inclusive Schools Network, 2018).

The general education teacher (my co-teacher) teaches both the AM and PM session. There is another early childhood special education teacher who co-teaches in the AM session in room 205. The AM staff agreed to participate in my study to help provide a larger sample.

I took pre and post data for the PM session, and my co-teacher took pre and post data for the AM session. I modeled how to take pre-intervention data in the PM, so that my co-teacher would be able to take baseline data in the AM session in the same way. Post-intervention data was collected at the end of the study in the same way as the pre-intervention data. I also modeled how to run the intervention so that my co-teacher was able to interventions in the same way for the AM session.

Description of setting. This study takes place in an early childhood learning school in large city in the Midwest. This school has students from three different funding sources. Early childhood special education students make up the largest percentage of the students attending this early learning school. Parents of students on individual education plans attending this early learning school do not pay parent tuition. 58% of the students have individual education plans and the primary source of funding for these students is the government, (funding comes from

government at the local, state, and federal level). 18% of the students' families pay full parent tuition and 24% of families attending receive scholarships and reduced tuition.

General education students attending must register through the community education program and pay tuition. Tuition is paid based on the type of program a student is registered for. A Monday through Friday half day session (AM session 9:00AM -11:30AM and PM session 1:15PM-3:45PM) preschool class costs $330 per month. A Monday through Thursday all day session runs 9:00AM-3:30PM and costs $625 per month. There is a sliding fee scale so that "No resident will be denied participation due to inability to pay" (Community Education PAIIR Online Fall Catalog, 2018, p. 16). If families are not able to pay the full amount for tuition, they are asked to indicate how much they are able to pay when registering. Figure 1 shows a breakdown of what a family will need to pay to have their child attend preschool in this building.

16

Financial Assistance Sliding Fees

How does the PAIIR Sliding Fee Scale Work?

Find your income range on the chart. →

Find the # of sessions your class will meet.

Find the sliding fee for the class and sibling care. This is your ***recommended*** fee.

For example: If your income is $20,000 to $30,000 and the class meets 6 times, the recommended class fee is $13.50, sibling care is $9.50.

PAIIR/ECFE SLIDING FEE SCALE 2018-2019

income >	$75,000 +		$50,000 - $74,999		$30,000 - $49,999		$20,000 - $29,999		$0 - $19,999	
# of class sessions	class:	sibling care	class:	sibling care	class:	sibling care	class:	sibling care	class:	sibling care
1	$11.00	*$6.50*	$8.50	*$5.00*	$6.00	*$3.50*	$2.50	*$2.00*	$1.50	*$0*
2	$21.50	*$12.50*	$17.50	*$9.50*	$11.50	*$6.50*	$4.50	*$3.00*	$2.50	*$0*
3	$32.00	*$18.50*	$25.50	*$14.00*	$16.50	*$9.50*	$6.50	*$5.00*	$3.50	*$0*
4	$42.50	*$24.00*	$34.50	*$18.50*	$21.50	*$12.50*	$8.50	*$6.50*	$4.50	*$0*
5	$53.00	*$30.50*	$42.50	*$23.00*	$26.50	*$15.50*	$11.50	*$8.00*	$5.50	*$0*
6	$63.50	*$36.50*	$50.50	*$27.50*	$32.50	*$18.50*	$13.50	*$9.50*	$6.50	*$0*
7	$74.00	*$42.50*	$59.50	*$32.00*	$37.50	*$21.50*	$15.50	*$11.00*	$7.50	*$0*
8	$84.50	*$48.50*	$67.50	*$36.50*	$42.50	*$24.50*	$17.50	*$12.00*	$8.50	*$0*
9	$95.00	*$54.50*	$76.50	*$41.00*	$53.50	*$27.50*	$19.50	*$14.00*	$9.50	*$0*
10	$105.50	*$60.50*	$84.50	*$45.50*	$57.50	*$30.50*	$21.50	*$15.50*	$11.50	*$0*
11	$116.00	*$66.50*	$92.50	*$50.00*	$58.50	*$33.50*	$23.50	*$17.00*	$12.50	*$0*
12	$126.50	*$72.50*	$101.50	*$54.50*	$63.50	*$36.50*	$25.50	*$18.50*	$13.50	*$0*
13	$137.00	*$78.50*	$109.50	*$59.00*	$68.50	*$39.50*	$27.50	*$20.00*	$14.50	*$0*
14	$147.50	*$84.50*	$118.50	*$63.50*	$74.50	*$42.50*	$29.50	*$21.00*	$15.50	*$0*
15	$158.00	*$90.50*	$126.50	*$68.00*	$79.50	*$45.50*	$32.50	*$23.00*	$16.50	*$0*

Need additional assistance? Fees can be waived or reduced at any level if family circumstances would make payment a hardship. Register by phone at 507-328-4020, in person at the PAIIR office or indicate what you can afford to pay on your registration.

No Rochester resident will be denied participation due to inability to pay.

Contact PAIIR at 507-328-4020 or paiir@rochester.k12.mn.us for more information.

Figure 1. Financial Assistance Sliding Fees. PAIIR (Parents Are Important in Rochester) Online Fall Catalog. (2018, p.16).

There are 17 classrooms in this early learning school. All of the students are ages 3-5. There are general education preschool students, as well as early childhood special education students. There are two all day classrooms, three autism classrooms**,** three small group special education rooms, one severe/profound special education classroom, one therapeutic classroom, and seven co-taught classrooms.

The two all-day programs run from 9:00AM-3:30PM. These programs have a max of 16 general education students. The staff consists of one licensed general education teacher and one general education para.

The three autism classrooms have a maximum of eight students per classroom. The students in the autism classrooms have a diagnosis of autism spectrum disorder. There are AM and PM sessions in the autism rooms. AM session runs 9:00-11:30 and PM session runs 1:15-3:45. The staff consists of one early childhood special education teacher, and two early childhood special education paras.

The three small group special education classrooms have a maximum of eight students per classroom. These students have higher needs so they are placed in a small group setting vs. a more inclusive type of classroom. There are AM and PM sessions in the small group classrooms. AM session runs 9:00-11:30 and PM session runs 1:15-3:45. The staff in these classrooms consists of one early childhood special education teacher, and two early childhood special education paras.

The severe/profound classroom has students who have a severe or profound disability. There is a maximum of eight students in this classroom. There is an AM and PM session in the

severe/profound classroom. AM session runs 9:00-11:30 and PM session runs 1:15-3:45. The staff in these classrooms consists of one early childhood special education teacher, and two early childhood special education paras.

The one therapeutic classroom has students with an emotional/behavioral disorder with mental health components. There is a maximum of six students in this classroom. There is an AM session in this classroom that runs from 9:00-11:30. The staff in this classroom consists of one early childhood special education teacher, one mental health practitioner, and two early childhood special education paras.

The seven co-taught classrooms have a maximum of 16 students. Eight students are general education students, and eight students are on individual education plans. There are AM and PM sessions in the co-taught classrooms. AM session runs 9:00-11:30 and PM session runs 1:15-3:45. The staff consists of one general education preschool teacher, one early childhood special education teacher, and two early childhood special educations paras.

Informed consent. Permission to conduct this study was obtained from the Institutional Review Board at Minnesota State University. Permission was also obtained by the principal of the building.

Protection of human subjects participating in research was assured. Participants were informed of the purpose of the research and any procedures required by the participant, including disclosure of risks or benefits. Confidentiality was protected through the use of coding the students' data. Each student was given a number to identify them to protect their identity. The choice to participate or withdraw at any time was outlined in writing. Because of the young age of the students, parents/guardians were asked to given their written consent for the student to participate in this study.

Review of Literature

This study seeks to understand the effects of iPad instruction on the knowledge of capital letters in 4 and 5 year olds at Hoover Early Learning School in Rochester, Minnesota. While there are multiple studies that show students learn best through multisensory instruction; a current study by D'Agostino et al. (2016) concludes students who are taught letter knowledge skills through iPad instruction achieve higher scores on letter recognition assessments than students who were instructed using a multisensory method.

This literature review discusses studies that show students achieve higher on formal assessments when taught with multisensory instruction, teachers' attitudes and other potential barriers to using technology in the classroom, and lastly; how technology is being used in early childhood classrooms today. Articles were collected through journals and textbooks pertaining to early childhood education, early childhood development, and technology in classrooms.

Multisensory Instruction Learning Methods in the Classroom. Recent studies show students learn best when instructed with tactile, multisensory instruction. Using multisensory instructional teaching methods in the classroom, also supports Howard Gardner's theory of multiple intelligences. Gardener's theory of multiple intelligences is that different people learn best/have strengths in different areas. His eight intelligences are "Linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, interpersonal, and intrapersonal, naturalistic" (Martin & Fabes, 2006, p. 375).

A quasi-experimental action research with a pretest-posttest same subject design study conducted by Phillips and Feng (2012) compared the rates of recognized site words in kindergarteners using traditional flashcards vs. multisensory methods. There were 15 kindergarteners of differing ethnicities and reading abilities who participated in this study.

At the beginning of the study, Phillips and Feng (2012) took baseline data of the participants' knowledge of site words using the Dolch site word list. The same list was used in a posttest to compare the participants' site word knowledge after being exposed to either the flashcard or multisensory approach.

Students who received the flashcard instruction were presented with a 12x12 index card that had the site word printed in Times New Roman size 72 font. The researcher flipped through the set of five words three times in one sitting. First, the researcher read the word to the participant, second the researcher used the word in a sentence and third, the participant was asked to identify the word. Words not correctly identified by the participant were repeated by the researcher and placed at the back at the pile to try again. This was repeated until the participant correctly named all five site words. Instruction took place at the same time, following the same procedures for two weeks. At the end of the two weeks, participants were assessed on the five site words. The correct number of words were recorded.

Participants who received the multisensory approach were exposed to five site words using the same flashcard procedure as the flashcard only group. In addition to the flashcards, these participants were exposed to multisensory instruction such as writing the word in the air and chopping the word out on their arm. These participants were also asked to write the word three times on a textured screen, and write the word in a sentence. The process was completed with all five site words.

At the end of the two weeks, participants were assessed on the five site words using the same procedure for the students who had received the flashcard instruction. After analyzing the data, Phillips and Feng (2012) concluded that the participants who were exposed to the

multisensory approach preformed significantly higher on the word site assessment at the end of the four weeks.

Another study supporting the theory that students learn best though multisensory instruction was conducted by D'Alesio, Scalia, and Zabel (2007). In their study, they looked at three different types of instruction and the effect of vocabulary acquisition of second and seventh graders. The participants in this study consisted of three different schools near a major metropolitan area. Two middle schools from the same suburban community were selected, along with one elementary school from a different suburban community.

The participants of this study were 73 students spread between two middle schools and one elementary school. D'Alesio et al. (2007) used four different instruments to take data in this study. One of the instruments used to gather data was a strategy survey. A pre and post survey was administered to the participants of the study asking them what strategies they used to figure out words they did not know. The other types of instruments used to collect data in this study were vocabulary assessment tools, reflection journals and teacher field notes.

The vocabulary assessment was given to participants as a pre and posttest. The reflection journals were filled out by the 73 participants and included a rating scale of the different interventions. Participants were asked to rate if the interventions didn't help at all, helped some, or helped a lot. Teacher field notes were kept to gather observations about the interventions being used on the participants.

The participants were exposed to three different interventions; "The three interventions included: 1) a word graphic organizer carefully designed for direct instruction of vocabulary along with icon-enhanced pretests and posttests; 2) selected classical baroque music played

during vocabulary lessons/activities; 3) three distinct Brain Gym® movements practiced before vocabulary lessons/activities" (D'Alesio et al., 2007, p. 26).

Over a span of 11 weeks the participants were exposed to the three different types of interventions. At the end of the 11 week mark, the post surveys, and tests were administered and the reflective journals and teacher field notes were collected to be analyzed. After analysis of the data, D'Alesio et al. (2007) concluded that students achieve at higher rates when taught with multisensory instruction. One of the most significant findings of this study was,

> Before the intervention was implemented, 43% of students responded that they had "never heard or seen" the selected words. After the intervention, only 7% chose this response. The category that shows the most significant change, however, is the student responses to "I know this word." On the pretest, 27% of students chose this response; while on the posttest, 68% of students chose this response—an increase of 154%, considerable growth in vocabulary recognition. In addition, another 15% felt they could "guess the meaning (D'Alesio et al., 2007, p. 33).

Another significant finding of this study was that students who received the multisensory intervention could define over five times as many words after the intervention. The number of words defined jumped from 378 to 1,941 words (D'Alesio et al., 2007, p. 34).

Gray and Schlesinger (2017) conducted a multiple baseline multiple probe single-case design with alternating treatments structured language and multisensory intervention. This study looked at the instructional methods and how they impacted the pre-reading skills such as letter knowledge and sound production, in 11 second graders. Five of these students had dyslexia and six were typically developing (p. 224). After analysis of the data, Gray and Schlesinger (2017)

concluded, “Results extend the literature by demonstrating structured language, and multisensory interventions were efficacious for teaching foundational literacy skills” (p.249).

Multisensory instruction is also shown to help improve the vocabulary skills of underachieving students. Folakemi and Adebayo (2012) conducted a study that looked at the multisensory approach verses the metacognitive approach. This study looked at the effects of both types of instruction on the vocabulary achievement of 120 underachieving secondary school students. After collecting and analyzing data from their study, Folakemi and Adebayo (2012) found that the group exposed to the multisensory approach outperformed the students who did not receive the multisensory instruction.

No More Letter of the Week is a framework for integrating multisensory pre-reading strategies into early childhood classrooms. Ideas mentioned in this framework range from visual picture cues to help students learn letter sounds, to creating site words for students to put on the word wall. Another idea mentioned by Lusche (2003) is sentence bags, “Utilizing Sentence Bags as a center activity allows students to actively study and manipulate familiar sentences with the use of cut-up sentence strips…” (Lusche, 2003, p. 45).

Some other ways teachers can incorporate multisensory instruction in early childhood classrooms is too provide children with “…lots of opportunities to explore print in a variety of forms, such as in books, magazines, written rhymes, invitations, signs, posters, catalogues, cards, etc.” (Topfer, 2007, p. 10). These hands-on, multisensory ideas will give students multiple opportunities to practice letter recognition skills.

Teacher’s Attitudes and Other Potential Barriers towards Technology and how it effects the use of Technology in Classrooms.

D'Agostino et al. (2016) looked at teachers' attitudes towards using technology and potential barriers to using technology in the classroom. At the end of the study, teachers were asked if they preferred the iPad or magnetic letters to teacher letter knowledge skills, and why. All seven of the teachers in the control group (used magnetic letters) chose magnetic letters. The main reason for choosing the magnetic letters was because the method involved learning through a multisensory method. The Reading Recovery training the teachers received discussed the importance of teaching students with multisensory methods to help improve achievement. Studies by Phillips and Feng (2012) and D'Alesio et al. (2007) also support the theory that students learn best through multisensory instruction. Other reasons listed (2 out of 7) for choosing the magnetic letters over the iPad were because of unfamiliarity with the iPad.

When looking at the results of the treatment teachers (used the iPad) only two of the seven teachers preferred the iPad over the magnetic letters, even though students achieved higher scores with the iPad. Three of the teachers preferred magnetic letters and the remaining two were undecided but leaned towards the magnetic letters.

A mixed methods study by Hsu (2016) asked teachers about barriers pertaining to the use of technology in the classroom. Hsu (2016) conducted his research by analyzing the online surveys of 152 teachers. He also observed and interviewed eight different teachers. These teachers ranged from kindergarten to sixth grade. After analyzing the data from his research he listed the top four barriers to using technology in the classroom, "students' lack of computer skills, teachers' lack of training in technology, teachers' lack of time to implement technology-integrated lessons, and teachers' lack of technical support" (Hsu, 2016, p. 35).

Additional research discussing barriers in the classroom by Hammonds, Matherson, Wilson and Wright (2013) says that other than access to technology, the top two barriers to using

technology in the classroom are teachers' familiarity with technology, and teachers' values about technology. Like a person in everyday life, the less familiar we are with something, the less likely we are to use it. This is the same for teachers and the use of technology in the classroom. If a teacher is unfamiliar with technology, he/she is less likely to use it in the classroom with students.

The second major barrier to a teacher's use of technology in the classroom are the teacher's values about technology. Many of today's current teachers grew up in an era where technology was not valued, therefore, not commonly used in the classroom. If a teacher did not see technology used in his/her classroom, he/she will be less likely to use it in his/her classroom. In the past technology has not been valued as being a benefit to being used in the classroom, Hammonds et al. (2013).

Hammonds et al. (2013) concludes with five technology tools (websites) that teachers can use to begin to integrate technology into the classroom. One of the five websites is a classroom management tool and the other four are storage/collaboration tools. Class Dojo is a classroom management website that students help participate in to make rules, and earn classroom rewards. Dropbox, and Social Bookmarking are used primarily for resource management and collaboration. Evernote is a website that can be used for data collection. The final website Hammonds et al. (2013) lists for integrating technology into the classroom is Edmodo, a website for content management and communication.

Chin and Ching (2012) also contribute research on the barriers of using technology in the classroom. They discuss first-order, second-order, and third-order barriers. A first-order barrier is an external barrier to technology. First-order barriers include access to hardware, software, and internet; as well as time for training. A second-order barrier is an internal barrier. Second-

order barriers include "teachers' pedagogical beliefs, technology beliefs, and teachers' willingness to change; these are teachers' personal beliefs that may hinder the implementation of technology integration in classrooms" (Chin & Ching, 2012, p.1057). Chin and Ching (2012) also mention a third-order barrier; technology integration. Once first and second-order barriers are reduced and removed, it should be easy to break through the third-order barrier and integrate technology into the classroom.

Technology Use in Today's Early Childhood Classrooms. With the influx of technology being used in homes, early childhood teachers must decide how, when, and if they should use technology in the classroom. The American Pediatrics Association recommends that "children ages 2 to 5 years, limit screen use to 1 hour per day of high-quality programs" (American Pediatrics Association Online, 2016). With that knowledge, some teachers are choosing to keep iPads out of the hands of their students, but they are continuing to use technology for other purposes in the classroom.

An exploratory study by Vaughan and Beers (2017) looked at how 18 female preschool teachers in a private, faith-based child development center used iPads in the classroom. The teachers participating in this study each received their own iPad, along with a two hour long basic training provided by an Apple consult hired by the school.

The teachers were given the iPads and told they had to use them in their classrooms. The teachers received no direction on how to use the iPads just that they had too. Vaughan and Beers (2017) took data in three different ways: (1) interviews with the teaching staff and the center's director, (2) focus groups, and (3) an artifact collection of the notes from the teachers' biweekly meetings. The data was codded and analyzed by the researchers. The researchers coded their data by reoccurring themes and concluded that the preschool teachers in their study used the

iPads 11 different ways. The 11 ways these teachers used technology in the classroom, with the number of teachers who used those methods is illustrated in table 1.3.

Table 1.3

Ways Technology is used in the Classroom

Technology Used	Number of Staff Using Technology
Parent communication	12
Information resource and visual aid	10
Photographs/camera	8
Lesson planning and team sharing	7
Music and exercise	5
Youtube videos	5
Facilitation of children's social skills	4
Skill building apps/games	4
Documentation and note taking	3
Daily transitional tool	2
E-books	1

(Vaughan & Beers, 2017, p. 327).

Beschorner and Hutchison (2013) conducted a qualitative case study of teachers' use of technology in the classroom. This study looked specifically at the iPad as an instructional tool in two early childhood classrooms at Independence Preschool in a small suburban community in the Midwest.

Beschorner and Hutchison (2013) collected data through weekly observations that happened twice a week, digital samples of the student's work, parent e-mails, an informal survey filled out by the parents and semi-structured interviews with the teachers. The data found that teachers used the iPads for one-to-one, small, and large group instruction. Students were observed listening to interactive stories, and writing names of themselves and peers with a magnetic letter app. Students were also observed sounding out words and then using the

keyboard to type them out. Both teachers in this study used the iPad to communicate with families.

One of the teachers choose to use a story writing app with her class and reported a positive increase in peer interactions, "Children were also able to solve problems together. Mrs. Miller noted that, "I'd see a kid teaching other kids." For example, when Kiley was writing her digital book using Storykit she wanted to make her cover a solid color. Kiley noticed that Ashley had made her cover solid pink, so Kiley asked Ashley how to change the cover" (Beschorner & Hutchison, 2013, p. 23).

According to Neumann and Neumann (2017) tablets have a positive influence when used for instruction in early childhood classrooms. Tablets have been seen to increase letter knowledge, increase positive social interactions between peers, and increase prewriting skills. Another potential benefit of using technology in the classroom, is that teachers can personalize learning for students. Harold (2016) discusses "personalized learning" and how technology can play a big role in personalizing learning. Using technology, students can set up individual learning profiles. A student's learning profile should contain documentation of his/her strengths, weaknesses, preferences, and goals. Learning profiles set up individualized goals and teach students at their own pace and learning style. "And educational software and applications have grown more "adaptive," relying on technology and algorithms to determine not only what a student knows, but what his or her learning process is, and even his or her emotional state" (Harold, 2016).

If teachers are looking for additional ways to use technology in the classroom, Bruyckrer, Kirschner, and Hulshof (2016) suggest to use a smartboard to show short videos and other visuals to students, and to use Power Point presentations for certain topics. "Evaluations of apps

from Sesame Workshop and the Public Broadcasting Service (PBS) also have shown efficacy in teaching literacy skills to preschoolers" (Radesky & Christakis, 2016, p. 2). The U.S. Department of Education also has suggestions for implementing technology into classrooms. "Schools can use digital resources in a variety of ways to support teaching and learning. Electronic grade books, digital portfolios, learning games, and real-time feedback on teacher and student performance, are a few ways that technology can be utilized to power learning" (U.S. Department of Education, 2018).

A 2016 study by D'Agostino et al. (2016) shows that students who are taught using an iPad app to learn capital letter knowledge achieve significantly higher on capital letter knowledge assessments than students who were taught using magnetic letters. This goes against the studies by Phillips and Feng (2012) and D'Alesio et al. (2007) that show that students achieve higher assessment scores when instructed with multisensory instruction.

D'Agostino et al. (2016) conducted an experimental study with a double random assignment and mixed methods approach. The participants of this study involved 50 first-grade students between the ages of 6 and 7. The teacher participants included 14 teachers recently trained in Reading Recovery. Seven of the lowest preforming elementary schools in an urban area of a Midwestern state participated in this study. All schools used an identical procedure to identify students for the Reading Recovery program. After the students were identified, they were randomly assigned to either a treatment or control teacher.

Data instruments used in this study were "pre and post achievement data using the Pre- and post-treatment achievement data (from an approximately 20-week period) were collected for each student, including a DIBELS letter name fluency test (Good et al., 2002), a Slosson Oral Reading Test Revised (SORT-R) (Nicholson, 1990) and all tasks of the OSELA (Clay, 2013)"

(D'Agostino et al., 2016, p. 534). Other instruments used to collect data in this study were interviews, iPad application use, and documents.

After reviewing and analyzing data, D'Agostino et al. (2016) concluded that students who received Reading Recovery instruction on the iPad (including capital letter recognition) scored significantly higher scores at the end of the study than the students who received Reading Recovery instruction with the magnetic letters (including capital letter recognition).

The study conducted by D'Agostino et al. (2016) goes against the majority of research that shows students learn best through multisensory instruction. This study was used as inspiration to come up my hypothesis about the early childhood students who attend Hoover Early Learning School.

Hypothesis Statement

The capital letter knowledge of four and five year olds attending Hoover Early Learning School who are taught capital letter instruction using the iPad will achieve higher capital letter recognition scores than those who receive capital letter instruction using wooden puzzle letters.

Chapter Two

Chapter two discusses my research question, as well as the methods and rational for my research project. Table 2 shows a breakdown of the schedule for my research, and possible ethical issues and the anticipated response are included in this chapter as well.

Research Question

As a teacher in the early childhood setting, I see the importance of student's being taught with multisensory instruction. Students are more engaged when hands on, multisensory instruction is used. Using multisensory instruction also helps cater to each students' learning style.

I also have knowledge of the guidelines on screen time for young children by the American Academy of Pediatrics. Screen time should be limited, and meaningful. Many of my students have access to multiple kinds of screens at home, ex. tablets, computers, smart phones, etc. This knowledge causes a sense of unease when I think about using the iPad to teach my students. With so much exposure to screens at home, I feel my early childhood classroom should be a screen free zone. After thinking about my observations, experiences and reviewing current literature, I came up with my research question.

1. Will students recognize more capital letters when taught letter instruction with an iPad vs being taught letter instruction with wooden puzzle letters?

Answering the above question will help me, as well as other early childhood teachers feel more confident in deciding whether or not to use iPads to instruct capital letter learning in early childhood classrooms.

Research Plan

My research project looked at the capital letter recognition of preschool students ages

four and five. Baseline data was taken at the beginning of the study to show how many capital letters the students could identify. An intervention was then implemented for six weeks. Students were either shown capital letters on the iPad, or wooden puzzle letters. After six weeks of intervention, data was collected again to show how many capital letters the students could identify. Data was then analyzed to show which method, iPad or wooden letters, helped students make the most progress in capital letter recognition.

Methods and rationale. This was a quantitative research project that looked at the effect of type of instruction (I-pad versus wooden puzzle letters) on the knowledge of capital letter recognition in four and five year olds at Hoover Early Learning School. Prior to the start of the school year students were randomly placed in classrooms by the placement coordinators of the building. Students in room 205 were chosen for this study because I teach as an early childhood special education teacher in this classroom in the PM. The AM and PM class in my room have the same general education preschool teacher (my co-teacher). My co-teacher agreed to run the interventions in her AM class to help provide me with a larger sample to collect data from.

The class who received the iPad capital letter instruction was chosen randomly. The other class received capital letter instruction through the multisensory use of wooden puzzle letters. Once a week, each student received individual instruction with the use of either the iPad or wooden letters.

The 26 letters were divided into three groups. One group of eight and two groups of nine. The groups did not need to be in a certain order as long as all three groups were looked at each week. Individual instruction took place on each set, three different days a week. First, the teacher (myself for PM and my co-teacher AM) told the student what the letter was, and then asked the student to repeat it. The process was completed with all the letters in the group. The

next day, the same process was completed with a different set of letters. This process took place three days a week.

Data for this study was collected by using a capital letter flipbook assessment. My co-teacher and I had a flipbook with all twenty six capital letters. There was one capital letter per page. When taking baseline data, I for the PM, and my co-teacher for the AM flipped through the book and circled capital letters correctly named on a corresponding checklist. Then we added up the number of correctly identified capital letters to get the students score. Baseline data was collected before the intervention was implemented, and post-intervention data was collected in the same way at the end of the six week study.

Reliability for the flipbook assessment method was tested using the test-retest method. The assessment was given to a set of students and scored. Two weeks later, the assessment was retested on the same group of students. This checklist was validated using content validity. The scores of the flipbook/checklist method were compared with the scores the students received on the capital letter recognition objective for Creative Curriculum.

Schedule

Table 2.0 shows the schedule that was followed to complete the research for this project. The intervention was ran for six weeks- September 17th-November 9th.

Table 2.0

Schedule for Capital Letter Research

Data collection	Dates
Baseline data collected	September 17th – September 21th
Interventions implemented (iPad or wooden puzzle letters)	September 24th- November 2nd th
Post intervention data collected	November 5rd- November7th

Analysis of data	November 7th –November 9th

Ethical issues

This study is taking place in a school where many students come from homes with a low socioeconomic status. Possible ethical issues that may arise from this study could be the unfairness of one group having access to an expensive piece of technology while the other group is using everyday manipulatives that are found in every classroom.

Anticipated response

If any ethical issues arise, they will be dealt with accordingly. All of the classrooms at Hoover Early Learning School have iPads, it is up to the teachers to decide if they want to use them with their students.

Chapter Three

This chapter discusses the methods of my research project and how each intervention was ran. Figure 3.0 and 3.1 show how data was collected, and 3.2 and 3.3 show a breakdown of pre and post intervention data for each class. Data analysis is also discussed in this chapter.

Description of Data

There was potential for a total of 21 students to participate in this study. Of those 21 students, 17 returned the consent to participate. Once baseline data was collected on the 17 participants, six could already correctly identify 26/26 capital letters. Those six students were left out of the intervention process because they already knew all 26 capital letters. This left a total of 12 students to participate in this study. There were seven participants from the AM class and five participants from the PM class.

IPad Instruction Intervention. The AM class was chosen to receive capital letter instruction on the iPad. The 26 letters were divided into three groups. Three days a week, each participant was pulled to receive one-on-one capital letter instruction from one group of letters on the iPad. My co-teacher showed the student the letter, named the letter, then had the student repeat the letter back to her. She used the checklist in figure 3.0 to help keep track of which student was shown which group of letters. There was a checklist for each week. At the end of six weeks, post-intervention data was taken on capital letter recognition to see how many capital letters the students gained.

Multisensory Wooden Puzzle Intervention. The PM class was chosen to receive the wooden puzzle intervention. The 26 letters were divided into three groups. Three days a week, each participant was pulled to receive one-on-one capital letter instruction from one group of letters with wooden puzzle letters. I showed the student the letter, named the letter, then had the

student repeat the letter back to me. The student then had an opportunity to trace, hold, or return the letter in the storage bag. I used the checklist in figure 3.1 to help keep track of which student was shown which group of letters. There was a checklist for each week. At the end of six weeks, post-intervention data was taken on capital letter recognition to see how many capital letters the students gained.

Students	Group 1	Group 2	Group 3
AM1			
AM2			
AM3			
AM4			
AM5			
AM6			
AM7			
AM8			

Figure 3.0 Checklist for iPad Intervention- AM Class

Students	Group 1	Group 2	Group 3
PM1			
PM2			
PM3			
PM4			
PM5			
PM6			
PM7			
PM8			
PM9			

Figure 3.1 Checklist for Wooden Letter Intervention- PM Class

After six weeks of intervention, post data was taken on all 17 of the participants. Table 3.2 and 3.3 show the students' pre and post intervention capital letter data and the number of letters gained after six weeks of intervention. Letters gained are either in green or red font. Some of the students did not go up in capital letter recognition because they already knew all 26 capital letters. The 0 in the letters gained column will be green to show the students who knew

all 26 letters. A 0 in red font means the student did not gain any capital letters after six weeks of intervention.

Interpretation of Data. After analyzing my data, I have come to the conclusion that the iPad is more effective in teaching preschoolers capital letter instruction versus using the

Table 3.2

Pre- and Post-Intervention Data for AM Class (iPad)

Student	Number of capital letters recognized Pre-intervention (iPad)	Number of letters recognized post-intervention (iPad	Letters gained
AM1	1	6	5
AM2	0	3	3
AM3	17	22	5
AM4	3	17	14
AM5	12	23	11
AM6	2	9	7
AM7	26	26	0
AM8	0	0	0

multisensory method of wooden puzzle letters. My study had the same results as D'Agostino et al. (2016). Both of our studies concluded that students who were instructed with the iPad app achieved higher on capital letter recognition skills than students who were instructed with the multisensory method of magnetic/wooden letters.

I am aware of how much exposure many preschool students have to technology and the dangers of too much exposure. I was hoping the results of my study would show the wooden puzzle letters helped students learn more capital letters so that I would have another valid reason

to keep iPads out of the hands of my students. The results of my study have changed the way I think about using iPads with my students. In the future, I plan to use the iPad more often with my students. I will follow the American Pediatrics Association recommendation of only using

Table 3.3

Pre- and Post-Intervention Data of PM Class (Wooden Puzzle Letters)

Student	Number of capital letters recognized Pre-intervention (Wooden Letters)	Number of letters recognized post-intervention (Wooden Letters)	Letters gained
PM1	26	26	0
PM2	0	0	0
PM3	26	26	0
PM4	2	9	7
PM5	9	20	11
PM6	9	7	-2
PM7	26	26	0
PM8	26	26	0
PM9	26	26	0

high quality apps (American Pediatrics Association Online, 2016), with my preschoolers when we work on the iPad.

One reason the iPad may have been more effective than the wooden letters is because the capital letters shown when using the iPad were pictures of the flashcards that the students were assessed with for the pre and post data. The wooden puzzle letters were a variety of colors, red,

blue, green and yellow. I wonder if the results would have been the same if the wooden puzzle letters were all the same color.

There were no problems presented while collecting data and running the interventions for my study. The data collection tool was adequate and provided accurate data. The participants were willing to work with the teacher and no behaviors arose during intervention sessions.

Methods

This study consisted of 17 participants from the AM and PM preschool sessions in a preschool room in an early learning school in south eastern Minnesota. The AM class received capital letter instruction on the iPad and the PM class received capital letter instruction with the multisensory method of using wooden puzzle letters.

Three times a week, each student received individual instruction with the use of either the iPad or wooden letters. The 26 letters were divided into three groups. One group of eight and two groups of nine. The groups did not need to be in a certain order as long as all three groups were looked at each week. Individual instruction took place on each set, three different days a week. First, the student was told what the letter was, and then asked to repeat it. The process was completed with all the letters in the group. The next day, the same process was completed with a different set of letters. This process took place three days a week.

Data for this study was collected by using a capitol letter flipbook assessment. Baseline data was collected by flipping through the capital letter flipbook and circling capital letters correctly named on a corresponding checklist. The number of correct capital letters was added up to get the students' pre-intervention score. Post-intervention data was collected at the end of the six week study using the same procedure. Pre and post-intervention data collected was compared.

Research Question

Will students recognize more capital letters when taught capital letter instruction with an iPad vs being taught letter capital letter instruction with wooden puzzle letters?

Yes, students who were taught capital letter instruction with the iPad were able to identify a higher number of capital letters than the students who were taught capital letter instruction with wooden puzzle letters. Out of the seven AM students who were taught capital letter instruction with the iPad, six of those seven students went up in their knowledge of capital letters after the six week intervention. One of those students did not gain any new capital letters, one student gained three capital letters, three students gained five to seven new capital letters, and two students gained 10 to 14 capital letters. Out of the four PM students who were taught capital letter instruction with the wooden puzzle letters, two of the four students gained capital letters at the end of the six week intervention. One student did not gain any capital letters, one student lost two capital letters, one student gained seven capital letters, and one student gained 11 capital letters.

Conclusion

The question of whether or not iPads help students learn to identify capital letters better than the multisensory method of using wooden puzzle letter can be confidently answer “yes”. After analyzing the data 75% of the students who received the iPad instruction gained capital letters at the end of the study while only 50% of the students who received wooden puzzle letter instruction went up in their capital letter recognition.

Chapter Four

After analyzing my data, I plan to use iPads more frequently with my students. I can use iPads to help work on academic and social/emotional skills. My ideas on how I plan to integrate iPad use in my classroom is disused further in this chapter.

Action Plan

Even though there are potential risks to long term exposure to technology, using technology in the classroom can be beneficial in helping students learn new information. According to Neumann and Neumann (2017) tablets have a positive influence when used for instruction in early childhood classrooms. Tablets have been seen to increase letter knowledge, increase positive social interactions between peers, and increase prewriting skills. The analysis of data from my study supports this statement. The number of students who received capital letter instruction on the iPad were able to correctly identify more capital letters at the end of the study than students who were taught capital letter instruction with wooden puzzle letters. Neumann and Neumann's study and the results of my research project have changed the way I think about using iPads in my classroom. In the future, I plan to integrate the direct use of iPads with my students more frequently.

IPads will be incorporated into classroom activities by being given as a choice during buddy play. Buddy play is when students are put into pairs and choose a board game/cooperative toy to play with for five minutes. Social skills such as turn taking, using language to express one's needs, and making fair choices are focused on during buddy play. Students will be given a choice of two apps to explore during buddy play. IPads will also be used during free choice time as a way for the teacher to work on academic skills such as letter and number recognition.

Students will be monitored by staff at all times while they are on the iPad, and only high quality apps, such as Martha Speaks and Super Why will be will be offered as choices for my students. A 2010 study by the Public Broadcasting System (PBS) concluded that their Martha Speaks and the Super Why app helped children ages 3-7 gain vocabulary and literacy skills.

Chapter Five

In this chapter a plan for sharing is discussed. I plan to share information collected from my research project with my colleagues and building and program administration. I will share information with my colleagues during professional learning community meetings and share information with administration during one-on-one meetings.

Plan for Sharing

Findings from this study will be shared with my colleagues during professional learning community (PLC) meetings. "Professional learning communities are designed not only to determine what students will learn, but also to develop a space for teachers to determine how to respond when students do not learn (Hoaglund et al., 2014)" (Brown, Horn, & Kin, 2018, p. 54). PLC meetings are held twice a month in my building. My PLC group consists of three early childhood special education teachers, and one general education preschool teacher.

During our PLC meetings we look at students' data and compare how many students are below target, on target, or above target. We then create common assessments and share lesson plans for lessons on the skills we plan to assess. If one class has a higher rate of student achievement in a certain area, they share what they are doing to have such a high rate of success in that area. If I identify it is needed, I will suggest using the iPad to work with students who are not on target for letter recognition and other literacy skills.

The results of my study will also be shared with the building principal and early childhood special education program coordinator. All teachers in their first three years of teaching for the district must set a professional growth plan goal and have three observations completed by either the building principal or early childhood special education coordinator. It is

my second year as an early childhood special education teacher so I had to set a goal and have observations completed.

My goal is to have 100% of students going into kindergarten be on target or above for the number of capital letters identified before going to kindergarten. D'Agostino et al. (2016) showed that students who received letter instruction on the iPad had a higher level of achievement then students who received letter instruction with a multisensory method. The results of my study came to the same conclusion. These two studies helped me realize that using the iPad for capital letter instruction was more effective in helping students learn to correctly identify capital letters then the instructional method of wooden capital letters. In the future, I will not shy away from using iPads to help with letter recognition with my students.

References

American Academy of Pediatrics. (2016). American Academy of Pediatrics announces new recommendations for children's media use. Retrieved from https://www.aap.org/en-us/about-the-aap/aap-press-room/pages/american-academy-of-pediatrics-announces-new-recommendations-for-childrens-media-use.aspx

Beschorner, B., & Hutchison, A. (2013). iPads as a literacy teaching tool in early childhood. International Journal of Education in Mathematics, Science, and Technology, 1 (1) 16-24. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1055301

Brown, B. D., Horn, R. S., & King, G. (2018). The effective implementation of professional learning communities. Alabama Journal of Educational Leadership (5) 53-59. Retrieved from 1fd7d-87b9-4678-8eed-web.a.ebscohost.com.trmproxy.mnpals.net/ehost/detail/detail?vid=3&sid=56c22b6e7ad5b00%40sessionmgr4006&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=EJ1194725&db=eric Accession Number: EJ1194725

Bruyckere, P. D., Kirschner, P. A., & Hulshof, C. D. (2016). Technology in education: what teachers should know. American Educator**,** Spring 216. 12-18. Retrieved from https://www.aft.org/sites/default/files/ae_spring2016debruyckere-kirschner-and-hulshof.pdf

Chin, C. T., & Ching, S. C., (2012). The "third"-order barrier for technology-integration instruction: implications for teacher education. Australasian Journal of Educational Technology 28 (6) 1057-1060. Retrieved from http://web.b.ebscohost.com.trmproxy.mnpals.net/ehost/ pdfviewer/pdfviewer?vid=1&sid=1e0f5cda-88b8-4ef8-84eb-2054a49d84f7%40sessionmgr102 Accession Number: 83767443

Chiong, C., & Shuler, C. (2010). Learning, is there an app for that? Investigations of young children's usage and learning with mobile devices and apps. Retrieved from http://www-tc.pbskids.org/read/files/cooney_learning_apps.pdf

Community Education PAIIR (Parents Are Important in Rochester) Online Fall Catalog. (2018). Financial Assistance Sliding Fees. Retrieved from http://www.rochesterce.org/UserFiles/Servers/Server_3087734/File/Departments/Early%20Childhood/PAIIR-ECFE/Catalogs/2018-19/PAIIR_Fall18_web.pdf

D'Agostino, J. V., Rodgers, E., Harmey, S., & Brownfield. K. (2016). Introducing an iPad app into literacy instruction for struggling readers: teacher perceptions and student outcomes. Journal of Early Childhood Literacy, 16 (4) 522–548. doi: 10.1177/1468798415616853

D'Alesio, R., Scalia, M. T., & Zabel, R. M. (2007). Improving vocabulary acquisition with *multisensory instruction* (Master's thesis). Retrieved from ERIC. **(**ED496974**)**

Dietze, B., & Kashin, D. (2013). Shifting views: exploring the potential for technology integration in early childhood education programs. Canadian Journal of Learning and Technology, 39 (4) 1-13. Retrieved from https://files.eric.ed.gov/fulltext/EJ1029330.pdf accno=EJ1029330

Folakemi, A., & Adebayo, L. R. (2012). Comparative effects of multisensory and metacognitive instructional approaches on English vocabulary achievement of underachieving Nigerian secondary school students. *International Education Studies*, 5 (1) 18-27. doi:10.5539/ies.v5n1p18

Gray, S., & Schlesinger, N. (2017). The impact of multisensory instruction on learning letter names and sounds, word reading, and spelling. Annals of Dyslexia, 67 (3) 219-258. doi: 10.1007/s11881-017-0140-z

Hammonds, L., Matherson, L. H., Wilson, E. K., & Wright, V. H. (2013). Gateway tools: five tools to allow teachers to overcome barriers to technology integration. Delta Kappa Gamma Bulletin, 80 (1) 36-40. Retrieved from http://web.b.ebscohost.com.trmproxy.mnpals.net/ehost/pdfviewer/pdfviewer?vid=1&sid=c5f4a463-bebc-4206-8f0c-545211e4b43d%40sessionmgr120 Accession Number: 90555780

Herold, B. (2016, February 5). Technology in education: an overview. Education Week. Retrieved from https://www.edweek.org/ew/issues/technology-in-education/index.html

Hsu, P. S. (2016). Examining current beliefs, practices and barriers about technology integration: a case study. *TechTrends*, 60 (1) 30-40. doi: 10.1007/s11528-015-0014-3

Inclusive Schools Network. (2018). Paraeducators. Retrieved from https://inclusiveschools.org/category/resources/paraeducators/

Kara, N. & Cagiltay, K. (2017). In-service preschool teachers' thoughts about technology and technology use in early educational settings. Contemporary Education Technology, 8 (2) 119-141. Retrieved from web.b.ebscohost.com.trmproxy.mnpals.net/ehost/pdfviewer/pdfviewer?vid=6&sid=288da327-ba54-4198-a88a-6707ff2702cf%40sessionmgr120 Accession Number: 122641930.

Lusche, P. (2003). No more letter of the week. Peterborough, New Hampshire: Crystal Springs Books.

Martin, C. L., & Fabes, R. (2006). Discovering child development. Boston, Massachusetts: Pearson Education.

Neumann, M. M., & Neumann, D. L., (2017). The use of touch-screen tablets at home and pre-school to foster emergent literacy. Journal of Early Childhood Literacy 17 (2)

203-220. Retrieved from http://journals.sagepub.com.trmproxy.mnpals.net/doi/pdf/

Phillips, W. E., & Feng, J. (2012, October). Methods for sight word recognition in kindergarten: traditional flashcard method vs. multisensory approach. Paper presented at the Annual Conference of the Georgia Educational Research Association, Savannah, GA.

Radesky, J., & Christakis, D. (2016). Media and young minds council on communications and media. Pediatrics Official Journal of the American Academy of Pediatrics, 138 (5) 1-6. Retrieved from http://pediatrics.aappublications.org/content/pediatrics/138/5/e20162591 .full.pdf doi:10.1542/peds.2016-259

Rideout, V. (2017). The common sense census: media use by kids age zero to eight. Common Sense Census. Retrieved from https://www.commonsensemedia.org/sites/default/files/ uploads/research/csm_zerotoeight_fullreport_release_2.pdf

Topfer, C. (2007). Discovering letters and sounds. research in practice series. Early Childhood Australia. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICS ervlet?accno=ED497543 Accession Number:ED497543

U.S. Department of Education Use of Technology in Teaching and Learning. (2018). Use of technology in teaching and learning. U.S. Department of Education Online. Retrieved from https://www.ed.gov/oii-news/use-technology-teaching-and-learning

Vaughan, M., & Beers. C. (2017). Using an exploratory professional development initiative to introduce iPads in the early childhood education classroom. Early Childhood Education Journal, 45 (3) 321-331. Retrieved from https://doi- org.trmproxy.mnpals.net/10.1007 /s10643-016-0772-3