

ELECTRONIC PICTUREBOOKS: DO THEY SUPPORT THE CONSTRUCTION OF PRINT
KNOWLEDGE IN YOUNG EMERGENT LITERACY LEARNERS?

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ABSTRACT

This dissertation presents the results of an intervention study examining whether electronic picturebook applications on a tablet computer support the development of print knowledge in preschool age children in low literacy childcare environments. Print knowledge is one of the earliest literacy skills to develop and there is evidence that children who enter kindergarten without this skill are less likely to be reading on grade level two years later (Piasta et al., 2012; Whitehurst & Lonigan, 1998). Since print knowledge is so critical for later literacy development, it is important to make sure that all children acquire this capacity. The sample for this study consisted of 3 and 4 year old children who attended six low literacy classrooms in four childcare centers located in Delaware and Chester Counties. Classrooms were randomly assigned as either experimental or control. A tablet computer preloaded with interactive electronic picturebooks was added to the experimental classroom for children to interact with during free play. Teachers were told not to use the tablet for individual, small or large group reading and there were no other changes to the literacy environment. Children were allowed to play with the tablet as a free choice activity. There were no changes to the literacy environment of the control classrooms. A pre-test/post-design using the Get Ready To Read Screening tool measured changes in children's print knowledge learning over the three month period of time in which the study was conducted. The quality of the literacy environment was measured at the beginning and end of the study. Additional data were gathered through teacher and family questionnaires and classroom observation. The frequency and duration of tablet use was also tracked. The results indicate that there were no positive significant differences in print knowledge from pre to post test. This indicates that the teacher is still the most critical component of the emergent literacy environment.

DEDICATION

This study is dedicated to my father, Daniel Caramanico. Without his influence, I would not have been able to do this work.

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CHAPTER 1: INTRODUCTION

Background

Print knowledge is a cluster of skills that focus on how print is organized and how it conveys a message or tells a story. The development of print knowledge begins as soon as children start interacting with print, typically during the preschool years. Print knowledge is one of the earliest literacy skills to develop and there is evidence that children who enter kindergarten without this skill are less likely to be reading on grade level two years later (Piasta et al., 2012; Whitehurst & Lonigan, 1998). One of the best strategies to construct this knowledge is shared picturebook reading (Whitehurst & Lonigan, 1998). The collaborative experience between adult and child during shared story book reading provides a contextualized experience with books and text. Storybook reading allows the adult to explicitly reference print and book structure in a pleasurable and engaging way.

Since print knowledge is so critical for later literacy development, it is important to make sure that all children acquire this capacity. With the rapid development and use of various types of electronic devices, modern technology holds the potential for helping all children. One of these recent devices that hold great potential as a tool for teaching young children about the meaning and function of print, or *print knowledge* are electronic picturebooks on mobile devices. Mobile technologies now provide an additional tool for children to interact with and construct knowledge about print and the structure of books. Commonsense Media (2013) reports that 75% of children under the age of eight have access to and interact with mobile devices and that 17% interact with them daily. Even more striking is that 38% of children under the age of two have interacted with media on a mobile device (Commonsense Media, 2013). Surprisingly, children are reading or being read to only 30 minutes per day despite the fact that the sale of electronic

books increased significantly in 2011. The portability of mobile technologies, especially e-readers, provides many more opportunities for young children to engage with print and books. While it is evident that electronic picturebooks have the potential to assist in the development of print knowledge, there is little actual hard evidence that they have this effect. There needs to be a deeper understanding of the efficacy of electronic books in supporting print knowledge development. The purpose of this dissertation is to help fill this gap.

The National Association for the Education of Young Children (NAEYC, 2012) developed a position statement in 2012 that makes several recommendations about the use of technology with young children including sharing electronic picturebooks. Electronic picturebooks fall into the category of interactive media. “Interactive media refers to digital and analog materials, including soft-ware programs, applications (apps), broadcast and streaming media, some children’s television programming, e-books, the Internet, and other forms of content designed to facilitate active and creative use by young children and to encourage social engagement with other children and adults” (NAEYC, 2012). Electronic picturebooks allow children to actively engage with the book in multiple ways such as having the book read to them or reading on their own. The NAEYC makes the recommendation that e-picturebooks should be used with children in similar ways as traditional print books. This highlights a significant gap in the research. It is as yet unknown if the strategies for sharing traditional print books yield the same results as electronic books.

The Conceptual Framework

The teaching strategies for supporting the construction of print knowledge with traditional print books are soundly grounded in the theory of emergent literacy. Emergent literacy is the “skills, knowledge and attitudes that are the developmental precursors to reading

and writing and the environments that support these developments” (Whitehurst & Lonigan, 1998, pg. 848). Literacy learning is considered a developmental process that begins with emergent literacy and ends with conventional reading. The processes involved in emergent literacy are conceptualized as “inside out” and “outside in” processes (Whitehurst & Lonigan, 1998). Inside out processes include those that are needed to construct meaning from print including print concepts, alphabetic knowledge, phonological awareness and phonemic awareness. These skills help the reader decode print. Outside in skills are those helping the reader to derive meaning from print. The interaction of these two processes is needed for reading fluently.

In order for young children to develop these skills, they must be nested in high quality, emergent literacy environments. A high quality emergent literacy environment provides multiple, varied and authentic experiences with print and language. Shared storybook reading seems to be one of the primary vehicles for children to construct this knowledge. The use of dialogic reading techniques and print referencing during shared picturebook reading has been shown to have the greatest significance on the development of both inside out and outside in processes (Justice & Piasta, 2011; Whitehurst, n.d.). Dialogic reading entails engaging the child in the shared picturebook reading through dramatic and engaging tone, critically analyzing the text, pictures and story line, defining vocabulary and asking questions. Print referencing techniques include referencing print in authentic contexts including shared storybook reading. In shared picturebook reading, the reader references the form, function, organization of print and books as well as referencing letters, sounds and words. This is done through pointing to print while reading, explicitly drawing attention to the form and structure of print and books and asking questions about print. Both of these strategies have been shown to be effective in

constructing print knowledge by embedding direct instruction into the shared reading experience (Piasta et al., 2012; Whitehurst & Lonigan, 1998).

The importance of developing print knowledge through the use of picturebooks is well documented and the interaction between teacher and child is critical. For this work, however, the teacher must have the requisite knowledge and skills to support literacy development. In 2011, 12.5 million children were in some type of childcare outside the home with 13% of those children in regulated childcare centers (Laughlin, 2013). Unfortunately, childcare regulations do not require highly trained teachers who have the requisite skills to support literacy learning and the low compensation for these positions does not draw the best and brightest teachers. In addition, the adult-to-child ratio in childcare is 10:1. Consequently, childcare teachers may not have the time to provide high quality experiences with print. Since print knowledge is predictive of later reading success, the teacher becomes critical in supporting this development. The e-picturebook holds potential for mediating these teacher deficits. The e-picturebook has the capability of mimicking the teacher behaviors through the highlighting of print as it is read, and “hotspots” that the child can activate. While this is generally true, there is wide variability in the interactive components of e-picturebooks that are available commercially. Where children may not construct print knowledge by “reading” traditional print picturebooks independently or with an unskilled teacher, they may be able to construct this knowledge through the interactivity of the e-picturebook during play.

Play is necessary for children to construct knowledge about their environment but it may not be sufficient in regards to constructing knowledge about print. There is research to support that direct instruction is most effective in the teaching and learning of print knowledge. Effective teachers, however, are able to embed this instruction in play (Nelson et al., 2010).

When teachers act as engaged play partners and provide a print-rich environment, the construction of print knowledge can be facilitated. An example of embedding print knowledge in play is presenting print in authentic ways. The teacher can create grocery store lists when the children are playing store or add a word wall to the classroom to record the learning of new vocabulary organized by the alphabet. It is the interaction between the children and a print-filled play environment that helps them construct meaning about print. The electronic picturebook is an alternative tool for children to interact with print in play that is child directed and child initiated. The child can be self-directed in accessing e-picturebooks. Lastly, e-picturebooks on mobile devices are able to embed direct instruction and make print salient for the reader within the context of play.

Statement of the Problem

This study was designed to add to the literature by examining if print knowledge is constructed when e-picturebooks are used in play by emergent literacy learners in childcare classrooms that do not provide high quality, print rich environments.

Purpose

The purpose of this study is to add to the literature on the role of electronic picturebooks in young children's development of print knowledge.

Research Questions

This study examined the relationship between electronic-picturebooks (e-picturebooks) on an e-reader and the development of print knowledge in very young children in low literacy classroom environments. Specifically,

- (1) Does print knowledge increase when electronic picturebooks are added to the current literacy environment in childcare programs?
- (2) Do the children interact with the tablet during play periods?
- (3) Does the overall literacy environment improve with the addition of this technology?

DEFINITION OF TERMS

Emergent literacy: skills, knowledge and attitudes that are the developmental precursors to reading and writing and the environments that support these developments

Play: activity engaged in by children that is child directed, child initiated and done for its own sake.

Childcare: care outside of the home.

Childcare center: A program that provides all day, out of home care for 13 or more children and is licensed by the State of Pennsylvania as a childcare center (Pennsylvania Department of Human Services, Child Care Regulations, Chapter 3270).

Teacher: Anyone working with young children in child care environments regardless of education level.

Picturebook: a book containing many illustrations, especially one for children.

e-picturebook: any picturebook needing electronic platforms to access.

mobile technologies: any device that is portable including smart phones, tablets and e-readers.

Organization of the Study

Chapter one provides the background, conceptual framework, statement of the problem, purpose, research questions and definition of terms for this study. Chapter two provides a review of the research on postmodern picturebooks, print knowledge development, e-books, play and literacy learning. The review of the research identifies gaps in the research that are addressed in this study. The most significant gap is whether e-picturebooks used in play support the development of print knowledge. The research and design of this study is presented in Chapter

3. Chapter 4 includes the analysis and interpretations of the data. Chapter 5 addresses the conclusions that can be drawn from this study, limitations and directions for future research.

CHAPTER 2: LITERATURE REVIEW

The introduction of mobile technology such as e-readers, tablets and smart phones has made electronic picturebooks available almost anywhere for our youngest children. Electronic picturebooks can go beyond the printed text by including interactive components that are thought to support early literacy development. There is vast diversity in the format and structure of electronic picturebooks available commercially (DeJong & Bus, 2002; Shamir, Korat & Barbi, 2008; Shamir, 2011). The efficacy of storybook reading with traditional print picturebooks in emergent literacy development is well researched but it is not yet known if the same principles apply in the digital environment. Prior research on the efficacy of electronic books has investigated the relationship between CDROM story books on desktop computers, diverse literacy skills and early readers. Although prior research has shed some light on how electronic books support or hinder literacy development, the relationship between print knowledge and electronic picturebooks on e-readers has received very little attention. Since the most salient difference between a traditional print picturebook and an electronic picturebook is the presentation of the text, it is critical that this interaction is studied. Print knowledge (upon formal school entry) is predictive of future reading success, so it is important that early childhood educators have valid research to guide their decisions to use electronic picturebooks on an e-reader in literacy instruction. This study examined whether mobile e-picturebooks support the development of print knowledge in preschool age children in classrooms where high quality literacy experiences are not typically provided.

Print Knowledge and Shared Storybook Reading

Print knowledge is a cluster of skills that emerge during the preschool years that has been identified as a critical precursor to skilled reading (Storch & Whitehurst, 2003). An

understanding of the form and function of written English is developed when children interact with print in their daily lives. As they encounter print, they build schemas about book and print organization, print meaning, the alphabet and word meaning. These skills provide children with the prior knowledge needed for future reading outcomes. Storch and Whitehurst (2003) demonstrate that print knowledge is not just a theoretical construct but is a critical component of future reading achievement. Children do not regularly attend to print in picturebooks and seem much more interested in the meaning than the text (Zucker et al., 2009). Zucker et al. (2009) also found that adult readers rarely direct attention to the print. Print knowledge is an easily malleable concept and simple interventions seem to help children construct knowledge about print (Justice & Piasta, 2011). Studying digital print on mobile devices can provide insight into how to use these new technologies to develop print knowledge.

The longitudinal study conducted by Piasta, Shayne, Justice, McGinty, and Kaderavek (2012) provides evidence that print knowledge has a significant influence on later reading achievement. They examined the influence of Project STAR (Sit Together and Read) on development of print knowledge in preschool age children. Project STAR is an approach to shared story reading with pre-readers that incorporates print referencing. This includes pointing to words as they are read, pointing out print in illustrations, referencing specific words and asking questions about print. Classrooms in preschools, Head Start and childcare were randomly assigned to the high dose Project STAR strategy (120 sessions), low dose Project STAR strategy (60 sessions) or typical strategies of shared story book reading. The same 30 books were used in all three conditions. Assessment of book and print organization, word recognition, spelling and comprehension occurred one and two years post intervention. The hierarchical linear analysis indicated a significant increase in post-intervention scores in the classrooms that used either high

dose or low dose Project STAR strategies. A causal relationship between the Project STAR strategy and later reading achievement is indicated by the results. There is also practical implications of these findings since print referencing strategies do not require a significant change in shared reading strategies in natural environments. A limitation of this study is that it was not determined how many print references per reading session are needed to produce these gains.

Girard et al. (2013) examined the development of print knowledge by studying how children learn literacy skills. They examined how children responded to large group story book reading with a childcare teacher and how they responded to a post-story writing activity. As expected, the results indicated that during the picturebook reading, both children and the teacher engaged in more cognitively oriented, decontextualized language interactions that helped children build meaning, make predictions, draw inferences and connect the story to their own life. More talk about print, letter names and sounds occurred during the post story writing activity. This is not too surprising since the writing activity required the child to understand how spoken language is represented in print. This study did highlight that childcare teachers with two year degrees often lack domain specific content knowledge about early literacy and strategies to support children's literacy development. This study is limited through its design. Teachers and children were videotaped during the story reading and writing activities. Teachers may have changed their behavior in order to demonstrate the behaviors they thought were desired by the study. Also, children's learning was not measured so it is unknown if the teacher's reading styles and writing activity help or hinder children's literacy development. The study does provide additional support that story book reading does not support print knowledge unless the teacher explicitly highlights the print in the book. Only addressing print during writing activities

may not be enough for children to construct meaning about the interaction of spoken language, print and reading. This study also highlights that proper teacher training is necessary for the teacher/child interaction to work effectively.

McGinty et al. (2011) examined how the dose and frequency of the print referencing intervention influence the development of print knowledge. Print knowledge was conceptualized as a multivariate construct composed of alphabetic knowledge, name writing and print concepts. Head Start classrooms were utilized for this study and teachers were instructed to provide the print referencing intervention with variation in intensity and frequency. This study demonstrates that the frequency of print referencing supports the development of print knowledge when the intensity within the story reading was low but if the dose was high, then frequency was no longer significant. This is an important distinction and supports that notion that “quality is better than quantity”. What also emerged as significant is that both high dose and high frequency print referencing showed a threshold effect. In other words, there was not a significant increase in skill level under the high dose/high frequency condition. This study is limited by the possibility of confounding variables. Teachers may have implemented additional literacy activities using the print referencing intervention that were not observed for this study.

Print referencing is a strategy that has shown great promise in supporting the emergence of print knowledge when there is a skilled teacher. This strategy has the teacher explicitly direct children’s attention to the text and then explains the form and function of print. These prompts are designed to encourage talk about text between the children and the teacher during shared picturebook reading. Features of picturebooks that draw children’s attention to print include visual sound, visible speech, environmental print and font changes for emphasis (Justice & Piasta, 2011). Both children and teachers seem to attend to these print features naturally. In

picturebooks that do not have print salient features, it is the responsibility of the teacher to encourage children to engage with the print. All of the studies reported picturebook reading with a teacher but it can be inferred that digital print referencing would have a similar result. A critical question is whether strategies for supporting the development of print knowledge in young children with traditional print and a skilled teacher are transferred to the digital environment without a teacher.

Play and Explicit Instruction in Early Literacy learning

Play supports all areas of child development and developmentally appropriate programs provide a play environment that supports children's learning. Play, as a literacy learning strategy, however, is not supported in the research as the most effective strategy for literacy learning. Research on the interaction of play and literacy learning provides evidence that play is necessary but not sufficient for developing prerequisite skills such as symbolic thinking, print awareness, vocabulary and comprehension (vanKleek et al., 2010). All play, though, is not created equal and it is the quality of play with print and language that supports literacy learning (Golinkoff et al., 2006; Justice & Pullen, 2003; Saracho & Spodek, 2005, VanKleek et al., 2010). Additional research provides support that structured activities in a play environment that include explicit instruction also significantly influence these skills. Explicit instruction seems to be necessary for the development of discrete skills such as phonological awareness, and print knowledge especially for children from deficient literacy environments (VanKleek et al., 2010). Golinkoff and colleagues (2006) propose a balance of child directed play, scaffolded play and activity for optimum literacy learning. Electronic picturebooks on e-readers have the potential to merge explicit instruction and play which could support print knowledge development in low literacy environments that do not use print referencing strategies.

A small, qualitative study conducted by Saracho (2002) provides evidence that teachers can embed literacy learning in the play environment and examines the roles teachers demonstrate in children's literacy related play. Interactions between five kindergarten teachers and children during literacy related play were videotaped and analyzed to determine the types of roles teachers perform during these events. The teacher roles included discussion leader, storyteller, examiner, informer, instructional guide, and decision-maker which answered the primary research question of how teachers support literacy-related play. There are several factors that limit this study and require that the results are analyzed cautiously. The first is the scope of the research question. This study did not address whether the roles of the teacher were effective in building literacy skills, but rather just what roles teachers utilize. A better designed study could determine the efficacy of these roles in children's learning in the play context and would provide greater insight into how teachers modify strategies to meet children's learning needs. A second significant limitation is the possibility of teacher bias. All the teachers knew the content and scope of the study which could have influenced their behavior during the observations. A third limitation to this study is that not all interactions were within the context of play. Some of the interactions were in teacher led direct instruction activities. This study provides information on teacher roles during interactions with children but does not give additional insight into the effectiveness of these roles in children's play-based literacy learning.

Wayne and colleagues (2007) also studied the role of play in the development of emergent literacy skills by looking at how both the environment and the teacher influence literacy related play. The key research question is how literacy related props and teacher mediation support engagement in literacy related play behaviors. This is a single subject design that used the Early Language and Literacy Classroom Profile as the primary assessment tool and

provided pre and post intervention results. Nine preschool age children across three classrooms were observed along with their teachers. The Early Language and Literacy Classroom Profile assessed the environment and teacher/child interactions using a time sampling method. The intervention consisted of adding literacy props to the environment and having teachers invite and reward children for using them. Specific learning centers were targeted each day for teacher intervention. The results indicate a significant increase in literacy related behaviors defined as listening to book, looking at a book, looking at letters/words in the environment, writing, playing with alphabet puzzles, and looking at someone write as a result of the intervention. This study is limited in its design, though, and it is difficult to determine if the intervention was the primary correlated variable. The literacy props added to classroom learning centers were not clearly identified except for the addition of books to each center and “reading glasses” to encourage looking at books. This would influence the results because different props may have elicited different behaviors from the children. Also, mediation behaviors were open to interpretation by the teachers. They were only told to invite children to the target learning center, encourage them to use the props and reward the behavior. Differences in the interaction style of the teacher could influence the results. Lastly, the emergent literacy skills of the children were not assessed. So, it cannot be concluded that props and teacher mediation actually support the development of emergent literacy although this relationship is suggested by other research (Justice & Pullen, 2003).

Chien and colleagues (2010) attempted to identify which pedagogical strategy significantly explains differences in children’s emergent literacy skills. Specifically, they investigated how children’s classroom engagement influences the growth of language, literacy and mathematics during the pre-kindergarten year. The data were drawn from a multi-state study

conducted by the National Center for Early Development and Learning. The sample was diverse in socioeconomic status, ethnicity and home language. Classroom observations, child assessment and teacher report were used to assess growth over time on the pre-academic skills identified. A latent content analysis grouped the children in the profiles of “free play”, “individual instruction”, “group instruction”, and “scaffolded learning” based on the pedagogical philosophy of the early childhood classroom in which the children were enrolled. An analysis of covariance examined gains in the school readiness skills identified between the four profiles. The most notable results are that children in the free choice profile made the least amount of progress on the pre-academic skills as compared to the other three profiles. Additionally, high SES children in the free play, group instruction and scaffolded learning profiles made greater gains than lower SES children. Low SES children, however, made greater gains in the individual instruction profile than higher SES children. At first glance, the results indicate that direct instruction is beneficial for teaching pre-academic skills and that free play is not beneficial especially for children from low income environments. A more valid interpretation postulated by the authors is that children who live in high SES environments benefit most from child directed and supported play and children in low SES environments benefit from direct instruction. Also, since the children from low SES environments scored lower on the pre-assessment, it is expected that they would make the greatest gains over time since they have more to learn. Children in both groups showed significant gains in the scaffolded learning profile which indicates that the teacher/child interactions have the greatest influence on learning within the play environment. These results are limited because effect sizes were small, and the majority of children were in at-risk categories. In addition, free play supports critical thinking, problem solving and comprehension and these skills were not included in the assessments.

There may be other confounding variables such as peer interactions and home environment that may be influencing the results. Further study is needed to provide additional clarity on the role of the teacher in children's play, and how peer to peer interactions in play support development. This would provide depth in understanding the characteristics of high quality interactions in literacy learning.

Connor and colleagues (2006) also examined the role of the teacher using hierarchical linear modeling. This quantitative study was conducted in the Midwest United States and drew the sample from Head Start, and publicly funded school district preschool programs. This study investigated the interaction between dimensions of instruction (teacher mediated, child mediated and teacher/child mediated), the amount of time in language and literacy activities and the type of instruction (explicit/implicit) with growth of phonemic awareness, letter knowledge and vocabulary. Using observational data, the researchers coded classroom activities based on the dimensions of instruction, time, instructional type and whether the activity was meaning focused or code-related focus. Play was always coded as implicit even if the teacher and child were interacting together. Children's skills were assessed using the Woodcock Johnson III using a pre/post model. The results provided evidence to support that more exposure to literacy related experiences both in play and through explicit instruction are correlated with growth in emergent literacy skills. Play produced the greatest effect size for vocabulary growth while explicit instruction individually or in small groups produced the greatest growth in alphabet knowledge. It is important to note that explicit instruction was not a drill and practice model but rather involved code-related skill activities that were interactive and imbedded in other activities such as art, dramatic play and shared story book reading. This is evidence that it is the interaction between children and teachers that supports emergent literacy. The most significant results were

when children were engaged with the teacher regardless of the type of instruction. Teachers that support and extend children's literacy related play are more effective in supporting children's growth than teachers who do not. Also, the most significant growth for children was in classrooms that provided implicit and explicit instruction on both code-related and meaning-making experiences. The limitations of this study include length of observations, child characteristics, variations between classrooms and home influences. Each classroom was observed and recorded for one day which only gives a snapshot of the types of experiences provided. Also, there was significant variability in the amount of time spent in literacy-related activities in each classroom. This would influence the results because the observations may not be a "typical" day and the observers may not have seen the true amount of time spent in literacy related activities. There was variability in the children as well. Children who had low scores in the initial assessments showed the greatest growth but this could be due to the fact that they had more to learn. In addition, classrooms where the least amount of time was spent in literacy-related activities had children who showed the least amount of growth. This indicates that the amount of time in literacy-related activities is a significant variable in children's literacy learning. Lastly, the amount of time children spend in literacy related activities at home was not factored into the model. Literacy rich home environments could also explain skill development over time. This study does support prior research that teachers play a critical role in children's development of literacy by providing individualized and small group instruction as well as opportunities to play in a literacy rich environment (Justice & Pullen, 2003; Saracho & Spodek, 2006).

Young (2009) studied play and literacy learning using a mixed methods research design. The primary research questions include the effects of literacy related play on children's emergent

literacy skills, how teacher attitudes about emergent literacy changed over the course of the study and teacher's reflective practice. This study included several phases beginning with a collaborative intervention design to embed language, phonological awareness and concepts about print into the play environment. There were three phases to the study-implementation: analysis and reflection. The sample consisted of 50 preschool age children and two teachers. A pre/post-test design was used to assess changes in children's emergent literacy skills. The intervention consisted of using environmental print found in the children's home and community to produce teacher made games such as bingo and matching games. The results indicated a positive significant difference in children's emergent literacy skills with the greatest effect being that boys made greater gains than girls. Teachers also showed growth in their perceptions and abilities to embed literacy activities into a play curriculum with mentoring by the researcher. A problem with the study was that the embedded literacy activities incorporated by the teachers were not clearly defined and statistical analysis used to demonstrate the effect was also not defined. Since the quantitative analysis was not clearly defined, it is impossible to evaluate the validity of the results. Also, the strategies used by teachers during play interactions around literacy were not reported and incorporating teacher led activities like bingo does not meet the standard definition of play but is rather playful explicit instruction. These limitations impact the value of this study because it is unknown what truly influenced the gains made by the children. Although there are limitations, this study does highlight that literacy instruction needs to be thoughtfully planned and the teacher plays a key role.

Green and colleagues (2006) contribute to the study of how literacy is supported in play by surveying early childhood education teachers who attended training through a regional professional development center. The survey was meant to assess the promotion of language and

literacy activities in their classroom. The research questions were whether early childhood teachers are promoting language and literacy in their classrooms and what program characteristics are associated with their ability to implement those activities. A Likert scale was used for the survey and the items included educational strategies used by teachers to support emergent literacy. The items were categorized as reading practices, instruction about books, exposure to books, alphabet recognition, and phonological awareness. The survey also included items to assess program characteristics that support teachers in implementing early literacy activities. The results indicated that teachers from this sample do in fact provide many opportunities for children to gain emergent literacy skills in their classrooms. A multiple regression showed that the factors that correlated with language and literacy promotion were availability of materials, the teacher's self-efficacy in providing literacy and language activities and the number of children cared for. This study helps to highlight that teachers are providing literacy experiences for preschool age children that is supported in the research as best practice but it does not address the quality or appropriateness of the activities. Also, the survey was analyzed for reliability but a factor analysis was not reported. A factor analysis would strengthen the results by identifying if the survey items were measuring what they were intended to measure. Although this study is limited in its quantitative measures and is not generalizable, it does provide added insight into the role early childhood teachers play in literacy learning.

Nelson and colleagues (2010) investigated emergent literacy development from the direct instruction lens. They chose to study whether supplemental instruction provided by community based tutors would significantly affect the development of phonological awareness and print knowledge. The sample for this study was eight Head Start classrooms and the intervention was a literacy program called "Stepping Stones to Literacy". This is a structured literacy program

that provides materials and instructions for implementation. The control groups received interactive book reading in the classroom. Children were randomly assigned and a pre/post-test design assessed changes in children's literacy knowledge specifically related to print awareness, alphabetic knowledge, phonological awareness, and vocabulary. The groups were homogeneous in that they did not significantly differ from each other on demographic variables. Tutors were recruited within the community served by the Head Start program and were trained to provide direct instruction using a sequence of flash cards with target words from the storybook, open ended questioning and opportunities for independent practice. The tutors were scripted and trained to be engaging and encouraging. The intervention was provided 20 minutes a day, five days a week over 10 weeks. Multilevel modeling measured the direct and unique effects of the supplemental instruction that controls for other possible confounding variables. The results indicated that children who received the intervention scored significantly higher on the posttest than children in the control group. The strongest result was in the gains of alphabetic knowledge. Children from impoverished environments made the greatest gains in phonological awareness and print knowledge. The other implication is that with appropriate training, parents and community members can provide the supplemental instruction. There are several limitations to this study. Even though children made gains, it is unknown exactly which of the explicit instruction activities had the greatest effect. For example, activities on blending may have a greater effect than activities on syllables. Another limitation is the homogeneity of the sample. Most of the children were from impoverished environments so it is unknown if the same results would be found if the sample was more heterogeneous. The literacy environment in the home was not factored into the model which could also be confounding the results. Lastly, the authors postulate that there are several benefits to the community-based tutor model. The tutors

were trained to follow a basic script and it is unknown whether they were able to adjust to the needs of individual children. So, although there are benefits, the community- based tutor may not be equipped to differentiate instruction when needed by the children. This could influence the results in that the children may not be actively engaged in the activity due to teaching skill limitations in the tutors. Also, the authors hint that training is enough to be effective which marginalizes the skill of the classroom teacher.

Bingham et al. (2006) approach the role of the teacher in children's literacy learning by examining the effectiveness of para-educators in delivering the "Systematic and Engaging Early Literacy" framework which uses explicit instruction through engaging, interactive and hands on activities (Bingham et al., 2006). The key principles of the Systematic and Engaging Early Literacy (SEEL) framework are utilizing explicit instruction as the primary teaching strategy and implementing small group and individual activities in a playful and engaging manner. "Playful and engaging" is defined as varying presentation, responding to child input, linking the literacy skills to natural contexts and displaying enthusiasm in order to maintain children's attention and engagement with the activity. An example would be taking a ride on a bus to teach the letter/sound association for the letter "Bb". This program provides preplanned activities that target literacy skills in the areas of phonological awareness, alphabet knowledge, phonics, and letter sound associations. The curriculum is sequenced as well to scaffold children's learning. This curriculum was developed for whole group instruction but this study examined whether para-educators can effectively implement this curriculum for children at risk for reading difficulties as supplemental instruction. The para-educators were trained in implementing the curriculum before the intervention began and there was ongoing training throughout the study. The children attended kindergarten in their local school district and were identified as needing

remediation in reading and writing. The children's literacy skills were assessed both before and post intervention using the Phonological Awareness Literacy Screening and para-educators were observed periodically through the study to insure they were implementing the curriculum using the strategies identified. Instruction was provided to small groups of children outside of the classroom three times per week for the duration of the school year. The comparison group was exposed to district approved one-to-one tutoring sessions with a para-educator. The initial screening indicated that the two groups of children were significantly different from each in that the treatment group had lower skill levels than the control group. To account for this, an ANCOVA was used to analyze the data. The children in the treatment group made significantly greater gains in literacy skills from pre to post-test which indicates that the SEEL curriculum is an effective intervention for children at risk for reading difficulties. These results also indicate that para-educators who are adequately trained are an available resource to provide extra support to those children who need it. Children's engagement in the SEEL activities was not researched so it is unknown whether the children's engagement or the curriculum is most effective. It can be assumed that the more actively involved the child is in in the activity, the more learning that will occur. One limitation of this study is that the sample was not randomly assigned to treatment or control group resulting in inequalities between the two groups although both groups made gains in literacy skills. A second limitation to this study is the engagement of the children in the activities was not included in the variables studied. Children's emotional response to the activity influences their attention and interest in the activity. This study provides additional insight into the role of the teacher in delivering a specific curriculum but does not address the teacher behaviors that have the most influence in children's learning.

As expected, this body of research does demonstrate that children make significant gains in literacy learning in both play and explicit instruction activities that are balanced to meet children's learning needs (Chien et al., 2010; Golinkoff et al., 2006; Missall et al., 2006; Saracho & Spodek, 2005; Saracho, 2002; Wayne et al., 2007; Young, 2009). The teacher's role in children's literacy learning also emerged as a significant variable in both explicit instruction and play. Teachers are critical in children's literacy play by acting as mediator, designer, discussion leader, storyteller, examiner, informer, instructional guide, and decision-maker (Saracho, 2002; Saracho & Spodek, 2006). How the teacher implements explicit instruction also emerged as significant. Teachers who provide explicit instruction in a playful manner and connected to the children's interests were most effective (Chien et al., 2010; Green et al., 2007; Missal et al., 2006). Scaffolding children's learning both in play and through literacy activities seems to be the most effective for teaching emergent literacy skills to young children and the interaction between teachers and children is the key variable. It is also interesting to note that the classroom teacher does not have to be the sole deliverer of instruction but that adequately trained paraprofessionals also can play an active role in the literacy learning environment by providing additional support for children at risk of reading difficulties (Bingham et al., 2006; Nelson, 2009).

It is clear that teachers play a critical role but they need to be skilled and reflective in preparing an environment that supports literacy learning. A common explicit literacy activity in childcare classrooms is story time and classrooms have picturebooks in the library center that are available for children's exploration in play. It can be extrapolated from the research that story time supports print knowledge development when teachers explicitly focus children's attention on print conventions, book construction and the alphabet. Play with books is not sufficient for

constructing this knowledge. Teachers need to be skilled at providing a balance of free play, guided or scaffolded play and playful activity for optimum literacy learning (Bingham et al., 2010; Chien et al., 2010; Golinkoff et al., 2006; Missal et al., 2006; Saracho & Spodek, 2006). Unfortunately, a skillful, highly trained teacher is more of the ideal than the reality. Teachers in childcare programs often do not have the training, time or resources to integrate play, story time and a high quality literacy environment. Also, childcare teachers have many responsibilities when providing early care and education which limits their time to facilitate high quality, literacy play with all children in their care. Mobile technology has great potential for providing explicit instruction in play when the teacher is not available. Electronic picturebooks on an e-reader specifically are well suited for teaching print knowledge. The mobile platform of the e-reader can provide more literacy-related play experiences and allows children to explore print in child directed, child initiated play that adapts easily for diverse skill levels. E-picturebooks on a handheld reader have the potential to provide teachers with another “tool” to support the diverse learning needs of children and to differentiate instruction.

Print Knowledge and Electronic Picturebooks

Technology changes at a rapid pace and most of the literature on electronic books used electronic books on CD-ROM. Children are now being exposed to digital text on handheld e-readers, tablets, or cell phones. Greater attention needs to be given to handheld e-readers since their design is different than an e-book on CD-ROM. Screen sizes are smaller and book features are different. For example, the Kindle does not have page numbers in some books. Also, handheld readers are very portable so that children can interact with a book almost anywhere. Since this increases the exposure to e-books, effective interactive components that provide print references could be very beneficial in supporting print knowledge development. The existing

research provides a foundation for evaluating the interactivity of new devices and whether they have value for supporting literacy in the early learning classroom with pre-readers.

Shamir (2011) examined how the electronic book supports development of phonological awareness (PA) and concepts about print (CAP) in children ages 5-7 years who were either typically developing(TD) or at risk for learning disabilities(ALD). The ALD and TD experimental groups demonstrated significantly greater gains in phonological awareness and concepts about print. The most notable result is that the ALD group that received the intervention had the most significant positive gains in CAP. This indicates that multimedia and multisensory components of the e-book design do support development of pre-reading skills in young children, especially those at risk for learning disabilities. However, the interactive components of this e-book were specifically designed to support the pre-reading skills being assessed but were not included in the primary research question. In other words, the researchers designed the interactive components of the e-book but did not study specifically whether those components supported the skills they wanted to assess. The primary research question was comparing the efficacy of the e-books in supporting development in the sample groups. A significant limitation of this study is that the story book used was not included in the regular curriculum so the results may be somewhat inflated

In a similar study, Korat, Shamir and Klein (2007) examined the efficacy of e-books in supporting emergent literacy in kindergarten age children. The research questions included whether the addition of the e-book to the classroom is more effective than classrooms without e-books, which literacy skills are supported by e-book activity, and how learning context (adult led or child-to-child interactions) influences emergent literacy. The results demonstrate an increase on all measures from pre-test to post-test with the children in the paired groups with the e-book

making the greatest gains. Children in the individual learning and adult led groups also showed modest significant gains. This can be interpreted to mean that it is better to have children work together when reading an e-book and that there is pedagogical value to the e-book medium. This finding could also be valuable for classroom teachers since it provides additional experiences with print that are not teacher led. A major concern with this study involves the inconsistency in instruction between the control group and the experimental groups. The control group that received the standard curriculum was not exposed to the same book as the experimental groups; thus, it is difficult to determine if the e-book was responsible for the gains. It is possible that the book itself includes features that support emergent literacy. Having the control group participate in story reading of the same book may shed light on whether the e-book had the most influence. A second limitation is in the paired study design. Since the control group did not engage in this learning context, the gains could have been due to the learning context, not the e-book.

Shamir, Korat and Barbi (2008) investigated how the medium of book reading and socioeconomic status influence emergent literacy. Emergent literacy was defined as vocabulary, phonological awareness, word recognition and story comprehension. Children were randomly assigned to either the adult led e-book condition, adult led story reading with the same book in the traditional print or the control group that received the regular curriculum. There was a significant increase in vocabulary for the intervention groups and a significant gain in phonological awareness for children identified as low SES regardless of intervention. Since there were no other significant findings, it can be interpreted that the medium of story book reading does not influence literacy development. This is evidence that the e-book format is not negatively affecting children's development and learning but is not necessarily more effective than more traditional strategies.

Segal-Drori, Korat, Shamir and Klein (2007) also used SES as a variable to examine how literacy development is supported by e-books for children from low SES contexts. They hypothesized that kindergarten children from lower SES families will demonstrate an increase of emergent reading skills as measured by concepts of print, phonological awareness and word reading through adult instruction with electronic print. Also, a comparison was made between the e-book and traditional print story reading. The results indicate that the e-book with adult instruction had a positive significant difference compared with the other conditions. Also, the conditions that had adult instruction with print and e-books showed greater gains than either the control or the individual conditions. This indicates that children benefit from direct instruction in emergent literacy to gain these skills. One significant limitation to this study is that there was additional teacher instruction after each session on the targeted skills. It is possible that the main effect on emergent literacy is the pedagogy of instruction and not the format of the book. An analysis of the teaching strategies used by the classroom teacher could add clarity to these results.

DeJong and Bus (2001) studied the effects of book format on emergent literacy skills of children ages 4-6 years. Specifically, the authors wanted to know if the e-books were a viable tool for reading instruction. They examined how book format influences meaning-making, reading fluency, text knowledge, and word recognition and whether there is a difference from traditional print books. Also, they wanted to know if children's level of emergent literacy influences how children internalize text from book reading. The results were complex and did not yield significant results. The authors interpret these findings as meaning that the electronic book format is not suitable for use in reading instruction. This is a broad claim that exceeds the bounds of this study. This study did not have the same findings as the Shamir (2008) research.

It is possible that this is because of improvements in the technology to design e-books in the time span between the two studies.

Moody, Justice and Cabel (2010) approached this topic from a different perspective. They wanted to know whether children's engagement and communicative initiations were influenced by the medium of storybook reading (electronic vs. traditional) and whether these behaviors were quantitatively different in adult- led or child-led e-book reading. This study is similar to the previous studies except for the literacy skills examined. The analysis demonstrated that there is a positive significant difference in persistence (participation with the book) in the adult-led e-book condition and labeling behaviors (asking for more information) in the adult-led traditional condition. There were no other significant differences. This lends support to the influence of teaching pedagogy rather than modality in supporting literacy learning. Also, if children maintain attention to the e-book, it can be extrapolated that other literacy skills will be gained as well. A significant limitation to this study is that the "readers" were scripted in order to provide as similar an experience for all subjects, the reading was conducted in quiet areas outside of the classroom and the sample was very homogeneous. This is valuable for research purposes but does not address the diversity in children, teachers and early learning settings. Factors such as children's developmental level, the classroom environment, multiple teaching strategies and e-book design could interact to have either a positive or negative influence on children's learning.

Gong and Levy (2008) investigated how an electronic book influences pre-readers' development of print knowledge defined as word shape, word elements and spelling conventions. This study was more focused than the others in the skills studied. The e-book designed for this study included non-readable items within the story that either the children could mouse over or

not allow the child to continue without clicking on the item. Also, a ball bounced on the words as they were read. The results indicate that direct instruction in what is readable and unreadable print supports the development of print knowledge. The interactive components of the e-book could have influenced the results by distracting children from the print since gains were not made in letter knowledge. It is hypothesized that children attended more to the cues rather than the print itself. This study is limited by the possibility of confounding variables. Other activities in the classroom that support print knowledge may have also contributed to the children's learning. Having a control group that was just exposed to the regular curriculum would have addressed this problem.

The quality of commercially designed e-books was examined by DeJong and Bus (2003). They used content analysis to determine how the interactive and multimedia features of e-books support emergent literacy in children ages 3-7 years old. This adds evidence to the lack of quality of commercially available e-picturebooks and gives support for developing e-books specifically for education purposes. The electronic books selected for analysis were recommended by publishers for this age group. Books on CD-ROM were analyzed and coded for book knowledge, visual multimedia, multimedia linked to print, interactivity, and interactive legibility or the connections between interactivity and the print. This study lays the groundwork for evaluating e-picturebooks and demonstrates the low quality of e-picturebooks available at the time of this study. Technology changes rapidly and this study is already outdated due to new devices by which children can access e-picturebooks.

Electronic books can be beneficial to the development of early literacy skills in young children but the empirical evidence suggests there are multiple layers of complexity that need to be evaluated to come to any definitive conclusions. A review of the research conducted by

Burnett (2010) indicates that there are multiple interacting variables that influence literacy development with an e-book. The variables that have emerged in this review as significant are the interactive features of the e-book, and adult-led versus child led experiences.

The quality of the e-picturebook has emerged as a significant variable in understanding the influence of the e-picturebook on literacy. Several studies use e-books that were specifically designed to teach the literacy skills being studied (Gong & Levy, 2008; Segal-Drori, 2007; Shamir, 2007; Shamir & Shlafer, 2011). When compared with an analysis of commercially prepared e-picturebooks, the design features do make a difference in children's literacy development (DeJong & Bus, 2003). The greatest gains are when the e-picturebook was specifically designed to promote the literacy skills being examined. For example, Shamir and colleagues (2007, 2008) included interactive features that focus attention on the structure of words by breaking the words down into syllables when the children mouse over the identified vocabulary. All e-picturebooks highlighted the text as it was read but not all studied this feature in isolation and those that did produced conflicting results (DeJong & Bus, 2001, 2003; Gong & Levy, 2008; Segal-Drori, Korat, Shamir & Klein, 2007, 2008) DeJong and Bus (2001, 2003) and Gong and Levy (2008) found that highlighting of the text does little to support literacy development. In contrast, Shamir and colleagues (2007, 2008) found that highlighting has a significant influence. This indicates that further study is needed to determine the efficacy of highlighting print and how differing highlighting designs influence development (for example only highlighted key vocabulary versus highlighting all print).

Designing the interactive features to support the skills to be assessed can be construed as teaching to the test but it indicates that this may be an effective strategy for use in e-picturebook design. Only one study (DeJong & Bus, 2001) used a commercially prepared e-picturebook and

the findings lacked significance. The findings by DeJong and Bus (2003) support the need for more educationally focused design in commercial e-picturebooks. Interactivity that seemed to be most effective in developing phonological awareness and print knowledge are when vocabulary was highlighted and broken down into syllables when activated and when there are specific cues given for readable and unreadable print. Reading comprehension is best supported by animations that support the story. Moody, Justice and Cabel (2010) demonstrate that e-picturebooks are engaging for children but engagement alone does not seem to support the development of literacy skills. Publishers advertise the value of interactive components but these claims are not supported in the empirical evidence that compared traditional print books with e-picturebooks. Further study is needed on the efficacy of the interactive design of e-picturebooks.

Research Question and Hypothesis

This study was designed to contribute to early childhood pedagogy in emergent literacy by exploring the efficacy of electronic picturebooks as a teaching tool and addressed some of the limitations of the current research. Four variables that have not been studied together are electronic picturebooks on e-readers, print knowledge, play and very young children. The importance of print knowledge on future reading success is clear and effective strategies have been developed but prior studies typically focused on children four years old or older. Three year olds are just becoming interested in print but their primary focus is play. Play defined as child initiated, child directed activity has not been shown to be sufficient in supporting the construction of print knowledge. Electronic picturebooks on e-readers hold promise for embedding explicit instruction in a play environment and may be beneficial for children whose literacy skills are emerging and not supported in the learning environment.

This study examined the relationship between e-picturebooks on an e-reader and the development of print knowledge in low literacy classroom environments. The e-picturebook may be an effective intervention in environments where children are not read to consistently. Specifically,

- (1) Does print knowledge increase when electronic picturebooks are added to the current literacy environment in child care programs?
- (2) Do children choose e-picturebooks during play periods?
- (3) Is there a relationship between the literacy environment and electronic picturebooks on children's development of print knowledge?

It is hypothesized that e-picturebooks on e-readers support the development of print knowledge when children interact with them in play and that commercially developed e-picturebooks can support development even in a low literacy environment.

CHAPTER 3: METHODOLOGY

Participants

Initially, the participants of this quasi-experimental study were to be three year old children (36-48 months at the beginning of the study) nested in low-literacy childcare classrooms. The rationale for studying this age group included developmental considerations, lack of research and the quality of literacy contexts in childcare classrooms. Very young children are capable of constructing knowledge about print when in print rich environments through authentic interactions. Advancements in mobile technology provide opportunities for children to engage with print in a digital format at much younger ages. Also, the efficacy of mobile technology use either independently or with others has not been extensively studied in authentic settings. Lastly, focusing on this age group specifically will help to control for normative developmental differences that may influence children's emergent literacy capabilities. The final population for this study was children ages 36 – 60 months old. The change in the ages of the children was due to difficulty in recruiting participants in the limited age range proposed. Including slightly older children in the study does not change the efficacy of the design since four and five year old children also vary greatly in their understanding of print knowledge.

Sampling Procedure

The sampling procedure was a process of three phases that included recruitment of child care centers, teachers and children. Childcare centers in Delaware and Chester County, Pennsylvania were the focus for recruitment because of the diversity of children and quality environments within the county. Multiple childcare centers were called to request participation

in the study based on their involvement with Keystone STARS and STAR level. Keystone STARS is a voluntary quality improvement initiative in Pennsylvania that provides resources and supports for childcare centers to improve the quality of early care and education for children. Childcare centers that are at the lowest STARS rating are just beginning the quality improvement process. Since these centers are meeting minimum standards, they are less likely to have print rich environments and their voluntary participation in Keystone STARS demonstrates a commitment to quality improvement. When five centers did not respond to the request for participation, the criterion was expanded to include centers that had a STAR level of one through three. Two of the centers that agreed to participate were at STAR 3 and two were at STAR 1.

In addition, the specificity of the age group required that the center have at least one classroom of children ranging in age from 36-48 months but, ideally, priority would be given to centers that have two classrooms of chronologically grouped three year olds. The identification of two classrooms in the same center would control for possible cultural differences in educational philosophy and mission of the center. It proved not possible to find two, three year old classrooms in the same center but the intent of the research design was met by having an experimental and control classroom in the same center. The additional classrooms that agreed to participate were in two different childcare centers although both centers served a similar demographic and were in close physical proximity to each other. All classrooms utilized a play-based curriculum and had an enrollment of at least 18 children in each classroom. A smaller class size would confound the results because teachers have more time to engage children in literacy-related interactions. Finally, all four centers and classrooms agreed to a classroom assessment using the Early Childhood Environmental Rating Scale-E. In summary, the childcare

classrooms included in this study (1) were either STAR 1 or 3, (2) had at least one classroom of three year old children and (3) agreed to an ECERS-E assessment.

Centers that met the initial criteria of chronological age grouping and participation in Keystone STARS were assessed using the Early Childhood Environmental Rating Scale-E. This tool is valid and reliable for assessing the quality of the literacy environment. Validity and reliability analysis will be provided in the following research design. A score of three or below indicates minimal quality in the literacy environment. The specific score for print rich environments must also be a three or below. Teachers whose classrooms met this criterion were invited to participate and authorize their consent.

The target number of participants for each cohort (experiment and control) was forty for a sample of eighty children. Ideally, the two centers identified would have one experimental cohort and one control cohort. This was true for two of the centers chosen for participation. The other two classrooms were in two different childcare centers. Classrooms were randomly assigned to the experimental condition. Families of the children in each classroom were invited to participate and provided consent. A minimum of 75% of the families had to give consent for their children to participate for the classroom to be included and this threshold was met. This threshold gave a more robust sample size and simplified data collection. Children who did not complete either the pre-test or post-test screening were excluded for the study. The sample size was 67 ($n = 67$).

Research Setting

The research setting was naturalistic, low literacy environments in childcare classrooms as measured by the Environmental Rating Scales-E (ECERS-E). Children spend from 20-50

hours a week in childcare so this meets the criterion as a natural environment for these children. The amount of time in care outside the home also makes this environment critical for study since the experiences provided will have a significant influence on children’s development. Whitehurst and Lonigan (1998) demonstrate that print knowledge is a critical component in future reading success and that this knowledge needs to be in place prior to formal school entry. Since the majority of children are spending significant amounts of time in care outside the home, childcare classrooms have the potential to influence children’s current and future reading success.

The natural environment for many children in Delaware County, Pennsylvania is childcare. Over 33,000 children under the age of five reside in Delaware County and 45% live in homes that fall 300% below the poverty level. There are 138 centers in Delaware County participating in Keystone STARS that have earned STAR 1 designation. Centers must meet 10% subsidy rate for participation in STARS which means that most childcare centers are serving underprivileged children (Office of Child Development and Early Learning, 2010). The percentage of children receiving subsidized childcare for centers in this study is outlined in Table 3.1.

Table 3.1: Childcare center subsidy rates

Childcare Center	Percent of children receiving subsidy
1	80%
2	100%
3	45%
4	53%

A literacy rich environment as defined by the ECERS-E (The Four Curricular Subscales Extension to the Environmental Rating Scale) includes print in the environment, book and literacy areas of the classroom, adult reading with children, sounds in words, emergent writing/mark making and talking/listening. This cluster of environmental components aligns with research that suggests that emergent literacy is a constellation of skills that integrates talking, listening, reading and writing (Sylva et al., 2011). This study focused on the print environment and the book/literacy areas of the classroom. A print rich environment includes using environmental print in authentic ways. This could be through labeling of equipment, materials and toys as well as print displays. Classrooms that are not “print rich” do not utilize these strategies for exposing children to print nor do teachers orient children’s attention to print in play. The book and literacy area in low literacy classrooms often lacks diversity in the picturebooks available and there is little encouragement by teachers to play in this area. Also, this area may be used by children as a “waiting” area which reduces children’s interest in exploring picturebooks independently even though the area is available to children most of the day.

Research Design

To answer the research questions of this study, a quasi-experimental, pre/post design was utilized. The intervention for this study was commercially available e-picturebooks on an android tablet that included the Kindle as an e-reader. The tablet was loaded with 20 commercially prepared e-picturebooks that were included due to their structure to support the development of print knowledge. The American Library Association and Goodreads were used as sources of information to identify the 20 e-picturebooks. Caldecott and Newberry award winners, alphabet books and books whose focus is on print knowledge and phonological

awareness were chosen for inclusion. Table 3.2 outlines the print picturebooks and the characteristics shown to support the development of print knowledge.

Table 3.2 *Electronic Picturebooks and Content Domain Supported*

Title	Author	Publisher	Copyright	Content Domain	Print	Kindle
The Day the Crayons Quit	Drew Daywalt and Oliver Jeffers	Philomel	2013	Print knowledge	Yes	Yes
Once Upon An Alphabet	Oliver Jeffers	Philomel	2014	Print Knowledge	Yes	Yes
A Perfectly Messed Up Story	Patrick McDonnell	Little, Brown Books for Young Readers	2014	Print Knowledge	Yes	yes
Blue on Blue	Dianne White	Beach Lane Books	2014	Phonological Awareness	Yes	Yes
Square Cat ABC	Elizabeth Schoonmaker	Aladdin	2014	Print Knowledge	Yes	yes
The Book with No Pictures	B.J. Novak	Dial	2014	Print Knowledge	Yes	Yes
Pete the Cat and his Four Groovy Buttons	Eric Litwin and James Dean	HarperCollins	2012	Phonological Awareness	Yes	Yes

Table 3.2, continued

This is Not my Hat	Jon Klassen	Candlewick	2012	Print knowledge	Yes	Yes
The Duckling Gets A Cookie	Mo Willems	Disney-Hyperion	2012	Print Knowledge	Yes	Yes
LMNOPeas	Keith Baker	Beach Lane Books	2010	Print Knowledge	Yes	Yes
Books Always Everywhere	Jane Blatt	Random House Books for Young Readers	2014	Print Knowledge	Yes	Yes
Green Eggs and Ham	Dr. Suess	Random House Books for Young Readers	1960	Phonological Awareness	Yes	yes
Dr. Suess' ABC	Dr. Suess	Random House Books for Young Readers	1963	Print Knowledge	Yes	yes
Go Dog Go	P.D. Eastman	Random House Books for Young Readers	1961	Phonological Awareness	yes	Yes

Table 3.2, continued

Brown Bear, Brown Bear, What Do You See?	Bill Martin, Jr. and Eric Carle	Henry Holt and Co.	1992	Phonological Awareness	Yes	Yes
Chicka, Chicka, Boom Boom	Bill Martin, Jr., John Archambault and Lois Ehlert	Little Simon	1989	Print Knowledge	Yes	Yes
I'm Stuck In Your Kindle	Wally Otto	Amazon Digital Services, Inc.	2013	Print Knowledge	No	Yes
The Monster At the End of the Book	Jon Stone and Mike Smolin	Sesame Workshop	1971	Print Knowledge	Yes	Yes
The Three Pigs	David Wiesner	Clarion Books	2001	Print Knowledge	Yes	Yes

There was a modification to the tablet and electronic picturebooks used. The picturebooks identified in Table 3.2 were not available in the digital format or were only available in PDF format without interactivity on the Kindle application. Interactive electronic picturebooks are published as applications which meant that the e-reader was not needed. The e-picturebooks loaded onto the tablet are what is currently commercially available through the Google Playstore. The interactivity, author and publisher were considered when choosing the e-picturebooks. The electronic picturebooks chosen for this study are represented in Table 3.3.

Table 3.3: Electronic Picturebooks downloaded to tablet.

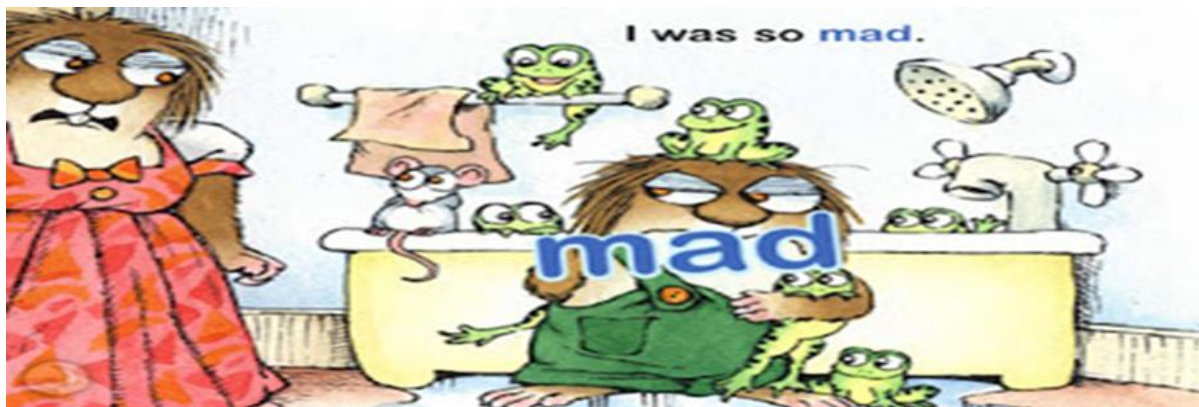
Title	Author	Publisher
All by myself	Mercer Mayer	Oceanhouse Media
The Lorax	Dr. Suess	Oceanhouse Media
Green Eggs and Ham	Dr. Suess	Oceanhouse Media
The Foot Book	Dr. Suess	Oceanhouse Media
Leo the Lightning Bug	Eric Drachman	Oceanhouse Media
When I get Bigger	Mercer Mayer	Oceanhouse Media
I Just Forgot	Mercer Mayer	Oceanhouse Media
Dr. Suess's ABC	Dr. Suess	Oceanhouse Media
Me Too	Mercer Mayer	Oceanhouse Media
One fish, Two Fish	Dr. Suess	Oceanhouse Media
Hop on Pop	Dr. Suess	Oceanhouse Media
Yertle the Turtle	Dr. Suess	Oceanhouse Media
I Was So Mad	Mercer Mayer	Oceanhouse Media
The Sneetches	Dr. Suess	Oceanhouse Media
5 Monkeys Jumping on the bed	Eileen Christelow	Oceanhouse Media
Just for You	Mercer Mayer	Oceanhouse Media
5 Monkeys Wash the Car	Eileen Christelow	Oceanhouse Media
I love you too	Ziggy Marley	Oceanhouse Media
Just Helping Dad	Mercer Mayer	Oceanhouse Media
Just a Mess	Mercer Mayer	Oceanhouse Media

Table 3.3, continued

Nothing Ever Happens at the South Pole	Stan and Jan Berenstain	Oceanhouse Media
Little Critter's ABC	Mercer Mayer	Oceanhouse Media
ABC Book for children	Oceanhouse Media	Oceanhouse Media
Goodnight Moon	Margaret Wise Brown	Oceanhouse Media
Alphabet zoo	Oceanhouse Media	Oceanhouse Media

Oceanhouse Media produced the most print salient interactivity of all publishers examined. The interactive design of the commercially prepared e-picturebooks mimics the print referencing strategy recommended to support print knowledge development. The text is highlighted when it is read or when it is touched. In addition, when hotspots in the graphics are activated, the print emerges from the picture. Figure 3.1 illustrates this interactivity.

Figure 3.1: Interactivity with print



The research design was grounded in play by allowing children to make all decisions on when and how to interact with electronic picturebooks. In electronic picturebooks, the child is able to control how he or she interacts with the book. The children can opt to have the book read to them, allowing them to read themselves or auto play. In the “Read to me” option, the book is

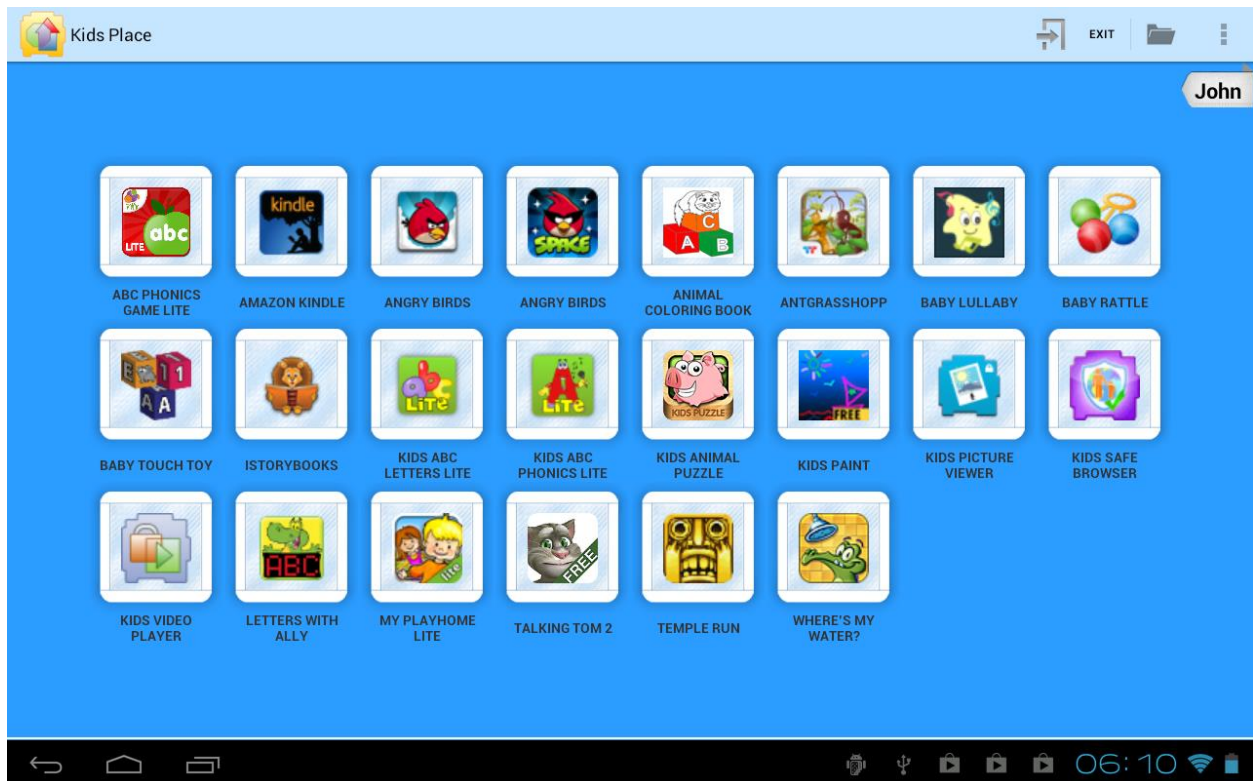
read to the child highlighting print as it is read. The “read to me” option also required children to turn the page to move forward with the story and hotspots could be activated. The “Read it myself” option allowed children to turn pages either forward or backward and to activate the hotspots in the book. The children had complete control of how they interacted with the book. The “autoplay” option reads the story and does not allow for interaction from the child. Figure 3.2 illustrates how children control how they interact with the book.

Figure 3.2: *Electronic picturebook options*



The Kids Place application was installed on the tablet so that the only applications available to the children are the picturebooks. Limiting children’s access to other applications controls for confounding variables of multiple types of applications. Exiting the Kids Place application required a password. Figure 3.3 illustrates this application.

Figure 3.3: Kids Place Application



An application usage tracker was installed to track how long each day the device was used. This application also tracked how long each book was open. The data from the app usage tracker were gathered weekly for each of the experimental classrooms.

In order to protect the device from accidents and breakage, it had a protective case and a screen protector. Headphones were also available for children. The tablet was added to the book/literacy center in the classroom and was available to the children each day during play for three months. The intervention dosage is a critical variable in this study because the screening tool used to assess children’s print knowledge and phonological awareness should not be repeated more frequently than three months apart to control for practice as a confounding variable. The children in the control classrooms experienced “business as usual” with access to

traditional print picturebooks in the library center and during shared picturebook reading.

Teachers in the control classrooms were instructed to follow their typical routines and strategies throughout the study. Teachers in the experimental groups were also instructed to follow their typical routines and teaching strategies but to not use the tablet for shared story reading.

Prior to introducing the tablet to the classroom, teachers were trained on how to use and charge the device as well as what their role is in the study. Since the research question looks at the role of play in the development of print knowledge, teachers were instructed to only provide technical support to the children when asked. They were not to interact with the children when they were reading with the tablet but could only help children who are having difficulty accessing the e-picturebooks provided. If children asked the teacher to read the e-picturebook, the teacher redirected the children to read and play independently. The teachers were also responsible for insuring that the device is charged each evening so that it is ready for children the following day. Teachers were not to make any other changes to their teaching practice or environmental design during the course of this study. This is an attempt to control for other possible variables within the classroom.

During the recruitment phase, the print environment of each classroom was assessed using the ECERS-E (The Four Curricular Subscales Extension to the Environmental Rating Scale; Sylva et al., 2011). To be included in this study, the print environment had to receive a score of 3 or below. This assessment was completed again at the end of the study. Assessing the print environment at the end of the study provided information on any improvements that may account for changes in children's knowledge and skill. This assessment tool is a reliable and valid tool for assessing program quality and program quality is positively correlated to children's development in cognition. Predictive validity for child outcomes relates to how this

measure is able to predict developmental progress over time. There is a significant positive correlation between the literacy subscale and children's pre-reading skills longitudinally over two years (Sylva et al., 2011). This indicates the validity of the scale in measuring classroom quality related to emerging academic skills (Sylva et al., 2011).

All teachers and parents were requested to complete a questionnaire at the beginning and end of the study that attempted to assess additional variables that may have influenced the results of this study. The questionnaire included gathering information on children's prior interactions with e-picturebooks, adult/child interactions that influence the development of print knowledge, the adult's knowledge of the importance of a print rich environment and teacher qualifications. Completing the questionnaire again at the end of the study indicated any changes in teacher or parent interactions with children that could account for changes in scores on the screening instrument. Appendix A includes the questionnaires distributed to families and teachers.

Children's print knowledge and phonological awareness were assessed using a pre/post design for both the intervention and control groups. I administered the revised *Get Ready to Read!* (GRTR) screening tool which was designed to screen children's print knowledge and phonological awareness. This instrument does not need training to administer, can be completed in 10-15 minutes and is easily interpreted. The GRTR! is norm referenced and significantly correlates with other instruments that measure the same or similar constructs (Lonigan & Wilson, 2008). The GRTR! was normed on 866 children who were 3-5 years old. The norming sample correlated to census data on demographic variables which supports the validity of the instrument. In addition, the GRTR! screening kit includes guidelines and scripts for administration.

Criterion predictive correlations, content sampling and age-related progression were examined to determine validity for the GRTR! instrument (Lonigan & Wilson, 2008). Content

sampling demonstrates that the items sample children’s knowledge of basic print concepts, concepts of written language, letter naming and letter-sound association. Internal consistency is .88 which is high and is within an acceptable range for all age groups (Lonigan & Wilson, 2008). Item correlations ranged from .30 to .81 with evidence of age progression. Item difficulty decreased from younger to older children (Lonigan & Wilson, 2008). Table 3.4 provides the item content and correlation for the screening tool.

Table 3.4: *Item Content of the Revised Get Ready to Read! Screening Tool*

Item	Item Content	Content Domain	p
1	Find picture that shows back of book.	Print Knowledge	.72
2	Find picture with letters.	Print Knowledge	.67
3	Find picture with letters.	Print Knowledge	.65
4	Find picture with word.	Print Knowledge	.77
5	Find picture that shows the name of the cereal.	Print Knowledge	.59
6	Find the letter R.	Print Knowledge	.74
7	Find the letter G.	Print Knowledge	.75
8	Find the letter that makes the /s/ sound.	Print Knowledge	.71
9	Find the letter that makes the /t/ sound.	Print Knowledge	.58
10	Find the letter that makes the /b/ sound.	Print Knowledge	.67
11	Find the letter F that is written the best.	Print Knowledge	.80
12	Find the name that is written the best.	Print Knowledge	.58
13	Find the longest story.	Print Knowledge	.81

Table 3.4, continued

14	Find the picture of the word that starts with the /b/ sound.	Phonological Awareness	.55
15	Find the picture of the word that starts with the /d/ sound.	Phonological Awareness	.64
16	Find the picture of the word that rhymes with “ball.”	Phonological Awareness	.44
17	Find the picture of the word that is “sea -- shell.”	Phonological Awareness	.76
18	Find the picture of the word that is “pen -- guin.”	Phonological Awareness	.74
19	Find the picture of the word that is “m -- oon.”	Phonological Awareness	.59
20	Find the picture of the word that rhymes with “arm.”	Phonological Awareness	.57
21	Find the picture of the word that rhymes with “hat.”	Phonological Awareness	.50
22	Find the picture that has numbers in it.	Print Knowledge	.42
23	Find the one that shows how to write two words.	Print Knowledge	.37
24	Find the word that is written the best.	Print Knowledge	.47
25	Find the picture that is “scar” without “sss.”	Phonological Awareness	.40

(Lonigan & Wilson, 2008)

Scoring for this instrument converts raw scores into standard scores with a standard deviation of 15. Scores can range from greater than 130 to less than 70. A score ranging from 90-110 is considered average. A low score could indicate that the child has had limited exposure to print related concepts and would benefit from increased activities that target these skills.

Table 3.5 provides the standard deviations for the raw score and ranks the scores to indicate skill level.

Table 3.5: Interpreting Standard Scores for the Get Ready to Read Screening Tool

> 130	Very Superior
121 – 130	Superior
111 – 120	Above Average
90 – 110	Average
80 – 89	Below Average
70 – 79	Poor
< 70	Very Poor

(Lonigan and Wilson, 2008)

Lastly, the experimental classrooms were observed during a shared picturebook reading with traditional print picturebooks. The observations were conducted over the three months of the study. Gathering information on the teacher’s strategies to support development of print knowledge during shared picturebook reading provided additional data that can identify possible variables in the findings. Children were also observed using the tablet in the experimental classrooms. This provided some insight into how children interacted with the e-picturebook.

The initial research design was changed slightly before the study was undertaken. The first change was in the e-picturebooks provided on the tablets. The e-picturebooks in the research design were changed due to the unavailability of those titles in the digital format. The books initially identified the use of print strategies that are meant to support the development of print knowledge. Since these were unavailable, e-picturebooks with interactivity that focuses on print were used.

A second change in the research design was on the number of classroom observations that were conducted. Due to time and resource constraints, only teacher led storybook reading was observed in the experimental classrooms. Control classrooms were not observed. The

observations conducted did highlight that the teachers in the experimental classrooms were not using dialogic reading or print referencing strategies.

In conclusion, this intervention study gathered data to answer the primary research question of whether e-picturebooks on hand held devices support the development of print knowledge in low literacy environments for very young children. This mixed method design provided depth and breadth of data in order to determine both statistical and practical significance of the findings and guide interpretations.

CHAPTER 4: RESULTS

This study hypothesized that young children's print knowledge would increase when interacting with electronic picturebooks in play and that commercially available e-picturebooks can support development in a low literacy environment. A repeated measures analysis of variance was performed to examine the differences between pre and post test scores on the *Get Ready to Read (GRTR-R)* screening tool. The primary independent variable was the amount of time children interacted with the electronic picturebooks during play. The interaction between the children's age and e-picturebooks read was also examined. Finally, the pre and post test scores on the Environmental Rating scales were examined to identify any changes in the literacy environment.

The sample consisted of 67 (N=67) children ranging in age from 36-62 months old who attended childcare centers located in low income, suburban neighborhoods. The duration of the study was three months as recommended by Whitehurst and Lonigan to avoid practice effects or fatigue bias. The repeated measures ANOVA examined the difference between the overall pre and post screening scores, the difference in scores for print knowledge and the difference in the scores for phonological awareness.

The first research question was whether electronic picturebooks support the development of print knowledge when added to the literacy environment. The means and standard deviations for the pre-test and post-test scores for print knowledge are contained in Table 4.2.

Table 4.2: Means and Standard Deviations for Print Knowledge at the Pre-Test and Post-test.

	Means and (Standard Deviations) at Pre-test	Means and Standard Deviations at Post-Test	Group Mean
Control Group (N = 33)	6.82 (3.76)	7.21 (3.16)	7.02
Experimental Group (n = 34)	7.29 (3.16)	6.82 (3.41)	7.05
Pre-Post Means	7.06	7.01	

The homogeneity of variance and the sphericity assumptions were checked prior to the analysis and both were found to be non-significant. The results for the repeated measures ANOVA are presented in Table 4.3.

Table 4.3: Repeated Measures ANOVA Summary Table for Print Knowledge

Source	SS	df	MS	F	Sig.	Partial Eta Squared
Group	.064	1	.064	.003	.955	.000
Pre-Post	.049	1	.049	.011	.916	.000
Group by Pre-Post	6.258	1	6.258	1.412	.239	.021

As shown in Table 4.3, none of the terms are significant. As such, the data show that children interacting with the e-picturebooks had no effect on print knowledge. Moreover, the children, whether in the experimental or control classrooms, did not demonstrate a change in print knowledge during the duration of the study.

The means and standard deviations for phonological awareness at the pre-test and post-test are presented in Table 4.4.

Table 4.4: Means and Standard Deviations for Phonological Awareness at the Pre-Test and Post-test.

	Means and (Standard Deviations) at Pre-test	Means and Standard Deviations at Post-Test	Group Mean
Control Group (N = 33)	4.45 (2.76)	4.91 (2.92)	4.68
Experimental Group (n = 34)	4.74 (2.66)	5.41 (2.96)	5.07
Pre-Post Means	4.59	5.07	

The homogeneity of variance and sphericity assumptions were checked and were not significant.

The results of the repeated measures ANOVA are presented in Table 4.5.

Table 4.5: Repeated Measures ANOVA Summary Table for Phonological Awareness

Source	SS	df	MS	F	Sig.	Partial Eta Squared
Group	5.14	1	5.14	.375	.542	.006
Pre-Post	10.71	1	10.71	4.74	.033	.068
Group by Pre-Post	.412	1	.412	.183	.671	.003

As shown in Table 4.5, there is a non-significant main effect for group and a non-significant interaction. The main effect for Pre-post is significant. As shown in Table 4.4, the children, in general, gained about half a point between pre-test and post-test. This difference, however, cannot be attributed to the use of e-picturebooks.

The second research question was whether children would choose to read e-picturebooks on the tablet during play. Children in the experimental classrooms averaged six hours a week of tablet use. Children had access primarily in the morning between 9 am to 12 pm since groups were mixed at other times of the day. Since it was impossible to track the amount of time each child used the tablet, allowing tablet use by children not in the study would have confounded these results. The amount of time spent on the tablet was collected weekly using the app usage

tracker. It should be noted that two children in two different classrooms were able to exit the Kids Place application by entering the password found on the back of the tablet.

The frequency of children’s use of the electronic picturebooks was analyzed with all children reading *5 Monkeys Jumping on the Bed* and *ABC Book for Children* although all 25 e-picturebooks were accessed throughout the study. The amount of time children interacted with the books ranged from 1 minute to 201 minutes. Any amount of time over 100 minutes was removed from the dataset since the app usage tracker would continue to track if the book was left open. The App Usage Tracker was not able to track individual use so it is unknown which children used the tablet and for how long. Table 4.6 gives the average amount of time children spent on each book over the three months of the study.

Table 4.6: E-picturebooks Frequency of Use

Title	Author	Frequency
All by myself	Mercer Mayer	2%
The Lorax	Dr. Suess	2%
Green Eggs and Ham	Dr. Suess	9%
The Foot Book	Dr. Suess	2%
Leo the Lightning Bug	Eric Drachman	4%
When I get Bigger	Mercer Mayer	3%
I Just Forgot	Mercer Mayer	2%
Dr. Suess’s ABC	Dr. Suess	5%
Me Too	Mercer Mayer	2%
One fish, Two Fish	Dr. Suess	4%
Hop on Pop	Dr. Suess	2%

Table 4.6, continued

Yertle the Turtle	Dr. Suess	>1%
I Was So Mad	Mercer Mayer	5%
The Sneetches	Dr. Suess	>1%
5 Monkeys Jumping on the bed	Eileen Christelow	>1%
Just for You	Mercer Mayer	1%
5 Monkeys Wash the Car	Eileen Christelow	5%
I love you too	Ziggy Marley	8%
Just Helping Dad	Mercer Mayer	2%
Just a Mess	Mercer Mayer	3%
Nothing Ever Happens at the South Pole	Stan and Jan Berenstain	4%
Little Critter's ABC	Mercer Mayer	2%
ABC Book for children	Oceanhouse Media	>1%
Goodnight Moon	Margaret Wise Brown	12%
Alphabet zoo	Oceanhouse Media	22%

These data indicate that most of the books were accessed by the children and they spent the most amount of time interacting with *Green Eggs and Ham*, *I Love You, Too*, *Goodnight Moon* and *Animal Zoo*. These data are also supported by teacher report and my observations.

Family questionnaires were also distributed at the beginning and the end of the study. There was a very low response rate but of the families that responded, the responses indicate that the children have access to electronic devices on a daily basis. Based of parent report, children use cell phones, tablets, laptop computers and desktop computers primarily for playing games while at home. The amount of time children spend interacting with digital media varied

considerably with some families reporting little use to several hours per week. Each family also reported reading to the children daily but mainly with traditional print books. This supports the Commonsense Media report that the reading of books has not increased with the availability and mobility of electronic picturebooks and indicates that children do not generally choose e-picturebooks at home.

The third research question is whether there is a relationship between the literacy environment (the childcare classroom) and e-picturebooks on the development of print knowledge. An environmental observation was conducted on each classroom in a pre-post design. The literacy subscale of the Environmental Rating Scale-E was used for this assessment. A score of five or higher indicates a high quality literacy environment. The means and standard deviations are presented in Table 4.7 and the ANOVA results in Table 4.8.

Table 4.7: Means and Standard Deviations for Classroom Observation Data

	Means and (Standard Deviations) at Pre-test	Means and Standard Deviations at Post-Test	Group Mean
Control Group (N = 3)	3.20 (.35)	3.47 (.61)	3.33
Experimental Group (n = 3)	2.87 (.51)	3.25 (1.12)	3.06
Pre-Post Means	3.03	3.36	

Table 4.8: Repeated Measures ANOVA Summary Table for Classroom Observation Data

Source	SS	df	MS	F	Sig.	Partial Eta Squared
Group	.224	1	.224	.27	.630	.063
Pre-Post	.320	1	.320	1.79	.251	.310
Group by Pre-Post	.011	1	.011	.061	.818	.015

As shown in Tables 4.7 and 4.8, the classroom scores did not indicate a high quality literacy environment and there was not a significant change in the scores from the beginning to

the end of the study. This indicates that teachers did not change the literacy environment or teaching strategies over the course of the study.

Each experimental classroom was observed during a shared storybook time and teachers did not use the print referencing strategy nor did they provide instruction on the structure of the book. The null result for the experimental classrooms indicates that e-picturebooks cannot override the negative influence of a low literacy environment. Teachers also reported having a foundational understanding of the importance of print knowledge in children's literacy development but indicated using developmentally inappropriate strategies (i.e. worksheets) to teach this skill. The observations of the children interacting with the e-picturebooks showed that children enjoyed the music, chose the "read by myself" option, and randomly activated hotspots in the book.

In conclusion, there were no positive significant results in the dependent variable as a result of this intervention. This interpretation is supported by the qualitative data gathered.

CHAPTER 5: DISCUSSION

Children entering kindergarten lacking print knowledge may never read on grade level (Piasta et al., 2013). This is a powerful assertion and highlights the need for high quality literacy environments in childcare classrooms. Preschool age children spend up to ten hours a day in childcare and classroom teachers are responsible for providing not only high quality care but also high quality education. With up to twenty children in a classroom, teachers have many tasks throughout the day that are necessary for children's well-being but often distract from reading to them. In addition, the teachers are often unaware of the strategies that support the development of print knowledge when reading picturebooks. Thus, it is reasonable to hypothesize that adding technology to the classroom provides additional experiences with picturebook reading. Since electronic picturebooks mimic strategies found to support print knowledge, this study focused on this technology to investigate if it would have the same efficacy when an adult was not available or trained to read to the children. The variables of time spent interacting with electronic picturebooks in play and the literacy environments were analyzed to answer the research questions. The lack of significance in the results is indicative of one critical missing variable, the teacher. Excluding the teacher as a variable was intentional to determine if the added experiences with e-picturebooks on mobile devices could override not having an adult available. The lack of significance across the analyses indicates that highly qualified teachers are needed to read both traditional print picturebooks and electronic picturebooks to support young children's development of print knowledge. This interpretation is supported in prior research.

The interactive design of the commercially prepared e-picturebooks mimics adult reading with a focus on print. The text is highlighted when it is read or when it is touched (FIG 3.1). In

addition, when hotspots in the graphics are activated, the print emerges from the picture. This is similar to the print referencing strategy proposed by Justice and Piasta (2013) and is meant to help children create meaning about print. It was reasonable to expect that this design would support print knowledge development since it mimics a strategy shown to be effective with traditional print books and makes the print salient. The results indicate that the interactive design of the electronic picturebook does not have the same efficacy as strategies designed for a teacher to use when reading to young children. The interactivity of electronic picturebooks may be more effective when the teacher uses joint attention strategies to focus the children's attention on the print. This interpretation is supported by prior research on the role of the teacher on emergent literacy. The research highlighted the need for teachers to provide balanced instruction and play with print to support development. Technology can be added to the learning environment as a tool to supplement balanced instruction and play but the teacher is still the most critical intervention for providing a print rich environment. Storybook reading with a teacher or parent that includes reading electronic picturebooks is still the most critical factor in supporting children's development of print knowledge. Technology cannot replace the teacher.

One of the findings in the literature review indicated that play is necessary but not sufficient for learning about print knowledge. The research proposes that explicit instruction on print knowledge is needed to learn this skill. The explicit instruction can be imbedded in play by a skilled teacher but play itself is not enough. The research design was grounded in play by allowing children to make all decisions on when and how to interact with electronic picturebooks. In electronic picturebooks, the child is able to control how he or she interacts with the book (FIG 3.2). It was hypothesized that when children engaged with print in a play context, that print knowledge would increase. Based on the lack of significant results, prior

research was supported. Play with e-picturebooks is not sufficient for learning print knowledge. An adult is needed to help children attend and give meaning to the print.

The National Association for the Education of Young Children recommends that teachers should use the same strategies as print picturebooks when reading electronic picturebooks. This study supports this recommendation. Based on the findings of this research, it is recommended that teachers and other adults read electronic picturebooks with the children using joint attention and print referencing strategies. The teacher should draw children's attention to the text that emerges from the pictures and support the child in creating meaning. The efficacy of electronic picturebooks used in play to support the development of print knowledge is unfounded but there are many limitations to this study. Since this study was done in a natural environment, it was impossible to control for all variables. Further research is needed to control for some of these variables.

Limitations

One limitation of this study is the age of the children. Children in this stage of development are limited in their thinking and are diverse in their development which makes testing difficult. Even though the screening tool is valid and reliable, the children in this study may have limited experience. Generally, assessment of young children in childcare classrooms is done using a portfolio strategy. Child products, objective teacher observations, and checklists are what make up the portfolio artifacts. Not being familiar with a testing environment or the researcher may have skewed some of the responses given. During the screening, some of the children exhibited confusion by pointing to more than one picture in their response.

A second limitation is the lack of data on how children interacted with the e-picturebooks on the tablet. It was impossible to determine whether all children engaged with the tablet, how

long individual children engaged with the tablet and what hotspots they activated. A child was observed using the tablet and she sat for one minute listening to the music at the beginning of the book without ever starting the book. Being able to gather data on how, when and for how long children interacted with the e-picturebooks would provide richer data.

A third limitation is the amount of time spent on the tablet. Tablet use averaged out to be six hours per week. The tablets were available to the children primarily between 9:00 am and 12 pm. Averaged out over the week, the tablet was in use two and half hours a morning. More time spent playing with the electronic picturebooks may produce a significant difference in the development of print knowledge. This limitation was in the operation of the child care center. The children in the control classrooms were mixed with the children in the experimental classroom during early morning and late afternoon with the primary teaching time occurring in the morning. The remainder of the day is made up of routine care routines like meals and nap. Having the tablet available during the more unstructured times of the day may have produced a different result. Teachers would also have more time to read with the children during these times.

A fourth limitation is the e-picturebooks versus a game application. Commonsense Media (2012) reports that children are more likely to play games on mobile devices than to read picturebooks. In fact, they report that even though electronic picturebooks are more readily available, the amount of time spent in picturebook reading has not increased. The parents who responded to the family questionnaire supported this. All parents reported children played games on a mobile device and most did not read picturebooks on these devices. This was also highlighted when two children in different centers “hacked” out of the Kidspac lock out program using the password taped to the back of the tablet. The teachers reported that the

children were looking for the games. I was present when a child walked up to the teacher with the message that the internet was blocked asking how she can get to “Warcraft”. This would point to a lack of interest by the children since their primary experience with mobile devices is playing games.

A fifth limitation to this study is the inability to control for accessibility and use of mobile devices outside of the classroom. The response rate for the family questionnaires was low but all that were returned reported that children had daily access to a mobile device with apps. Most reported children using cell phones. All reported reading traditional print books with their children on a daily basis. Children with little or no access to technology or who are not read to daily may benefit more from having access to e-picturebooks on mobile devices in the classroom.

Lastly, this study is not generalizable to the population of all preschool age children in childcare classrooms. There is great diversity in how childcare classrooms are operated, teaching strategies used, qualifications and experience of the teachers and the children who attend them. This diversity does not allow for generalizability to other classrooms or children.

Future Research

Even though this study did not have positive significant results, it does provide a foundation for future research. One significant change to this research design would be to conduct a more rigorous mixed method study. Adding a stronger qualitative design to accompany the quantitative data would provide more depth and would provide insight into the children’s learning. Video recording and analysis of children engaging with print during play and e-picturebook reading with a teacher would help to interpret the quantitative screening results. It would also highlight if the age of the children or the screening tool was confounding

results. Also, a qualitative study would provide insight into how the children interacted with the e-picturebooks. This would make the screening data more valid and interpretable.

Future research should also add the teacher into the design. Since it is interpreted that the missing variable in this study is the teacher, having the teacher and children read the e-picturebooks together may result in a positive significant difference in children's print knowledge. Having the teacher use the same strategies recommended for reading print picturebooks would give insight into whether these strategies are effective in the digital environment.

The interactive design of electronic picturebooks should also be examined in future research. It is possible that the interactive component of highlighting print and having print emerge from the graphics distract children from creating meaning about print. The lack of significant results could be due to the e-picturebook design. Finding electronic picturebooks that had a focus on print proved difficult and only one publisher provided e-picturebooks with this focus. More study is needed to identify the interactive components that support print knowledge development.

Recommendations for Educators

This study was developed to add to the literature on technology use with children, specifically the use of mobile devices. Even though there were no significant results, there are still several recommendations that can be made for use of this technology in the early childhood classroom.

1. Tablet use whether with e-picturebooks or games should not be used as a babysitter.

The teacher, parent or other adults should monitor children's use and interact with the children while they are using the technology.

2. Electronic picturebooks should mimic traditional print picturebooks including having a cover, title page, copyright page and dedication page. There should be a clear beginning and ending to the book.
3. Attention needs to be given to the interactive components of the electronic picturebooks and to choose e-picturebooks that have interactive components that focus on print.
4. Teachers should follow the recommendation of the National Association for the Education of Young Children to keep screen time to a minimum and read electronic picturebooks using strategies recommended for traditional print books.
5. Mobile devices can be used as a tool in the classroom but should not replace balanced instruction on print knowledge.

Recommendations for Publishers of electronic picturebooks

This study also provides evidence to inform publishers on designing electronic picturebooks to support young children's development of print knowledge.

1. Consider removing the "Play by myself" option and only allow the options of "Read to me" or "Autoplay". This way children will be forced to listen to the story before they are able to activate the interactive components.
2. Maintain the structure of a traditional print book in the digital environment. Include a title page, copyright page, page numbers and an end page.
3. Have the print emerge from graphics but focus on new vocabulary instead of having multiple hotspots which may be distracting.
4. Do not "gamify" electronic picturebooks. This distracts from the primary purpose of the picturebook which is to tell story.

5. Choose high quality children's literature whose design is intended to focus children's attention on the text. Consider using resources like the American Library Association, Goodreads, Caldecott and Newberry Awards to identify high quality children's literature.

Conclusion

This study adds to the literature on the use of technology tools and the development of children's print knowledge. Even though there were not positive significant gains in print knowledge with the use of electronic picturebooks, this study does highlight the need for more research on this topic. Young children are interacting with technology in multiple platforms with multiple applications. Also, technology is ever changing and the digital text comes in many forms. The research community needs to continue to study how mobile devices can support young children's literacy learning and be used as a teaching tool. It is especially important to continue to study very young children to build a repertoire of evidence to guide teachers and families on choosing devices, applications and other electronic media to support emergent literacy development.

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APPENDIX A: Family Questionnaire

Dear Families,

My name is Jean Allison and I am a doctoral student at Temple University. My research goal is to study how electronic picturebooks support young children's emergent literacy development. This study will add a tablet computer with interactive electronic picturebooks to the classroom for your child to play and interact with. Your child's teacher will assess the children's literacy knowledge using the "Get Ready to Read" screening tool at the beginning and the end of the study. Results of the study and your child's current literacy skills will be shared with you at the completion. There is minimal risk to your child to participate and may teach them important literacy skills.

Please respond to following questions and return to your child's teacher.

Thank you very much for participation.

Sincerely,

Jean C. Allison
Student Investigator, Temple University

1. Do you currently use technology to read books, magazines, or newspapers?
2. What type of device do you use? Cell phone, tablet, laptop computer or desktop computer
3. Does your child have access to the technology on a daily basis?
4. What type of device does your child use- cell phone, tablet, laptop computer or desktop computer?
5. What does your child usually do on this device? Read books, play games etc.
6. How often do you read traditional books to your child?
7. Do you read electronic books with your child?
8. Does your child read electronic books by themselves?
9. How much time do you think your child spends using technology while at home?

APPENDIX B: Teacher Questionnaire

Please indicate whether you strongly agree (SA), agree (A), are neutral (N), disagree (D) or strongly disagree (SD) to the following statements.

As a teacher I believe children

should not write until teachers show them how to form each letter. SA A N D SD

do not need to be taught the names of each letter because children can learn to read without knowing each letter and its name SA A N D SD

need to hear the same story more than once or twice. SA A N D S

Learn ending sounds by circling pictures of things that rhyme on worksheets. SA A N D SD

Learn letter names by singing the ABC song. SA A N D SD

Should look at books to help them learn to read. SA A N D SD

Do not need to hear many stories in order to become good readers. SA A N D SD

Need to be taught the names of each letter so they will be good readers SA A N D SD

Can be taught letter names as they write their names. SA A N D SD

Please provide a brief response to the following questions.

How do you currently teach children about print and the alphabet?

How do you currently use technology in the classroom?

Briefly describe the strategies you use when you read picturebooks to children. (Asking questions for example).