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LOYOLA UNIVERSITY CHICAGO

EMERGENT LITERACY SKILLS IN PRINT AND ELECTRONIC CONTEXTS:
THE INFLUENCE OF BOOK TYPE, NARRATION STYLE, AND ATTENTION

A DISSERTATION SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

PROGRAM IN DEVELOPMENTAL PSYCHOLOGY

BY

KATHRYN J. O'TOOLE

CHICAGO, ILLINOIS

AUGUST 2015

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ABSTRACT

Preschoolers can learn words and story content from traditional print books, but there has been no direct comparison of their learning from print and e-books while controlling for narration style. Additionally, very little empirical work has utilized a tablet e-book as the majority of research has examined learning from computer e-books. The current project examined how 4-year-olds ($N = 100$) learned words and story content from four different book reading contexts: a print book read aloud by a live adult, a print book narrated by an audio device, a tablet e-book read aloud by a live adult, or a tablet e-book narrated by an audio device. Children's prior experience with tablet e-books and their attention to the book were also measured and included in analyses. When prior experience was included, preschoolers learned more words from the e-book than the print book but only for those without prior experience reading tablet e-books with someone. Furthermore, regardless of experience, children learned more words in the audio narration conditions than in the live reader conditions. When attention was included, preschoolers who were more attentive learned more words than those who were less attentive but only for those who were read a print book by a live adult. Notably, there was a trend for preschoolers to learn more story content from the live reader than an audio device regardless of book type. Our results are consistent with theories of emergent literacy in the digital world, which are situated in a sociocultural perspective.

Key words: attention, emergent literacy, electronic books, tablet, preschoolers

CHAPTER ONE

GENERAL INTRODUCTION

Children learn about the world through interactions with more skilled peers and adults (Rogoff, 1990; Vygotsky, 1978). Traditionally, shared book reading has served as an opportunity for social interaction to facilitate children's emergent literacy skills (Dickinson & Smith, 1994), and historically, the majority of this work has been studied using traditional paperbound books. As electronic books (e-books) become more and more prevalent, the literature is expanding as researchers also study book reading in the electronic context. Theories of shared book reading, in an electronic context, are also situated within sociocultural theory (Neumann & Neumann, 2014; Yelland & Masters, 2007). These theories suggest that through scaffolding, children can learn from e-books. In this area of work, scaffolding has been conceptualized as both a tool and a technique (Rosenshine & Meister, 1992; Yelland & Masters, 2007). In the context of book reading (traditional print book reading and contemporary e-book reading), the book itself (e.g., print, electronic) and components of the book (e.g., audio narration) can be viewed as scaffolding tools. On the other hand, the behaviors and comments made by the adult comprise scaffolding as a technique. The current project sought to better understand scaffolding tools while holding technique constant.

In research comparing book reading in electronic and paper contexts, an adult typically reads the print book to the participant, and the electronic device (most often a

computer) typically “reads” (i.e., audio narrates) the book to the participant. A component that has been frequently overlooked in this area of work is the interactive influence of book type *and* narration style (i.e., the scaffolding tools). In fact, book type and narration style have frequently been confounded in research investigating how children learn from print and e-books. Although this confound is discussed in detail in a subsequent section, it is important to inform the reader that the primary goal of the current project was to disentangle this confound in order to better understand scaffolding as a tool. To do so, four conditions were utilized: live print book, live e-book, narration print book, and narration e-book. In the live conditions, a live adult read the book aloud, and in the audio narration conditions, the audio device narrated the story to the child. In the print conditions, the child followed along on a traditional print book, and in the e-book conditions, the child followed along on an iPad book. By doing so, we examined how scaffolding tools (books, narration) influence literacy development during book reading, an event that still takes place in a sociocultural context despite being digitized.

The present dissertation adopts the format described in the Developmental Training Track Policies and Procedures Manual (2012-2013). The dissertation format is a journal article “book ended” with a general introduction and general discussion. The current chapter and purpose of the general introduction is to describe the background literature in depth. Six sections comprise this first chapter. The first section defines and describes emergent literacy. The second, third, and fourth sections review the extant literature on how emergent literacy skills are fostered from print books, television, and e-books, respectively. Television research is included because e-books are similar to

television in multiple ways. The fifth section describes the role of attention in learning from media. Attention has been measured to a variety of cognitive tasks (e.g., toy play, task completion, television viewing) to better understand how goal-oriented attention facilitates performance. However, it has not been measured in book reading research. Attention to the book was measured to better understand the relation between attention and learning in different book reading contexts. The final section briefly describes the current project. Following the general introduction is the dissertation in journal article format. Specifically, Chapter 2 through Chapter 5 contain the elements of a standard journal article (introduction, methods, results, and discussion). The final chapter commences with a broad and more generalized discussion of the current project and more deeply explores the implications of the findings. In sum, Chapter 1 and Chapter 6 book end the journal article formatted report. Additional analyses, not included in the journal article, can be found in Appendix A (i.e., the child-report questionnaire and results, analyses examining word type, and focused attention results).

The Importance of Emergent Literacy Skills

Emergent literacy refers to the knowledge and abilities that are developmental precursors to conventional reading (Clay, 1966; Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998). Even as research on emergent literacy began to emerge, further research was warranted given the importance of emergent literacy for developing conventional reading abilities and literacy skills (Bloom, 1964; Hart & Risely, 2003; Lonigan, 1994; Lonigan, Schatschneider, & Westberg, 2008; National Research Council, 1998; Scarborough & Dobrich, 1994; Storch & Whitehurst, 2002; Teale & Sulzby, 1986).

The current project examined two important emergent literacy skills: word learning and story comprehension (Dickinson & Smith, 1994; Whitehurst & Lonigan, 1998). Word learning is an important emergent literacy skill because vocabulary level during the preschool years has been shown to predict later academic achievement (Hart & Risely, 2003). Although direct instruction (i.e., explicitly teaching children words and their meanings) accounts for gains in vocabulary during the preschool years, it is not the sole mechanism for fostering word learning. A large body of work suggests listening to adults read books aloud is an excellent forum for enhancing vocabulary in young children (Dickinson & Smith, 1994; Elley, 1989; Ewers & Bronson, 1999; Jenkins & Dixon, 1983; Nagy, Anderson, & Herman, 1987; Robbins & Ehri, 1994; Sénéchal, 1997; Sénéchal & Cornell, 1993; Sénéchal, Thomas, & Monker, 1995). Because shared traditional book reading is beneficial for facilitating vocabulary development, one goal of the current project was to examine if this finding extended to other book reading contexts. In addition to examining how preschoolers learned words from print books read aloud by an adult (i.e., the traditional method), the project also examined whether preschoolers learned words in other contexts (i.e., from print and e-books narrated by an audio device and from e-books read aloud by an adult).

Story comprehension refers to children's ability to infer story content from book reading. According to van Kleeck (2008), inferencing is at the core of story comprehension (see also van den Broek et al., 2005). Inferencing refers to when "a reader or listener goes beyond the information directly provided by the text [or story] to fill in information needed to understand the text [or story]" (van Kleeck, 2008, p. 628). For preschoolers (i.e., pre-readers), story comprehension requires children to understand the

causal events of stories *read aloud* (van Kleeck, 2008). That is, preschoolers make meaning from listening to an adult read a story. They do not yet make meaning from reading text. Difficulty with inferencing causes problems with story comprehension (Cain & Oakhill, 1999; van Kleeck, 2008), and because achievement gaps are established before the formal school years, it was important to include story comprehension as an outcome variable in the current project. In turn, we were able to understand how story comprehension differed as a function of book type (print, electronic) and narration style (live reader, audio narration). As mentioned, book reading is an important activity for fostering word learning and story comprehension, and so the next section describes how traditional book reading during early childhood nurtures these emergent literacy skills.

Learning from Books in Early Childhood

A large body of work supports the finding that shared book reading facilitates emergent literacy skills (Bus, Leseman, & Keultjes, 2000; Chomsky 1979; Clark 1978; Davidse, de Jong, Bus, Huijbregts, & Swaab, 2011; Durkin, 1966; Hindman, Skibbe, & Foster, 2014; Hindman, Wasik, & Erhart, 2012; Mol & Bus, 2011; National Research Council, 1998; Scarborough & Dobrich, 1994; Teale, 1987). Before books were digitized, literacy skills were fostered through this highly valued sociocultural activity. The present section reviews research on how preschoolers learn words and story content from traditional print books, which have typically been read aloud by a live adult. Reviewing this research is warranted because (a) the methods utilized in the current project were adapted from traditional book reading research and (b) in one of the conditions in the current project preschoolers were read a traditional print book by a live reader.

Word learning from books. There is substantial evidence suggesting shared book reading promotes young children's vocabulary development (Elley, 1989; Jenkins & Dixon, 1983; Ninio, 1983; Richman & Colombo, 2007; Robbins & Ehri, 1994; Sénéchal, 1997). Interestingly, prior work that has measured how children learn words from books has followed similar procedures (e.g., Ard & Beverly, 2004; Brackenbury & Fey, 2003; Elley, 1989; McLeod & McDade, 2011; Pemberton & Watkins, 1987; Sénéchal, 1997; Sénéchal & Cornell, 1993; Sénéchal et al., 1995). In general, children listen to an adult read a story aloud, and target words (e.g., unfamiliar words, nonsense words) are embedded in the story, which serve as the words children are expected to learn. After listening to the story, children are tested on their knowledge of the target words from the book. For example, work by Sénéchal and colleagues (Sénéchal, 1997; Sénéchal et al., 1995) has revealed preschoolers recognize unfamiliar words (e.g., angling) after being read a book, and other work has revealed children recognize nonsense words (e.g., tib) after being read a book (McLeod & McDade, 2011). An effective way to measure word learning is to utilize a receptive test of vocabulary, where children are shown a series of plates with one picture per quadrant and (for each plate) are asked to point to the image that depicts the target word (McLeod & McDade, 2011; Sénéchal, 1997; Sénéchal et al., 1995). A similar test was utilized in the current project. Because we could not pre-test participants on their knowledge of unfamiliar words, we utilized nonsense words to ensure none of the children had experience with the target words prior to participating.

Importantly, procedural variations can influence the number of words children learn from book reading. For example, preschoolers learn more words from a book read

aloud multiple times versus just once (McLeod & McDade, 2011; Sénéchal, 1997).

Preschoolers also learn more words when they label the target word during the reading session (Sénéchal et al., 1995). Finally, a preschooler's current vocabulary, as measured by a standardized vocabulary test, facilitates word learning from books (McCormick & Mason, 1986; Sénéchal et al., 1995). That is, those with high standardized vocabularies recognize more target words than those with low standardized vocabularies. Therefore, in order to foster word learning in the current project, we utilized strategies that would help, not hinder, children's word learning. Participants were read the book twice, and they labeled the target words in all conditions. We used a standardized vocabulary assessment so that we could control for vocabulary in the analyses.

In sum, word learning from books is robust during the preschool years (Elley, 1989; Jenkins & Dixon, 1983; McLeod & McDade, 2011; Ninio, 1983; Richman & Colombo, 2007; Robbins & Ehri, 1994; Sénéchal, 1997; Sénéchal et al., 1995). The current project adapted the methodology from this prior work. Because the goal was to measure how book type and narration style influenced word learning, we wanted children's opportunity to learn words to be optimal and the same across conditions. That is, we utilized the conditions prior work has revealed to be helpful in fostering word learning (multiple readings, labeling) and took prior vocabulary into account. We applied the same logic for story comprehension.

Story comprehension. Another important emergent literacy skill is children's ability to understand story material. Early story comprehension is related to later reading comprehension (Dickinson & Snow, 1994), reading achievement (Scarborough, 1998), and reading fluency (Sénéchal & LeFevre, 2002). For preschoolers, comprehending text

requires understanding stories read aloud as they cannot read text yet (van Kleeck, 2008). Preschoolers must construct a representation through aural (listening to the story) and visual (pictures in the book) modalities. In order to tap story comprehension, many researchers have asked children open-ended questions about story content after book reading (Kouri & Telander, 2008; Mira & Schwanenflugel, 2013; Roberts, 2013; Stevens, van Meter, & Warcholak, 2010; Strasser, Larraín, & Lissi, 2013; Vivas, 1996).

One area that has received extensive study is how variation in story reading style influences children's story comprehension. Parental reading strategy (Roberts, 2013), pitch variation in reading (Mira & Schwanenflugel, 2013), and singing versus speaking (Kouri & Telander, 2008) have all utilized story comprehension as an outcome measure. Although story reading style did not differ between the conditions in the current project, narration style did. Similar to the prior work that has manipulated reading style, we manipulated narration style, and thus, story comprehension is a valid indicator of what children learn from book reading. To measure story comprehension, children have been asked *Wh*-questions in order to measure comprehension [e.g., "Who are the main characters?" (Kouri & Telander, 2008); "What happened at Ray and Bunny's magic show downtown?" (Mira & Schwanenflugel, 2013)]. In the current project, children were asked a series of open-ended *Wh*-questions to obtain a measure of story comprehension.

An important procedural difference in the work just described is the use of a live reader versus audio narrator. For example, participants in Mira and Schwanenflugel's (2013) study listened to stories narrated by an audio device as they followed along on a traditional print book whereas the participants in other studies (Stevens et al., 2010; Strasser et al., 2013; Vivas, 1996) listened to an adult read a traditional print book aloud.

Thus, the finding that preschoolers were able to answer comprehension questions after listening to a live reader or audio device (while looking at a traditional print book) is relevant and important to the current study. Overall, the use of *Wh*-questions is a valid measure of story comprehension and a useful way to measure the content children learn from a book reading session, regardless of narration style.

Book reading: Concluding thoughts. The past work illustrates that shared book reading facilitates word and story learning. Greater parent-child book reading during the early years is associated with greater vocabulary development and improved reading comprehension later in life (Bus, van IJzendoorn, & Pellegrini, 1995; van Kleeck, 2008). In the current project, children's word learning was measured using a receptive test, and story comprehension was measured by asking children *Wh*-questions; these tasks are consistent with those utilized in prior work (e.g., Kouri & Telander, 2008; Sénéchal, 1997). The current project extends traditional methodology to better understand how children learn from books in traditional and contemporary contexts. Book type (print, electronic) and narration style (live reader, audio narration) were varied to better understand how these scaffolding tools affected a very important and valued activity in early childhood, book reading.

Word and Story Learning from TV and Video

Television research is briefly reviewed because television is similar to e-books, and there is a lack of research on how children learn from tablet e-books. Television and tablet e-books (a) are both screen media, (b) can contain animation or active movement, and (c) can provide audio narration. The subsequent section describes the work examining word and story learning from television to illustrate an important point:

children can learn words and comprehend story material from electronic media narrated by an audio device, which is similar to the narration e-book condition in the current project.

Word and story learning from television. Preschoolers can learn words and story content from television. First, preschoolers can learn nouns from TV (Singer & Singer, 1998), and longitudinal work suggests a positive relationship between viewing educational TV and vocabulary development (Rice, Huston, Truglio, & Wright, 1990a). In fact, television has the potential to teach preschoolers novel words. Both Rice and Woodsmall (1988) and Rice, Buhr, and Nemeth (1990b) revealed it is possible for preschoolers to learn new and challenging novel words from television. Similar to the method used in book reading research, children in their studies watched a television program and were then presented with a receptive test of word learning (i.e., plates divided into quadrants containing one target picture and three foils). Rice and colleagues revealed preschoolers can learn challenging, unfamiliar, novel words from television (Rice & Woodsmall, 1988; Rice et al., 1990b). In other words, children can learn words from electronic media narrated by an audio device.

Longitudinal work has also revealed that television viewing can enhance vocabulary development over the preschool years. Rice et al. (1990a) conducted a longitudinal investigation of *Sesame Street* viewing, and they examined whether the presence or absence of an adult co-viewer facilitated vocabulary growth. They found that viewing *Sesame Street* without an adult between 3 and 3.5 years of age predicted vocabulary at age 5, but viewing with an adult was unrelated to later vocabulary. Rice et al. (1990) conclude that learning from *Sesame Street* is possible without an adult present.

Thus, preschoolers can learn from educational television programs even when an adult does not watch the program with them. Although an adult was always with the participants in the current project, Rice et al.'s (1990a) study demonstrates that an adult is not necessary for a child to learn from *Sesame Street*, a reputable educational program.

Second, preschoolers can learn story content from television. Similar to book reading research, prior television work has revealed that by asking children open-ended *Wh*-questions, they could obtain a measure of children's program comprehension (e.g., Crawley et al., 1999; Fisch, Brown, & Cohen, 2001; Linebarger & Piotrowski, 2009; Lorch, Milich, Astrin, & Berthiaume, 2006; O'Toole & Kannass, in prep; Strouse, O'Doherty, & Troseth, 2013). Preschoolers have been asked general and specific comprehension questions to measure their story learning [e.g., "What happened in the story we just watched?" (Fisch et al., 2001); "What did you just see?" (Crawley et al., 1999); "Ben has to return the camera. What else does he have to do as part of his punishment?" (Lorch et al., 2006)]. Thus, television research has revealed that in addition to words, children can also learn story content from electronic media narrated by an audio device.

Relevant to the current project was a study conducted by Crawley et al. (1999). In this study, 3-, 4-, and 5-year-olds watched an age-appropriate television program and were then asked questions about it. Children who watched the same episode multiple times performed better on the comprehension questions than those who watched it once. Work by Crawley et al. (1999) reinforced our procedural decision to read the story more than once to participants. That is, just as multiple exposures to a print book narrated by an adult increased word learning (McLeod & McDade, 2011; Sénéchal, 1997), multiple

exposures to an electronic program narrated by an audio device also facilitated story learning. Therefore, in the current project, children were exposed to the books multiple times in order to create optimal conditions for word and story learning.

Learning from TV: Concluding thoughts. The past work has revealed that preschoolers can learn words and story content from age-appropriate, educational television programs. Importantly, the past work suggests that children can learn from electronic media narrated by an audio device. In fact, thus far, it is clear that children can learn emergent literacy skills from print books read aloud by an adult (e.g., Sénéchal, 1997), print books narrated by an audio device (e.g., Mira & Schwanenflugel, 2013), and electronic media narrated by an audio device (e.g., Rice & Woodsmall, 1998). This past work mirrors three of the four conditions in the current study (i.e., live print book, narration print book, and narration e-book, respectively). Research on e-books is presented in the following section, which led to the development of the fourth experimental condition.

The Electronic Book

The electronic book can take many forms. Electronic books can be CD-ROM storybooks, DVDs, computer books, interactive books, and digital books (Salmon, 2014). E-books can be downloaded onto a computer (computer e-book) or transferred to a digital handheld device with a screen (tablet e-book) (Salmon, 2014). Furthermore, e-books vary greatly in terms of their options or features for story reading. Some have none, and others have many. A reader may read the text of the story, listen to the story narrated aloud, or engage with additional features like games, activities, and hotspots (a feature that allows the reader to drag the mouse or a finger over text to activate animations, hear a definition,

or complete an activity) (de Jong & Bus, 2003; Gong & Levy, 2009; Korat & Shamir, 2012; Salmon, 2014). Some e-books for very young children are more equivalent to toys than conventional books; they have buttons to push and big, plastic pages to maneuver (e.g., Parish-Morris et al., 2013). E-books can be software, an application (app) for a tablet device (e.g., iPad, Nook, Kindle), or a series of PDFs bound together and uploaded onto a computer or tablet. In short, the label “electronic book” is an umbrella term; it does not refer to one specific medium.

Given the variability in type, form, and function of e-books, one may not be able to generalize the benefits of one type of e-book (e.g., a CD-ROM storybook that is narrated by the computer and accompanied by games and hotspots) to another (e.g., a tablet e-book with only text and no games or audio narration). For instance, the features of a CD-ROM book that promote learning may not be beneficial if presented in a tablet e-book form. Therefore, the subsequent section separates computer e-book research and tablet e-book research. The majority of research examining emergent literacy from electronic books has focused on computer e-books, despite the fact that tablet e-book reading is becoming a very popular activity for young children (Common Sense Media, 2013; Reich, Muskat, Campbell, & Cannata 2015). Following the review of e-books and learning, research on e-books and engagement is discussed. One reason why many educators support e-books is because they are thought to promote reading engagement (e.g., Moody, 2010). However, engagement has not always been measured the same way. The current project measured a component of engagement, attention, in order to better understand what features of the tablet e-book encourage engagement: the book itself or audio narration.

Learning from e-books. The present section discusses learning from computer and tablet e-books. It reviews research that has solely examined the utility of the computer e-book and then describes prior work that has attempted to compare learning from traditional print books and computer e-books. After the review on computer e-books, the next section addresses tablet e-books, as this was the device utilized in the current project.

Computer e-books. The majority of research examining how young children learn from computer e-books has either investigated (a) how computer e-books facilitate pre-literacy skills (Chera & Wood, 2003; Korat, Levin, Atishkin, & Turgeman, 2014; Korat & Shamir, 2012; Paciga, 2011; 2014; Shamir & Korat, 2007; Shamir, Korat, & Barbi, 2007; Shamir, Korat, & Shlafer, 2011; Shamir & Shlafer, 2011; Smeets & Bus, 2012) or (b) compared learning from print books versus computer e-books (de Jong & Bus, 2002; Korat, Segal-Drori, & Klein, 2009; Korat & Shamir, 2007; Korat, Shamir, & Heibal, 2013; Segal-Drori, Korat, Shamir, & Klein, 2010; Segers, Takke, & Verhoeven, 2004; Terrell & Daniloff, 1996; Verhallen, Bus, & de Jong, 2006). The present section reviews both areas of work.

Computer e-books: No print comparison. This area of work has examined how features of computer e-books foster emergent literacy (Chera & Wood, 2003; Korat et al., 2014; Korat & Shamir, 2012; Paciga, 2014; Shamir & Korat, 2007; Shamir et al., 2007; Shamir et al., 2011; Shamir & Shlafer, 2011; Smeets & Bus, 2012). In this research, there was no print comparison, and so it is unknown if computer e-books are superior to traditional print books.

Past computer e-book research has examined how computer e-books support word learning (Smeets & Bus, 2012) and story comprehension (Paciga, 2014) during early childhood. Indeed, preschoolers can learn emergent literacy skills from audio narrated computer e-books. In this work, procedural variations are utilized to examine how features of computer e-books facilitate word and story learning just like how procedural variations in traditional print book research are employed to understand how children learn from traditional books.

In computer e-book research, a child typically interacts with a computerized story for a duration of time. In some conditions, a child might have access to games or computerized dictionaries, as the goal in most computer e-book research is to understand these e-book features. Then learning is assessed. Interestingly, the measures of word and story learning in computer e-book research are similar to how word and story learning are assessed in traditional book reading research and television research. For example, Smeets and Bus (2012) examined word learning from computer e-books. After children listened to the audio device narrate a computer e-book story, the experimenter measured receptive word learning for target words embedded in the story using methods similar to receptive tests described previously. Importantly, the test was presented in the same mode as the book (i.e., in an electronic form), which is consistent with other work (Strouse & Ganea, 2015). It is important to keep the test mode the same as the book mode as the goal is to measure word recognition and not the ability to transfer between modes (e.g., Zack, Barr, Gerhardstein, Dickerson, & Meltzoff, 2009). Therefore, in the current project, children in the electronic book conditions were tested with an electronic receptive test, and children in the print book conditions were tested with a print version of the test.

Others have examined story comprehension. Paciga (2014) compared four versions of the same computer e-book story to determine which version facilitated comprehension. To measure comprehension, children were asked a series of open-ended *Wh*-questions (e.g., “What kind of food does Stلالuna love?”). Importantly, Paciga (2014) also measured children’s vocabulary using a standardized vocabulary assessment, the Peabody Picture Vocabulary Test (PPVT). Similar to past work showing that preschoolers’ current vocabulary knowledge influences how many new words they learn from a traditional print book reading session (e.g., Sénéchal et al., 1995), Paciga (2014) found those with high vocabularies had higher story comprehension scores than those with low vocabularies. Therefore, in the current project, it was anticipated that participants’ standardized vocabulary scores would have to be used as a covariate in the word learning and story comprehension analyses.

In short, past work reveals preschoolers can learn words and story content from audio narrated computer e-books (Paciga, 2014; Smeets & Bus, 2012). However, it is unknown whether computer e-books are superior or different than print books at enhancing emergent literacy skills. Likewise, it is unknown if audio narration is superior or different than a live reader at enhancing literacy development. The next section describes work similar to the current project: comparing learning from print versus computer e-books. As in the current project, the work described in the subsequent section altered these scaffolding tools.

Computer e-books versus traditional print books. A large body of work has compared the acquisition of literacy skills in print books and computer e-books (de Jong & Bus, 2002; Korat et al., 2009; Korat & Shamir, 2007; Korat et al., 2013; Segal-Drori et

al., 2010; Segers et al., 2004; Terrell & Daniloff, 1996). Although the current project was conducted with a tablet e-book, not a computer e-book, computer e-book research is discussed because very little work has examined tablet e-books. Research in this area has typically examined how preschoolers learn from a print book read aloud by an adult and an e-book narrated by an audio device (i.e., the computer). As is discussed in the current section, this design is flawed as book type (print, electronic) and narration style (live reader, audio narration) are confounded. The present section describes research comparing word and story learning from print and electronic books, and then addresses the confound between book type and narration style.

Research comparing print and computer e-books has investigated how book type influences word learning and story comprehension. However, the results are not always consistent. Korat and Shamir (2007) had participants listen to a computer narrate an e-book or an adult read a print book. Vocabulary and story comprehension scores did not differ between the groups. Other work has found similar results. Specifically, Segers et al. (2004) did not find differences in vocabulary and story comprehension for a native group of kindergartners (although they did find that immigrant children had higher vocabulary scores in the print book condition). Interestingly, Segers et al. (2004) had children engage with the e-book individually but listen to a teacher read the print book as a class. Based on this work alone (i.e., Korat & Shamir, 2007; Segers et al., 2004), it appears that vocabulary and story comprehension do not differ as a function of book type.

Others have found different results (Segal-Drori et al., 2010). In this work, three experimental conditions were utilized: (a) e-book with audio narration but without adult instruction, (b) e-book with audio narration and with adult instruction, or (c) print book

read aloud by an adult and with adult instruction. The control group engaged in their normal classroom program. In the experimental groups, children worked in pairs. Compared with the other experimental conditions (e-book without adult instruction, print book with adult instruction) and the control group, those who explored the e-book with adult instruction revealed the greatest progress in word recognition. Thus, the work conducted by Segal-Drori et al. (2010) suggests that kindergarteners learn words best from a computer that narrates an e-book when an adult is present to assist them.

Other work has shown support for traditional book reading. Similar to the work previously described, de Jong and Bus (2002) utilized three experimental conditions: (a) print book (b) audio narrated e-book without games, and (c) audio narrated e-book with games (i.e., they were examining differences in book type and specific features of computer e-books) and a control group (although they did not mention what the control group did). Furthermore, children participated in the book reading task individually (i.e., not in pairs), and interestingly, an audio-recording narrated the story in the print book condition. Word recognition was highest in the print book group and e-book group without games, and story comprehension was best in the print book group. Other work has also supported the utility of the print book over the e-book. Terrell and Daniloff (1996) found children learned more words from a print book read aloud by an adult than a computer e-book display with audio narration. Therefore, this work (de Jong & Bus, 2002; Terrell & Daniloff, 1996) suggests that a print book is best.

Collectively, it is unclear what type of book best promotes word learning and story comprehension. There are multiple reasons for the inconsistent findings described above. One reason may be due to procedural variations. In the majority of the past work,

an adult read a print book aloud, but in other work (e.g., de Jong & Bus, 2002) children listened to an audio recording as they followed along on the print book. Other procedural variations include who was present during the session; children engaged with the print and e-books in pairs (Segal-Drori et al., 2010) or with the e-book independently and the print book as a class (Segers et al., 2004). Furthermore, commentary was not controlled; children in Korat and Shamir's (2007) study heard different comments and were not asked the same questions in the print book and in the e-book conditions (although the comments and questions were the same for each participant). Others have also failed to control for adhering to a script to ensure similarities between conditions (Segers et al., 2004).

A second reason for the inconsistency in the literature might be due to differences in how word learning and story comprehension were assessed. To measure word learning, some children have been asked to describe the target word during testing [e.g., "What's a (target word)?"] (Korat & Shamir, 2007; Segers et al., 2004), whereas other children have been presented with a receptive test in which they had to select the target image from a group of foils (Terrell & Daniloff, 1996). Measures of story comprehension have also varied. In some work participants were asked a series of *Wh*-questions about story content (Korat & Shamir, 2007; Segers et al., 2004), whereas in other work, participants were asked to retell the story using their own words (de Jong & Bus, 2002).

Finally, a third reason may be due to the design of the past projects. Some past work has utilized two conditions (Korat & Shamir, 2007; Segers et al., 2004; Terrell & Daniloff, 1996), but others have utilized three (de Jong & Bus, 2002; Segal-Drori et al., 2010). However, none of these studies utilized four conditions to parcel out book type

and narration style, thus, unconfounding the variables. Consequently, it is impossible to determine if children learn better from print versus e-books or books read aloud versus audio narrated books.

Because book type and narration style have been confounded, conclusions can be misleading. For example, recall that Segers et al. (2004) found that immigrant children learned more words when a teacher read a book than when a computer narrated the story aloud. This result led them to conclude that that a teacher, unlike the computer, can tell when her students do not know a word based on their facial expression, and thus, they can pause during reading to elaborate on the unknown word. Furthermore, these elaborations can be accompanied by gestures and facial expressions, something a computer cannot do. Although valid, an alternative conclusion was not addressed: children learned more because the book was in a traditional print form. When considering the extant work in the field of learning and media, either conclusion is plausible. Preschoolers learn more from media when an adult is present than when they interact with the media alone (e.g., Singer & Singer, 1998; Jennings, Hooker, & Linebarger, 2009), suggesting a live reader may be helpful. Alternatively, it may have been the fact it was a print book. Adults have more difficulty reading e-books than print books (Li, Chen, & Yang, 2013), and adults recall more information from print books than e-books (Morineau, Blanche, Tobin, & Guéguen, 2005), suggesting a print book is better.

As discussed, in order to understand how book type and narration style influence learning from books, four conditions must be utilized. Because book type and narration style have not been parceled apart before, it is unclear if book type, narration style, or an interaction between the two variables affects learning from books. This was the main goal

of the current project. Furthermore, the current project addressed two limitations in the literature. First, the majority of work has been conducted with kindergarteners, not preschoolers, and so 4-year-olds were tested in the current project. There is a paucity of research with this age group, a time point when emergent literacy skills are beginning to develop. Second, more work has been conducted with computer e-books than with tablet e-books (e.g., iPad, Kindle, Nook), despite their popularity in families with young children (Common Sense Media, 2013). In short, the current project examined how a specific scaffolding tool, the tablet e-book, affected emergent literacy skills in preschoolers.

Tablet e-books. The National Association for the Education of Young Children and Fred Rogers Center (2008) contend children between 0 and 8 years of age should use tablets and educational apps to enhance emergent literacy skills. This specific reference to tablet e-books (versus e-books in general) might be due to the ease with which children navigate tablets (Neumann & Neumann, 2014). Preschoolers find tablets easy to use because of their intuitive interface (Geist, 2012; McManis & Gunnewig, 2012), and relatedly, they do not have to learn how to use a complicated mouse; the touchscreen is easier (Blackwell, 2014). Furthermore, given that CD-ROM books are now obsolete (Hoffman & Paciga, 2014), and children are interacting with tablets more than ever before (Common Sense Media, 2013; Neumann & Neumann, 2014), it is essential to examine how these tools affect literacy development. The current section summarizes the points made in recently published syntheses of e-books and then describes the few empirical studies (quantitative and qualitative) that have examined how children learn

emergent literacy skills from tablet e-books. Similar to computer e-book research, book type and narration style have been confounded.

E-books, tablets, and emergent literacy: Current research syntheses. Impressions of early learning and digital technology are equivocal. Hisrich and Blanchard (2009) suggest that the influence electronic media (DVDs, computer software, iPhone apps, etc.) on emergent literacy is unknown. On the other hand, Salmon (2014) suggests computer e-books have a positive influence on literacy development. Others contend the iPad will not fundamentally alter education (Kucirkova, 2014; Murray & Olcese, 2011), yet there is support that tablet e-books have the potential to enhance emergent literacy skills (Neumann & Neumann, 2014), especially when e-book reading is a shared experience between a parent and child (Hoffman & Paciga, 2014) or scaffolded (Neumann & Neumann, 2014).

Neumann and Neumann (2014) suggest that the tablet e-book can be an effective tool to promote emergent literacy. Their theoretical perspective is situated in sociocultural theory and suggests that, through scaffolding, tablet e-books can support children's literacy development (see also Yelland & Masters, 2007). Consider the child engaging with a tablet e-book at home. The parent focuses the child's attention to the screen and asks questions about a new word (cognitive scaffolding). Then, the parent encourages the child to trace the letters on the touchscreen device, something the child has not done before (affective scaffolding). Lastly, the parent lets the device scaffold the child's learning (e.g., an app that asks comprehension questions during story reading) (technical scaffolding) (Neumann & Neumann, 2014; Yelland & Masters, 2007). Overtime, this process teaches the child to be a competent user of the tablet, while

promoting emergent literacy concepts. Furthermore, the tablet e-book is a beneficial scaffolding tool. That is, the device itself, when appropriately utilized, can promote learning (e.g., Masataka, 2014). The current project supports the perspective that the tablet e-book is a useful device for promoting word and story learning in preschoolers, when used appropriately and guided by an adult. We chose to compare how two scaffolding tools, the tablet e-book and the traditional print book, facilitated learning. Furthermore, our design permitted us to address the previous confound between book type and narration style.

Empirical research and tablet e-books. Empirical work examining tablet e-books has been quantitative (Krcmar & Cingel, 2014; Masataka, 2014) and qualitative (Blackwell, 2014; Falloon, 2013; 2014; Falloon & Khou, 2014; Flewitt, Messer, & Kucirkova, 2014). Additionally, a small body of non-peer-reviewed research has also explored tablet e-books (Chiong & Shuler, 2010; Goodwin, 2012; Michael Cohen Group, 2012). The current section reviews the extant research examining young children's interaction with tablets in educational contexts, emphasizing literacy.

Two quantitative studies have utilized the tablet as an e-book, although their goals differed. Masataka (2014) investigated kana (i.e., Japanese character) learning as a function of book type, and Krcmar and Cingel (2014) examined how parent-child book reading differed as a function of book type. Interestingly, their findings did not support the same type of book. Masataka (2014) assigned preschoolers to a print book condition in which their mother read the book aloud (she was instructed not to provide any additional comments) or an e-book condition in which an iPad narrated a story aloud to children and the kana were highlighted as the narration proceeded. Results revealed that

the number of kana preschoolers could read significantly increased from pre- to post-test only in the e-book group. It is important to note that because text highlighting and audio narration were confounded, it is impossible to determine whether text highlighting, audio narration, or a combination of these scaffolding tools facilitated learning. Krcmar and Cingel (2014) utilized a within-subjects design, and so in their study, parents read print and tablet e-books aloud to their preschoolers (counter-balanced). Parents' comments varied as a function of book type: they made more comments about the e-book's format (i.e., the device itself), but they made more comments about story content when they read the print book. In turn, children's story comprehension scores were higher when they were read the print book.

Although their results support different types of books, it is important to note that their study goals were different (kana learning versus parent commentary and learning). Furthermore, their design (between-subjects versus within-subjects), procedures (multiple readings versus one reading), and outcome variables (kana learning versus story comprehension) were not the same. Nevertheless, both studies have implications for the current project. Similar to computer e-book research, book type and narration style were confounded in Masataka's (2014) study, and although Krcmar and Cingel (2014) revealed parent commentary about tablets affects children's story comprehension, what happens when commentary is controlled? In the current project, commentary and story reading were identical across conditions to better understand how the device itself affects learning.

Qualitative work has focused on the utility of the iPad in early childhood classrooms (Blackwell, 2014; Flewitt et al., 2014). This work has not compared print and

tablet e-books; it has only qualitatively examined tablet e-books or tablet apps. This work has revealed that teachers believe iPads enhance student engagement (Blackwell, 2014) as well as student learning, concentration, and communication (Flewitt et al., 2014). Interestingly, teachers utilize apps on the tablet to create e-books for their students. For example, Blackwell (2014) interviewed one teacher, who re-appropriated the iPad using an app to create an audio narrated e-book so students could listen to poems and stories without an adult present. The teacher utilized the picture and audio functions to create a relatively simple e-book (i.e., no hotspots, games, etc.). Although an app was not utilized in the current project, the e-book that the teacher created was similar to the e-book participants in the narration e-book condition listened to. Thus, e-books are not always commercially manufactured products; teachers and possibility parents, are creating custom-made audio narrated tablet e-books for preschoolers with the intent to promote learning.

Researchers have also published reports on young children's tablet use (Chiong & Shuler, 2010; Michael Cohen Group, 2012), although these have not been published in peer-reviewed journals. Chiong and Shuler's (2010) research revealed that apps on the iPod touch (a smaller version of a tablet) can promote literacy skills in children as young as 3. They found that after interacting literacy apps, children's vocabulary scores increased after 2 weeks. It is important to note they did not utilize a control group nor did they report if they controlled for other factors that could enhance vocabulary, and so these results should be interpreted cautiously. That is, it is unknown if the apps promoted vocabulary development or if it was something else. The Michael Cohen Group (2012) explored parents' perception of apps. Their study revealed parents of 2- to 8-year-olds

perceive apps with greater value if an app (e.g., an audio narrated e-book) can provide children with the opportunity to engage with it independently (i.e., without the parent). Although an adult supported the participants in the current project across conditions, the fact that children can listen to audio narrated e-books without the presence of an adult is an important area for future investigation.

Learning from e-books: concluding thoughts. The research examining the effects of e-books on emergent literacy is speculative. First, in computer e-book research, procedural variations, variability in measurement, and the confound between book type and narration style contribute to the inconsistent findings regarding the efficacy of print books versus computer e-books. Furthermore, this research cannot be generalized to the tablet, a device that is much more intuitive for young children to use (Blackwell, 2014; Geist, 2012; McManis & Gunnewig, 2012). Second, tablet e-book research is very limited. Only a few studies to date have examined the tablet as an e-book and compared it with print book learning in preschoolers (e.g., Krcmar & Cingel, 2014; Masataka, 2014). Similar to computer e-book research, past work comparing learning from print and tablet e-books has confounded book type with narration style. In short, there is no evidence that unequivocally supports that one type of book is superior to the other for cultivating emergent literacy skills in 4-year-olds.

Engagement and e-books. In addition to examining how children learn from e-books, another area of research has examined how e-books facilitate reading engagement (Ciampa, 2012; Levy, 2009; Moody, 2010). Reading engagement has been defined as children's attentiveness to a book and the ability to sustain attention as the book reading session progresses (Moody, 2010; Moody, Justice, & Cabell, 2010). Because the current

project examined the relation between attention and learning from books, it is relevant to briefly discuss the literature on e-books and engagement.

Reading engagement has been measured multiple ways. For instance, Moody et al. (2010) refer to reading engagement as attention to the book, but they did not measure attention. Instead, they defined and measured engagement as children's persistence, enthusiasm, and compliance, which was rated by a coder on a 7-point scale. Only differences in persistence emerged. Children were more persistent when an adult led the session with an audio narrated computer e-book than when an adult led the session by reading a print book aloud. Others have examined how preschoolers' control of a computer e-book affects their attention to it (Calvert, Strong, & Gallagher, 2005). It is important to note Calvert et al. (2005) did not measure engagement, but rather, attention. Children and adults interacted with a computer e-book multiple times. The e-books were read aloud by the adult, but hotspots made noises when clicked and a continuous musical soundtrack played throughout the story. Interestingly, children's attention to the computer e-book declined when an adult led the session (i.e., controlled the mouse, clicked to turn the page), but when children led the session, attention remained constant.

Preschoolers' engagement with apps on tablets has also been examined in qualitative research. Although an app was not used in the current project, one of the apps Kucirkova, Messer, Sheehy, and Panadero (2014) examined was a story-making app (i.e., children could make an e-book). Instead of rating persistence (Moody et al., 2010) or measuring attention (Calvert et al., 2005), they used a taxonomy to measure engagement. Children showed signs of self-regulated interest (e.g., typing in their own name in the app's text box) and critical engagement (e.g., demonstrating digital expertise by trying

out the app's features such as audio-recording and image insertion) when working with the story app.

In sum, young children are more persistent when they listen to an audio narrated computer e-book than when they listen to an adult read a print book aloud (Moody et al., 2010). Children are also more attentive when they read a computer e-book session than when an adult does (Calvert et al., 2005). With apps similar to e-books, children show critical engagement. Thus, it appears e-books may be quite engaging. It is important to point out that Moody et al. (2010) defined engagement as attention but did not measure attention. Given that engagement can be conceptualized as attention, it is really important to measure attention or looking to the book. In the current project, children's attention to the books was measured in addition to word and story learning. By doing so, we were better able to understand the relation between these cognitive processes, an important relation that has received considerably little exploration in print and e-book reading research.

The Relation between Attention and Learning from Media

Attention and memory are general cognitive processes, and they are necessary for word learning (Samuelson & Smith, 1998). Children's memory for novel words is tied to the context in which they learn the word, and attentional mechanisms facilitate the process by highlighting the novel to be learned word in their environment (Samuelson & Smith, 1998). However, research examining the relation between attention and learning from books is lacking. In fact, attention to books has been measured to rule it out as an indicator of learning (Brito, Barr, McIntyre, & Simcock, 2012; Tare, Chiong, Ganea, & DeLoache, 2010). Specifically, toddlers' attention to a book was measured to illustrate

that the development of dual representation, and not attention, is responsible for toddlers' ability to learn from books. Preschoolers' comprehension of dual representation is much more sophisticated, and so it does not hinder their ability to learn from symbolic media like books. Instead, it is likely that another cognitive process, such as attention, is at least partially responsible for preschooler's ability to learn from books. During the later preschool years, attention becomes more goal-oriented and supportive of cognitive activities that require sustained attention (Colombo & Cheatham, 2006). Thus, the emergence of goal-oriented attention facilitates preschoolers', but not toddlers', ability to learn from books. The current section first describes the development of attention, focusing on research examining preschoolers' attention to goal-oriented activities such as toy play and television viewing (as no work has examined preschoolers' attention to books). It then concludes with a small body of work that has investigated the role of attention in learning and performance.

The development of endogenous attention. Endogenous attention refers to young children's increasing ability to hold or allocate their attention in a volitional manner to a particular object (a toy, a TV) or task (completing puzzles, reading a book) (Colombo, 2001; Colombo & Cheatham, 2006). Endogenous attention comes online during the second half of the first year of life and gradually becomes stronger during the preschool period. Others theorists suggest that a later maturing attention system emerges at the end of the first year of life, and this system is responsible for goal-oriented attention (Ruff & Rothbart, 1996).

Endogenous attention is conceptualized as internally directed attentional functioning (Colombo, 2001). At its core, volitional attention is essential for maintaining

engagement with a task, and so attention span, vigilance, perseverance, and distractibility all fall within the model of endogenous attention (Colombo, 2001; Colombo & Cheatham, 2006). Endogenous attention gradually improves throughout toddlerhood and the preschool years (Colombo & Cheatham, 2006) and is supported by the development of the frontal lobes and pathways (Posner & Rothbart, 1991). As this system matures during the preschool years, it provides the necessary foundation for the development of goal formation and planning (Ruff & Rothbart, 1996). Endogenous or goal-oriented attention supports children's increasing sophistication in completing cognitive activities such as book reading, TV viewing, and task completion.

Measuring attention. Children become increasingly better at sustaining their attention to objects, tasks, and television over the preschool period (Anderson & Levin, 1976; Colombo & Cheatham, 2006; Kannass & Colombo, 2007; Ruff, Capozzoli, & Weissberg, 1998; Ruff & Lawson, 1990). By measuring attention (i.e., duration of looking) to a variety of tasks in 30-, 42-, and 54-month-olds, Ruff et al. (1998) revealed some important findings about the development of attention in preschoolers. First, attention to less structured activities like TV viewing and free play increase during the preschool years, which suggests children become better at volitionally maintaining their attention to an activity. In the current project, children had to sustain attention to a specific activity, book reading. Second, Ruff et al. (1998) found stability in attention measures within contexts, suggesting preschoolers are consistently more or less attentive when the constraints of a task remain the same. However, attention is not as stable between contexts as it is within contexts. That is, preschoolers' attentiveness varies to meet the demands of tasks they work on. These last two points have an important

theoretical connection to the current project. That is, participants attended to books in multiple contexts. By measuring their attention, we were able to investigate if book reading across these contexts is similar or qualitatively different. For example, are children generally attentive to the book regardless of book type or narration style, or does their attention vary to meet the demands of the book reading context?

The relation between attention and learning. There is small body of research that suggests attention is associated with learning (or performance) (Levy, 1980), and this relation differs as a function of context (Kannass & colleagues; Krcmar, Grela, & Lin, 2007). For example, Levy (1980) conducted a vigilance test with preschoolers (i.e., children pressed a button when stimuli appeared in succession on a screen). Longer looking at the screen was associated with better performance on the task. However, others have found this relation may depend on context. Kannass and colleagues (Kannass & Colombo, 2007; Kannass, Colombo, & Wyss, 2010; Wyss, Kannass, & Haden, 2012) have examined how preschoolers complete tasks in distracting environments (i.e., when the television is on). Their projects have revealed a theoretically important finding: children's performance was unrelated to their attention to the task when no distraction was present; however, in challenging environments, the relation between performance and attention was positively related. That is, the relation between attention and performance differed across contexts. This is relevant to the current project because the relation between attention and learning was analyzed in different book reading contexts. No other experimental research has investigated the relation between attention and performance or learning in different contexts, and so one of the objectives of the current project was to contribute this unique finding to the field.

One study to date has examined how attention facilitates word learning from media, and their finding suggests that attention is beneficial for learning in some contexts but not others. Specifically, Krcmar et al. (2007) examined how toddlers learned words from a videotaped adult speaker (i.e., a video recording of an adult facing the camera and talking) versus a child-directed TV program (i.e., *Teletubbies*). Those who were highly attentive to the videotaped speaker learned more words than those who had low attention to the speaker. However, attention was not a moderator in the child-directed TV program condition. That is, attention was beneficial for learning in certain contexts (videotaped adult speaker) but not others (child-directed TV program). The project extends this area of work by investigating if attention facilitates learning from a different medium: books. That is, the goal was to examine if attention moderated learning as a function of book reading context.

Concluding thoughts. In sum, we have learned a great deal by measuring preschooler's attention to activities such as task completion and television viewing, but we have not measured it to other activities like book reading. This is warranted because (a) goal-oriented attention, which is necessary for cognitive activities (e.g., book reading), gradually becomes stronger during the preschool years (Colombo & Cheatham, 2006; Ruff & Rothbart, 1996); (b) the relation between attention and performance is not stable across contexts (Kannass & Colombo, 2007; Kannass et al., 2010; Wyss et al., 2012); and (c) attention facilitates learning from media in certain contexts but not others (Krcmar et al., 2007). It is unknown how book type and narration style influence children's attention to books. Furthermore, it is unknown if attention facilitates learning in certain book reading contexts but not others. This was one goal of the current work.

The Current Project

The primary goal of the current project was to investigate how two important literacy skills, word learning and story comprehension, differ as a function of book reading context. The project is situated in sociocultural theory, which suggests traditional print books and tablet e-books can promote literacy skills through scaffolding.

Scaffolding has been described as a technique and a tool, and we manipulated scaffolding as a tool in the current project to address a confound in prior work. Both book type and narration style varied, and so preschoolers were assigned to one of four conditions: live print book, live e-book, narration print book, and narration e-book. In addition to measuring learning, attention to the book was measured, as no work has examined the relation between attention and learning in traditional and contemporary book reading contexts.

CHAPTER TWO

INTRODUCTION

A large body of work supports that shared book reading facilitates emergent literacy skills (Bus, Leseman, & Keultjes, 2000; Clark 1978; Chomsky 1979; Davidse, de Jong, Bus, Huijbregts, & Swaab, 2011; Durkin, 1966; Hindman, Skibbe, & Foster, 2014; Hindman, Wasik, & Erhart, 2012; Mol & Bus, 2011; National Research Council, 1998; Scarborough & Dobrich, 1994; Teale, 1987). Shared book reading contributes to young children's word learning (Ewers & Bronson, 1999; McLeod & McDade, 2011; Sénéchal, 1997; Sénéchal & Cornell, 1993; Sénéchal, Thomas, & Monker, 1995) and story comprehension (Dickinson & Smith, 1994; Mira & Schwanenflugel, 2013; Roberts, 2013; Strasser, Larraín, & Lissi, 2013; Vivas, 1996). However, given a new type of technology, the electronic book (e-book), book reading no longer has to be a shared experience, and the book itself no longer has to be a paperbound book with pages to turn. Instead, a book can be uploaded onto a touchscreen tablet and narrated to a child. Very little work has investigated how this contemporary style of book reading compares with the traditional process. The goal of the current project was to investigate how 4-year-olds learn from print and tablet e-books and how narration style, prior experience, and attention affect the process.

The e-book can take many forms. Traditionally, e-books were on the computer and engaging with one was a distinct activity. However, given the omnipresence of

smartphones and tablets, e-books can be viewed and/or listened to anywhere and at any time. Many e-books come equipped with audio narration, and so unlike traditional book reading, an adult is not necessary for a preliterate child to hear a story. That is, the e-book can narrate the story aloud to the child. Interestingly, reading in general has declined over the years, and e-book reading among young children is on the rise. Specifically, the amount of time 0- to 8-year-olds spend reading or being read to in general has decreased from 40 minutes per day in 2005 to 28 minutes per day in 2013 (Rideout & Hamel, 2006; Common Sense Media, 2013), and the percent of children who read on a typical day has decreased from 83% in 2005 to 60% in 2013 (Rideout & Hamel, 2006; Common Sense Media, 2013). How children are reading is also changing (i.e., print book versus e-book). Although reading overall is decreasing, children are reading more e-books on tablets and smartphones over the past few years. In 2011, 4% of 0- to 8-year-olds had read an e-book on a tablet or smartphone, whereas in 2013, 30% of children in the same age group had read an e-book on one of these devices (Common Sense Media, 2013). Furthermore, the majority of these children read e-books on tablets (23%) versus smartphones (7%) (Common Sense Media, 2013). As expected, the availability of tablets has also increased in homes from 9% in 2011 to 40% in 2013 (Common Sense Media, 2011; 2013). Simply put, tablet e-book reading is becoming an increasingly popular activity for young children.

Electronic Book Research

The current research examining how young children learn from tablet e-books is limited, as the majority of research focuses on how children learn from books on the

computer (i.e., CD-ROM books). Although computer e-book research is informative, it is important to note that computer e-book reading is qualitatively different than tablet e-book reading. Tablet e-book reading has been described as easier and more intuitive for preschoolers, particularly due to its touchscreen, a tactile based digital interface (Blackwell, 2014; Geist, 2012; Neumann & Neumann, 2014). Prior work has revealed that preschoolers and kindergarteners can learn words and story content from audio narrated computer e-books (Gong & Levy, 2009; Korat & Shamir, 2012; Mioduser, Tur-Kaspa, & Leitner, 2000; Paciga, 2011; 2014; Shamir & Korat, 2007; Shamir, Korat, & Schlafer, 2011; Smeets & Bus, 2012). However, in this research, there was no print comparison, and the control group engaged in their regular classroom activity [or no control group was utilized (e.g., Paciga, 2014)]. Other work has found that young children learn more from computer e-books when an adult assists them versus when they operate it alone (Korat, Levin, Atishkin, & Turgeman, 2014; Schetz & Stremmel, 1994; Segal-Drori, Korat, Shamir, & Klein, 2010; Yelland & Masters, 2007). That is, adults scaffold the process because they help children operate the program or device, but the computer e-book is a good scaffolding *tool* because it provides the story. Based on this work alone, it appears that computer e-books can facilitate emergent literacy skills and having an adult assistant is beneficial.

Other work has attempted to compare how children learn from print and electronic books. Terrell and Daniloff (1996) found that preschoolers learned more words when they listened to a live adult read a print book aloud than when they listened to a computer narrate an e-book. A similar study found that immigrant kindergartners learned more words from a live adult who read a print book than from a computer that narrated

the story (Segers, Takke, & Verhoeven, 2004). For the native kindergartners, learning did not differ between the conditions (Segers et al., 2004). Interestingly, neither the immigrant nor native group learned more story content as a function of condition. These results need to be interpreted cautiously, as the type of book (print versus electronic) and the style of narration (adult reader versus audio narration) were confounded.

In contrast to a wealth of research on computer e-books, there is a paucity of research on tablet e-books. Because of the physical differences between computer e-books and tablet e-books, we cannot assume tablet e-books will have similar effects on early literacy development. More tablet e-book research is warranted. Only two studies to date have compared how preschoolers learn from traditional books and tablet e-books. First, Krcmar and Cingel (2014) had parents read a print book and a tablet e-book aloud to their preschooler. They found that the content of the parents' talk varied as a function of book type. Parents made more comments about the book format (e.g., "Don't touch the iPad") when they read the tablet e-book, but they made more comments about story content when they read the print book. In turn, children's story comprehension scores were higher after they were read the print book. The authors suggest that parents' comments about the tablet e-book (i.e., the device) distracted children from learning story content.

Second, Masataka (2014) conducted a study with 4-year-old Japanese boys. The children were assigned to one of two conditions. In the e-book group, an iPad narrated a story aloud to children and the kana (Japanese characters) were highlighted as the narration proceeded. In the print book group, the mother read a print book aloud, but she did not provide additional commentary. In both conditions, children were exposed to a

story once a day for five days. Masataka (2014) found that the number of kana that the participants could read significantly increased from pre-test to post-test, but only in the e-book group. The authors suggest that when printed text is digitized and technological scaffolding is provided (i.e., audio narration, highlighted text) it contributes to preschoolers' literacy development. However, because audio narration and highlighted text were confounded, it may be that one is more beneficial than the other. Because the study was conducted in Japanese, the authors note that their research cannot necessarily be generalized to alphabetic writing systems like English.

Although parental commentary appears to distract children from story content during shared tablet e-book reading (Krcmar & Cingel, 2014), tablets and e-books are popular with parents and educators because of their purported ability to engage children (de Jong & Bus, 2003; Moody, 2010). According to reading engagement theory, e-books dramatize the story and fixate children's attention to the book through technological scaffolding (e.g., audio narration, highlighting of text, animation, graphics), which in turn, fosters word and story meaning (Moody, 2010). Empirical research has revealed that children are more persistent when an adult leads a reading session with a computer e-book than a traditional print book (Moody, Justice, & Cabell, 2010). Furthermore, children engage in more bookbinding (i.e., an important literacy function in early reading in which children silently attend to a story being read or narrated), and consequently have better phonological awareness after interacting with a computer narrated e-book (versus listening to an adult read a print book aloud) (Wood, Pillinger, & Jackson, 2010). On the other hand, children in the print book group chimed in more (i.e., a process similar to bookbinding but children chime in when they know a word or want to comment on the

story narrative), but this was not associated with improvement in phonological awareness (Wood et al., 2010).

A Sociocultural Perspective in an Electronic World

Similar to prior traditional book reading research, the current project is shaped by neo-Vygotskian theory. Children's cognitive development is shaped by society and the larger sociocultural context (Rogoff, 1990). We are living in a period of time in which digital expertise and technological skills are valued, and children are engaging with touchscreens and smartphones more than ever before (Common Sense Media, 2013).

Theories of emergent literacy suggest that through extended conceptualizations of scaffolding, young children can learn from tablet e-books (Neumann & Neumann, 2014; Yelland & Masters, 2007). Scaffolding can be conceptualized as a tool or as a technique (Rosenshine & Meister, 1992). For example, print books, e-books, and audio narration are scaffolding *tools* to support emergent literacy, while adult readers can use specific *techniques* (e.g., pointing to words, asking questions) to scaffold children's word and story learning from books. Although e-books have the potential to be useful scaffolding tools, theories of emergent literacy from electronic media suggest that it is critical for an adult to be present when children learn from digital devices (Yelland & Masters, 2007; Schetz & Stremmel, 1994). In the current project, we were cognizant of the design flaws and confounding variables in past research, and so we manipulated the type of scaffolding tool. Specifically, we manipulated book type (print versus electronic) and narration style (live reader versus audio narration) in order to better understand how these tools can scaffold children's word and story learning. Furthermore, an adult was always present to set up the story and ensure the child remained on the correct page. Because

past work has confounded book type and narration style, it is unknown how scaffolding tools (e.g., print books, e-books, audio narration) uniquely contribute to literacy development in preschoolers. The current project deepens our understanding of scaffolding as a tool by addressing this confound.

The Current Project

There were three main goals of the current project. The first goal was to compare how preschoolers learn from print and tablet e-books while controlling for narration style. The extant research in the field has examined how features of the e-book affect learning (Gong & Levy, 2009; Korat & Shamir, 2012; Smeets & Bus, 2012) and compared learning from print and e-books (de Jong & Bus, 2002; Segers et al., 2004; Terrell & Daniloff, 1996). However, in previous work, the style of narration was always confounded with type of book; an adult read the print book aloud and an audio device narrated the e-book. A goal of the current project was to disentangle book type and narration style and utilize a tablet e-book. Children were assigned to one of four conditions: live print book, live e-book, narration print book, and narration e-book. In the live reader conditions, an adult read the story aloud to the child, and in the audio narration conditions, an audio device narrated the story. In the print book conditions, the child followed along on a traditional book, and in the e-book conditions, the child followed along on an iPad book. Relatedly, we were also interested in how prior experience with tablet e-books affects learning, as it is unknown.

Because traditional shared book reading fosters emergent literacy skills (Bus, van IJzendoorn, & Pellegrini, 1995; Scarborough & Dobrich, 1994), we selected word learning and story comprehension as outcome measures; both have been used in past

work and are predictors of future academic success (Dickinson & Smith, 1994; Sénéchal, LeFevre, Thomas, & Daley, 1998; Storch & Whitehurst, 2002; Whitehurst et al., 1994). The number of words preschoolers know is positively associated with future standardized test scores (Hart & Risely, 2003) and reading achievement (National Research Council, 1998), and early story comprehension is related to later reading comprehension (Dickinson & Snow, 1994), reading achievement (Scarborough, 1998), and reading fluency (Sénéchal & LeFevre, 2002). Because tablet e-book reading is increasing in young children (Common Sense Media, 2013), it is essential to understand how word learning and story comprehension are affected by new technology.

The second goal was to examine if tablet e-books are more engaging than traditional print books. E-books elicit more engagement than print books, and engagement has been hypothesized to facilitate learning (de Jong & Bus, 2002; Moody, 2010). In the context of reading, engagement refers to, “children’s attentiveness to a storybook, and their ability to sustain attention over time” (Moody et al., 2010, p. 297). In the current project, we measured endogenous attention in order to better understand engagement to print and e-books. Endogenous attention refers to one’s ability to hold or sustain attention in a volitional manner to a particular object or task (Colombo, 2001; Colombo & Cheatham, 2006; Ruff & Rothbart, 1996). As this system develops over the preschool years (Colombo & Cheatham, 2006; Ruff & Rothbart, 1996), it supports cognitive activities such as book reading.

The last goal was to understand the relation between attention and learning. Attention is necessary for word learning (Samuelson & Smith, 1998), but research on attention and learning from books is limited. One study has revealed that attention

moderates learning from media. Specifically, Krcmar et al. (2007) examined how toddlers learned words from a videotaped adult speaker (i.e., a video recording of an adult facing the camera and talking) versus a child-directed TV program (i.e., *Teletubbies*). Those who were highly attentive to the videotaped speaker learned more words than those had low attention to the speaker. However, attention did not moderate learning in the child-directed TV program condition. That is, attention was beneficial for learning in certain contexts (videotaped adult speaker) but not others (child-directed TV program).

CHAPTER THREE

METHOD

Participants

Participants were recruited using two methods. In the first method, contact information for families from the metropolitan Chicago area were obtained through a commercial supplier. Letters were then sent to the families describing the nature of the project. Families received a follow up phone call requesting their voluntary participation. Testing took place in a laboratory on a college campus. In the second method, children were recruited from and tested at childcare centers and preschools in the metropolitan Chicago area.

One hundred two typically developing 4-year-olds participated in the project. Two participants' data were not usable due to experimenter error ($n = 2$). The final sample consisted of 100 preschoolers (51 females) with a mean age of 4.42 years ($SD = .28$). The majority of children participated in childcare centers ($n = 84$), and the remaining children participated in the laboratory ($n = 16$). Importantly, the contexts were similar. Testing always took place in a quiet setting, and the experimenter always sat adjacent to the child on the right hand side. The demographic breakdown was as follows: 70 children were White; 2 children were Black; 4 children were Hispanic; 6 children were Asian; 14 children were biracial; and 4 parents did not respond. The majority of children came from homes in which the mother had a college or graduate degree ($n = 84$).

Apparatus & Materials

All sessions were video recorded, and the camera angle and distance from the child was the same for children tested in the lab and in the childcare centers. Sessions were dubbed onto DVDs for coding purposes.

Print and electronic books. Two wordless pictures books were created for the project as prior research has also utilized wordless pictures books (Ard & Beverly, 2004; McLeod & McDade, 2011; Sénéchal, 1997; Tompkins, Guo, & Justice, 2013). A practice book and an experimental book were created. To create the books, pictures were taken with an iPad and altered using *ToonCamera* to appear like a cartoon. The practice book consisted of a title page and four pages of images. The experimental book consisted of a title page and 13 pages of images, and the story was about a superhero training her younger brother how to be a superhero. The book contained a series of images of the superhero in training accomplishing a variety of tasks (reading books, eating healthy foods, exercising, etc.).

The storyline for the current project imitated the story structure in *Just in Passing* by Susan Bonners (1989), which was utilized in a similar project (Sénéchal, 1997). In *Just in Passing* the main character yawns, and as others see him, they start to yawn, too. We utilized a similar story structure so target words were introduced at consistent intervals. The goal was to prevent some words from being more memorable than others, and so all target words were introduced in the same superhero context. The target words consisted of five nonsense nouns and five nonsense verbs which is consistent with past work (e.g., McLeod & McDade, 2011). The nonsense nouns referred to obscure objects

made from craft store materials (e.g., colored foam pieces glued together), and the nonsense verbs referred to obscure actions (e.g., crouching down with one's mouth and eyes wide open).

Print and electronic versions of the books were created. The print books were paperbound books with laminated pages. The first two pages of the experimental book introduced the characters and the last page concluded the story. The remainder of the pages was devoted to the storyline. Each page of the storyline contained an image of the superhero in training engaging in a task. A nonsense object and nonsense action appeared on each page of the storyline, but only the nonsense object or action was labeled. This was done so that the nonsense object or action that was *not* labeled could serve as a foil in the receptive word learning test. Each page was 24 cm x 17.3 cm (the size of an iPad) and the illustration on each page was 19.25 cm x 14.75 cm (the size of an iPad screen). That is, the print book was the same size as the iPad, and the illustrations were the same size as the iPad screen.

The e-book was created on an iMac computer by combining the images to form a PDF e-book, which was then transferred to the iPad. Thus, the entire illustration showed up on the iPad screen and the border of the "page" was the iPad. A white iPad was utilized so the color of the e-book border (i.e., the device itself) matched the white border of the print book pages. For both books, the pages were displayed one at a time.

Target words. To ensure there was not a bias for preschoolers to learn certain nonsense words over others, all nonsense target words contained the same syllabic structure: a consonant-vowel-consonant (C-V-C) pattern (McLeod & McDade, 2011). Two versions of the story were created, but the illustrations remained the same. That is,

only the script was altered. The nonsense nouns in story version 1 served as the nonsense verbs in story version 2 and vice versa. Two versions were created in case there was a bias for learning certain words as nouns or verbs.

The story was constructed so that the target word was repeated three times per page. Hearing a word more than once per page has been shown to facilitate word learning from books (Ard & Beverly, 2004; McLeod & McDade, 2011). The third presentation of the word was a request for pronunciation, (e.g., “Can you say *tib*?”). Repeating the target words aloud gave children practice with the target words and kept them interested in the story. Furthermore, labeling a target word has been shown to facilitate learning (Sénéchal et al., 1995).

Testing stimuli.

Receptive word learning test. The receptive word learning test was similar to tests used previous research (McLeod & McDade, 2011; Sénéchal et al., 1995). The test consisted of a series of plates. Each plate contained four pictures of objects or actions (one per quadrant). Fourteen plates were constructed. Four of the 14 plates contained familiar objects (e.g., a pencil, a spoon, a teddy bear, and a cup). These plates were embedded in the test to maintain children’s interest, which is consistent with past work (Sénéchal et al., 1995). The other 10 plates contained pictures of the nonsense objects and actions. Half of the plates contained depicted nonsense nouns and the other half contained depicted nonsense verbs. The images in distractor quadrants were other targets or foils from the story. Recall there was a nonsense object and action on every page of the book but only one of them received the nonsense label per page. Printed and electronic plates were created.

Story comprehension questions. Seven *Wh*-questions were created in order to measure children's story comprehension as open-ended *Wh*-questions are useful in determining young children's story comprehension (Segers et al., 2004; Westerveld, Gillon, & Boyd, 2012). The list of questions is presented in Appendix B.

Standardized vocabulary assessment. The Peabody Picture Vocabulary Test (PPVT-4) (Dunn & Dunn, 2007) is a nonverbal receptive vocabulary assessment. It is age-normed based on a nationally representative sample. The test contains 228 test pages, and each test page contains four pictures. The child is asked to point to a target word on each page. Testing is terminated once the child reaches ceiling level.

Questionnaire. A questionnaire was created to obtain the parent's report of the child's book reading experience (i.e., the parent questionnaire). The parent completed the questionnaire separately and returned it to the experimenter after the session (if testing was conducted in the lab) or returned it back to school with the child (if testing was conducted in a preschool). The child questionnaire, which was not included in analyses, can be found in Appendix A (as described in the general introduction).

Procedures

Book reading and testing. Book reading and testing consisted of three parts: a teaching and practice phase, book reading, and testing. Prior to participating, children were randomly assigned to one of four conditions: live print book, live e-book, narration print book, or narration e-book. Children in the live reader conditions listened to the story read aloud by the experimenter, and children in the audio narration conditions listened to the story narrated by the iPad (the recording was the experimenter's voice). Across conditions, the experimenter kept interactions to a minimum and did not engage in book

reading behaviors that scaffold learning (e.g., drawing connections between the story and real-life events) (Haden, Reese, & Fivush, 1996). The experimenter was present to monitor the child's behavior (e.g., keep the child on the correct page, ensure the child was not falling out of his or her chair, etc.). A fidelity check conducted on 25% of the sample revealed the experimenter adhered to these guidelines.

Teaching and practice phase. The study began with the experimenter introducing herself and explaining the directions [i.e., "It's story time! You have a very important job. When you hear this noise (experimenter played the bell), it is your job to turn the page/swipe the screen. Do you understand?"]. After introducing the practice book, the experimenter demonstrated what to do by advancing the title page to the first page. The child then continued with the remaining pages. If the child did not properly demonstrate turning the pages or swiping the screen, the experimenter re-explained the directions and the practice book was read or narrated again. All children demonstrated they knew how to turn the page/swipe the screen when they heard the bell with the practice book before moving on to the experimental book.

Book reading phase. After the practice book, the experimenter explained to the child that he or she would do the same thing with a new book. The experimenter introduced the experimental book and advanced the story from the title page to the first page. The child was responsible for the remaining pages. After the experimental book was read/narrated once, the experimenter told the child that the book would be read/narrated one more time. After the second reading, the recording device was turned off.

Testing phase. After book reading, testing was conducted. First, the receptive word learning test was administered. A practice plate was shown before the test plates, and the child learned to point to an image. Next, the 14 test plates were administered. The plates were presented in a semi-counterbalanced manner. The child was shown the plates one at a time and given ample time to respond after the prompt, “Point to...” After completing the last plate, the experimenter asked the story comprehension questions. All participants were asked the questions in the same order, given ample time to respond, and told that there were no wrong answers.

Standardized vocabulary measure. The PPVT-4 was administered after testing. The experimenter followed the testing protocol outlined by Dunn & Dunn (2007).

Coding and Measures

Receptive word learning. During testing, the experimenter recorded the image the child pointed to for each plate. After the session, the experimenter scored the receptive word learning test (1 point = correct; 0 points = incorrect). The maximum score was 10 points.

Story comprehension. During testing, the experimenter wrote down the child’s responses to the questions. After the session, two reliable coders scored each response, and answers received a score from 0 to 1 depending on how complete it was (e.g., Strasser et al., 2013). Answers were given 1 point if completely correct, ½ point if partially correct, and 0 points if incorrect. The percent agreement for the entire sample was 98.5%. All discrepancies were resolved, and the resolved coding was utilized in analyses.

Measures of attention.

Attention: Looking at the book. Using a reliable method from previous research examining attention to tasks (Kannass & Colombo, 2007), looking to the book was coded. Coders simultaneously watched a video recording of the session and pressed a button on a Macintosh computer using the program Habit (Cohen, Atkinson, & Chaput, 2004). The program records the duration of each look. Looks that were less than 1 second in duration did not count as a complete look. When these brief looks interrupt a look to the book, the looks before and after the brief look were combined and scored as one look. Whenever the child was looking at the book, the coder pressed the button to measure attention. Reliability was calculated for 25% of the sample by correlating the duration of each look for two coders. The average inter-rater reliability was .99 (mean difference = 0.56 s). Total duration of looking and average length of individual looks were calculated. Total duration of looking reflects the total amount of time children are attentive to the book, and it has been utilized in prior work examining how children maintain attention to a task (Choi & Anderson, 1991; Kannass & Colombo, 2007; Kannass et al., 2010). Average length of individual looks reflects how long, on average, children sustain their attention before disengaging. It is also a useful indicator of attention span (Colombo et al., 2004; Kannass, Oakes, & Shaddy, 2006; Wyss et al., 2012).

Inattention. Inattention was also coded. An experimenter pressed a button whenever the child was inattentive (i.e., looking anywhere that was not the book or experimenter). Reliability was calculated for 25% of the sample by correlating the duration of each look for two coders. The average inter-rater reliability was .97 (mean difference = 0.42 s). The total duration of inattention was calculated. Inattention has been

measured in prior work examining toy play and task completion (e.g., Choi & Anderson, 1991; Kannass & Oakes, 2008; Ruff & Capozzoli, 2003; Wyss et al., 2012), but it has not been utilized as a measure in book reading research.

Experimenter looking. Experimenter looking was also coded. An experimenter pressed a button whenever the child looked at the experimenter. Reliability was calculated for 25% of the sample by correlating the duration of each look for two coders. The average inter-rater reliability was .95 (mean difference = 0.25 s). Experimenter looking was coded because the source of information (i.e., the storyline) in the live conditions was the experimenter.

CHAPTER FOUR

RESULTS

Preliminary Analyses

Four issues were explored in the preliminary analyses: effects of condition on participant age, effects of gender on the dependent variables, chance word learning, and the effects of child vocabulary on the dependent measures. There were no significant effects of book type or narration style on participant age, $F_s < 1.16$, *ns*. The calculated age between participants in the live print book ($M = 4.48$, $SE = .06$), live e-book ($M = 4.40$, $SE = .06$), narration print book ($M = 4.38$, $SE = .06$), and narration e-book ($M = 4.42$, $SE = .06$) conditions were similar. There were no significant effects of gender on the learning outcomes or attention measures nor did gender interact with book type or narration style, $F_s < 2.46$, *ns* (see Table 1). Furthermore, word learning scores in all conditions were significantly greater than chance: live print book, $t(24) = 4.75$, $p < .001$, live e-book, $t(24) = 4.61$, $p < .001$, narration print book, $t(24) = 6.24$, $p < .001$, and narration e-book, $t(24) = 6.25$, $p < .001$.

In general, participants had high standardized receptive vocabulary scores. The average standardized PPVT score was 115.37 ($SE = 1.38$), which translates to an average age equivalent of 5.64 years ($SE = .11$) and an average percentile of 77.43 ($SE = 2.34$). PPVT scores did not differ between the conditions, $F < 1.68$, *ns*. The PPVT was administered in order to control for children's vocabulary level. Indeed, the standardized

PPVT score significantly explained 14% of the variance, $F(1, 98) = 16.00, p < .001$ in receptive word learning scores and 23.2% of the variance, $F(1, 98) = 29.66, p < .001$ in story comprehension scores. PPVT scores were utilized as a covariate in the analyses on word learning and story comprehension.

Table 1. Means and standard errors for learning outcomes and attention measures as a function of gender

	Gender		t-value	p-value
	Male M (SE)	Female M (SE)		
Receptive Word Learning Score	4.43 (.26)	4.43 (.25)	-.01	.99
Story Comprehension Score	4.35 (.22)	4.25 (.23)	.32	.75
Total Duration of Attention to the Book	417.97 (6.31)	403.67 (9.90)	1.21	.23
Average Length of Individual Looks to the Book	34.62 (4.52)	41.5 (6.99)	-.82	.41
Total Duration of Focused Attention	166.60 (12.23)	176.86 (17.76)	-.47	.64
Average Bout of Focused Attention	12.34 (1.01)	15.86 (2.26)	-1.40	.16
Total Duration of Inattention	23.48 (3.08)	32.31 (5.57)	-1.37	.17
Average Bout of Inattentive Episodes	2.36 (.14)	2.75 (.21)	-1.57	.12
Total Duration of Experimenter Looking	20.92 (3.24)	25.23 (3.86)	-.85	.40
Average Length of Individual Look to the Experimenter	1.76 (.12)	1.87 (.13)	-.44	.66

Main Analyses

For the main analyses, we examined (a) the effects of book type and narration style on learning (i.e., word learning, story comprehension), (b) the effects of these variables along with prior tablet e-book experience on learning, (c) the effects of book type and narration style on attention measures, (d) the effects of these variables along with attention on learning, and (e) exploratory correlational analyses on the relation between attention and learning.

Effects of book type and narration style. The main goal of the project was to understand how word learning and story comprehension differed as a function of book type and narration style, as no work to date has examined how preschoolers learn words and story content from print and tablet e-books while controlling for narration.

Word learning. To investigate differences in receptive word learning scores as a function of condition, an analysis of covariance (ANCOVA) was conducted with Book Type (2: Print, Electronic) and Narration Style (2: Live, Audio) as between-subject factors with PPVT as the covariate. The covariate was significant, $F(1, 95) = 19.74, p = .001, \eta_p^2 = .17$. The analysis revealed a main effect of book type, $F(1, 95) = 4.30, p < .05, \eta_p^2 = .04$ and a marginal effect of narration style, $F(1, 95) = 4.07, p = .05, \eta_p^2 = .04$. Children's receptive word learning scores were higher in the e-book conditions ($M = 4.77, SE = .23$) than in the print book conditions ($M = 4.09, SE = .23$). Additionally, there was a trend for children's receptive word learning scores to be higher in the audio narration conditions ($M = 4.26, SE = .23$) than in the live reader conditions ($M = 4.10, SE = .23$). The interaction was not significant, $F < .04, ns$. We also conducted these analyses separately for nouns and verbs, and the results were the same (see Appendix A, as

described in the general introduction). Descriptive statistics for word learning can be found in Appendix C.

Story comprehension. To investigate differences in story comprehension an ANCOVA was conducted with Book Type (2: Print, Electronic) and Narration Style (2: Live, Audio) as between-subjects factors and PPVT as a covariate. The covariate was significant, $F(1, 95) = 29.66, p < .001, \eta_p^2 = .24$. The analysis revealed no main effects or interactions, $F_s < 1.81, ns$. Children's story comprehension scores were similar in the print ($M = 4.19, SE = .20$) and e-book ($M = 4.40, SE = .20$) conditions and in the live reader ($M = 4.48, SE = .20$) and audio narration ($M = 4.11, SE = .20$) conditions.

Descriptive statistics for the story comprehension scores can be found in Appendix C.

Effect of prior tablet e-book experience. The second goal was to examine the effects of prior experience with tablet e-books (from the parent questionnaire) on word learning and story comprehension. Prior experience with tablet e-books was defined as the child's experience: (a) reading/listening to tablet e-books with someone else (e.g., a parent, sibling, etc.), (b) reading tablet e-books alone (without audio narration), and (c) listening to tablet e-books alone with audio narration, and analyses were conducted separately for each type of prior experience. ANCOVAs were conducted with Book Type (2: Print, Electronic), Narration Style (2: Live, Audio), and Prior Experience (2: No, Yes) as between-subjects factors. PPVT was included as a covariate. Table 2 lists the number of yes/no responses to the questionnaire.

Table 2. Parent report of child's book reading behaviors

	No. Responded	Parent Report	
		% Yes	% No
Child read print books alone?	N = 97	57	40
Child read print books with someone?	N = 98	97	1
Child listen to print books?	N = 89	35	54
Child read e-books?	N = 97	12	85
Child read e-books with someone?	N = 97	35	62
Child listen to e-books?	N = 95	42	53
Child read computer books?	N = 97	4	93
Child read computer books with someone?	N = 96	17	79
Child listen to computer books?	N = 94	16	78

Word learning. The analysis examining the child's experience reading/listening to tablet e-books with someone revealed interesting results. The main effect of narration style, $F(1, 88) = 6.82, p < .05, \eta_p^2 = .07$ revealed that children in the audio narration conditions ($M = 4.76, SE = .24$) had higher word learning scores than those in the live reader conditions ($M = 3.85, SE = .25$). Interestingly, there was a marginal book type x prior experience interaction, $F(1, 88) = 3.48, p = .07, \eta_p^2 = .04$. Follow-up analyses revealed there was no effect of book type for those who had previous experience reading/listening to tablet e-books with someone, $F < .09, ns$. That is, for those with this experience, word learning scores were similar in the print ($M = 3.98, SE = .35$) and e-book ($M = 4.14, SE = .37$) conditions. For those who have never read/listened to a tablet e-book with someone, there was a main effect of book type, $F(1, 59) = 4.88 p < .05, \eta_p^2 =$

.08. That is, for those without shared tablet e-book experience, word learning scores were higher in the e-book conditions ($M = 5.07$, $SE = .31$) than in the print book conditions ($M = 4.09$, $SE = .32$). The covariate was significant for the overall analysis, $F(1, 32) = 7.39$, $p < .01$, $\eta_p^2 = .11$, and there were no other main effects or interactions, $F_s < 2.63$, *ns*. The analysis examining the child's experience with tablet e-books alone (without audio narration) revealed no main effects or interactions, $F_s < 2.08$, although the covariate was significant, $F(1, 88) = 16.02$, $p < .001$, $\eta_p^2 = .15$. Finally, the analysis on the child's experience listening to tablet e-books alone with audio narration revealed a main effect of narration style, $F(1, 86) = 6.86$, $p < .05$, $\eta_p^2 = .07$. Children in the audio narration conditions ($M = 4.84$, $SE = .24$) had higher word learning scores than those in the live reader conditions ($M = 3.96$, $SE = .23$). The covariate was significant, $F(1, 88) = 14.44$, $p < .001$, $\eta_p^2 = .14$, and there were no other main effects or interactions, $F_s < 2.47$, *ns*. In sum, a lack of prior experience reading/listening to tablet e-books with someone is an important factor for learning words from tablet e-books.

Story comprehension. The analyses examining the child's prior experience with tablet e-books (when operationalized all three ways) revealed no main effects or interactions, $F_s < 1.89$, *ns*, and the covariate was significant in all three analyses, $p_s < .001$.

Effects of condition on attention measures. The third goal was to understand how book type and narration style influenced the attention measures. During the preschool years, children's ability to maintain attention becomes more sophisticated and goal-oriented (Colombo & Cheatham, 2006; Ruff & Rothbart, 1996). Although preschoolers' attention to tasks (Kannass & Colombo, 2007), toys (Ruff et al., 1998), and

television (Anderson et al., 1981) has been examined, no work has investigated preschoolers' attention to books. ANOVAs were conducted with Book Type (2: Print, Electronic) and Narration Style (2: Live, Audio) as between-subjects factors on attention, inattention, and looking to the experimenter.

Attention analyses. The analysis on total duration of attention to the book revealed a main effect of narration style, $F(1, 96) = 16.27, p < .001, \eta_p^2 = .15$. Children spent more total time looking at the book in the audio narration conditions ($M = 433.14, SE = 7.88$) than in the live reader conditions ($M = 388.21, SE = 7.88$). There were no other significant main effects or interactions, $F_s < .11, ns$. That is, children looked at the print books ($M = 408.87, SE = 7.88$) and e-books ($M = 412.48, SE = 7.88$) for similar durations.

The analysis on average length of individual looks to the book revealed a similar pattern. There was a main effect of narration style, $F(1, 96) = 15.27, p < .001, \eta_p^2 = .14$. Children had longer average looks to the book in the audio narration conditions ($M = 53.43, SE = 5.49$) than in the live reader conditions ($M = 22.85, SE = 5.49$). There were no other significant main effects or interactions, $F_s < 2.29, ns$. That is, children had similar average looks to the print book ($M = 44.01, SE = 5.49$) and e-book ($M = 22.26, SE = 5.49$).

Inattention analyses. The analyses on total duration of inattention did not reveal any main effects or interactions, $F_s < 1.24, ns$. The total duration of inattention was similar between the print ($M = 30.01, SE = 4.61$) and e-book ($M = 25.96, SE = 4.61$) conditions and the live reader ($M = 30.24, SE = 4.61$) and audio narration ($M = 25.73, SE = 4.61$) conditions.

Experimenter looking. The analysis on total duration of looking to the experimenter revealed a main effect of narration style, $F(1, 96) = 32.11, p < .001, \eta_p^2 = .25$. Children in the live reader conditions ($M = 35.68, SE = 3.14$) spent significantly more total time looking at the experimenter than those in the audio narration conditions ($M = 10.55, SE = 3.14$). There were no other significant main effects or interactions, $F_s < .20, ns$. That is, children in the print book ($M = 22.13, SE = 3.14$) and e-book ($M = 24.10, SE = 3.14$) conditions looked at the experimenter for similar durations.

Effect of attention on learning. The fourth goal was motivated by the finding that attention has moderated young children's word learning from media (Krcmar et al., 2007). The goal was to determine if greater attention to the books facilitated learning in specific contexts or uniformly. Because attention differed as a function of condition, it was included as a predictor in order to better understand the role attention played in facilitating word and story learning. To do so, we did a median split on average length of individual looks to the book. Children were classified as having longer sustained periods of attention ($n = 50$) if their average length of individual looks to the book was greater than 21.82 s and shorter sustained periods of attention ($n = 50$) if their average length of individual looks to the book was less than or equal to 21.82 s. This variable was then utilized in two ANCOVAs as a between-subjects factor along with Book Type (2: Print vs. Electronic) and Narration Style (2: Live vs. Audio) on word learning and story comprehension. PPVT was included as a covariate.

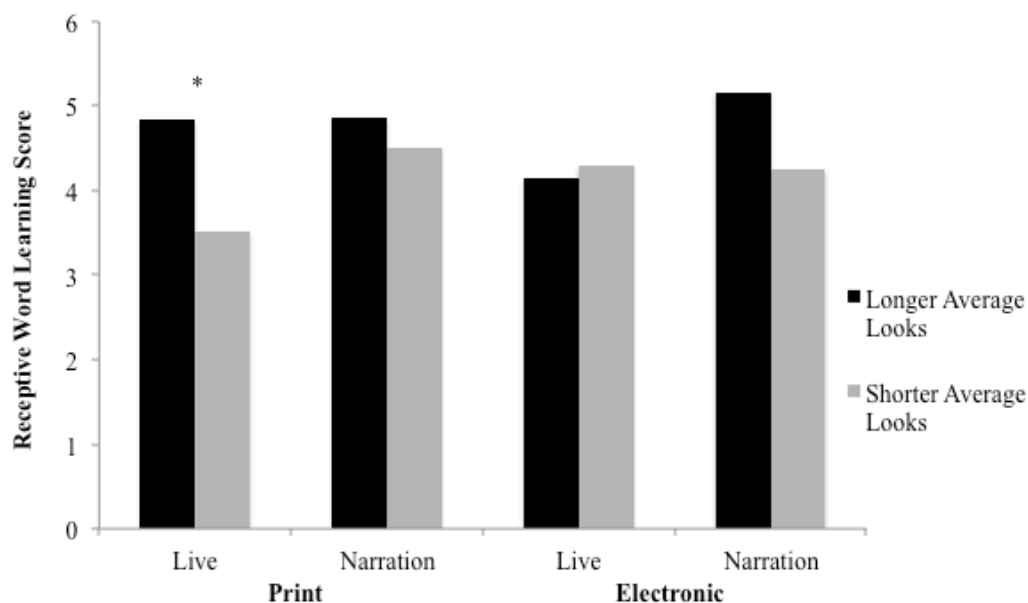
Average length of individual looks to the book as a predictor of word learning.

The 2 x 2 x 2 ANCOVA revealed a marginal 3-way interaction, $F(1, 91) = 3.09, p = .08, \eta_p^2 = .03$. The covariate was significant, $F(1, 91) = 15.33, p < .001, \eta_p^2 = .14$, and no

other main effects or interactions were significant, $F_s < 1.33$, *ns*. To follow-up the marginal 3-way interaction, analyses were conducted separately for the print and e-book conditions. In the print book conditions, the 2 x 2 ANCOVA revealed a marginal narration style x dichotomized average book look interaction, $F(1, 45) = 2.93$, $p = .09$, $\eta_p^2 = .06$. Follow-up analyses revealed a main effect of average book look in the live print book condition, $F(1, 22) = 5.11$, $p < .05$, $\eta_p^2 = .19$. That is, in the live print book condition those with longer sustained periods of attention ($M = 4.83$, $SE = .49$) had higher word learning scores than those with shorter sustained periods of attention ($M = 3.51$, $SE = .49$). Follow-up analyses did not reveal a significant effect of average book look in the narration print book condition, $F < .23$, *ns*. In the narration print book condition, children with longer sustained periods of attention ($M = 4.86$, $SE = .61$) and children with shorter sustained periods of attention ($M = 4.50$, $SE = .37$) had similar scores.

For the e-book conditions, the 2 x 2 ANCOVA did not yield any significant effects, $F_s < .69$, *ns*. That is, in the live e-book condition, children with longer sustained periods of attention ($M = 4.14$, $SE = .82$) and children with shorter sustained periods of attention ($M = 4.29$, $SE = .40$) had similar scores. Additionally, in the narration e-book condition, children with longer sustained periods of attention ($M = 5.16$, $SE = .41$) and children with shorter sustained periods of attention ($M = 4.25$, $SE = .87$) had similar scores. Figure 1 provides a graph of the results.

Figure 1. Effects of book type, narration style, and average length of individual looks to the book on word learning scores, $*p < .05$



Average length of individual looks as a predictor of story comprehension. The 2 x 2 ANCOVA revealed a marginal effect of narration style, $F(1, 91) = 3.57, p = .06, \eta_p^2 = .04$. There was a trend for children in the live reader conditions ($M = 4.52, SE = .23$) to answer more comprehension questions correctly than those in the audio narration conditions ($M = 3.89, SE = .24$). The covariate was also significant, $F(1, 91) = 20.84, p = .001, \eta_p^2 = .19$, and no other main effects or interactions were significant, $F_s < 2.37, ns$.

Relations between attention and learning. The relation between attention to books and learning words and story content from books is unknown. In order to understand these relations, a series of exploratory correlational analyses were conducted between the learning outcomes (word learning score, noun score, verb score, and story comprehension score) and indices of on-task attention (total duration of attention to the book and average length of individual looks to the book). Correlations were conducted

for each condition because we were interested if the relation between attention and learning differed between the different book-reading contexts.

Correlations in the live print book condition. For children in the live print book condition, the relation between attention and learning was only apparent for the word learning scores (see Table 3). Interestingly, the strongest relation was between the noun score and total duration of attention to the book, $r(25) = .47, p < .05$. Children who paid more attention to the book also identified more target nouns correctly on the receptive test. The overall word learning score was correlated with both attention measures. Specifically, the word learning score was significantly related to average length of individual looks to the book, $r(25) = .44, p < .05$. Longer average looks to the book were associated with identifying more of the target words correctly on the receptive test. Furthermore, the word learning score was marginally correlated with total duration of attention, $r(25) = .35, p = .09$. Thus, it generally appears that in the live print book condition, greater attention to the book is associated with higher word learning scores.

Table 3. Correlations between attention measures and learning outcomes in the live print book condition

	Receptive Word Learning Score	Receptive Noun Score	Receptive Verb Score	Story Comprehension Score
Total Duration of Attention	.35 [†]	.47*	-.04	.10
Average Length of Individual Looks	.44*	.27	.28	.05

[†] $p < .10$, * $p < .05$, ** $p < .01$

Correlations in the live e-book condition. For children in the live e-book condition, the relation between attention and learning was also apparent for the word learning scores (see Table 4). Specifically, the word learning score was correlated with the total duration of attention, $r(25) = .47, p < .05$. Longer duration of attention to the book was associated with identifying more target words correctly on the receptive test. Interestingly, the verb score was correlated with both the total duration of attention, $r(25) = .53, p < .01$ and average length of individual looks to the book, $r(25) = .40, p < .05$. The noun scores did not correlate with any of the attention measures. The relation between attention and learning was also significant for story comprehension, $r(25) = .45, p < .05$. Longer duration of total attention to the book was associated with answering more comprehension questions correctly.

Table 4. Correlations between attention measures and learning outcomes in the live e-book condition

	Receptive Word Learning Score	Receptive Noun Score	Receptive Verb Score	Story Comprehension Score
Total Duration of Attention	.47*	.25	.53**	.45*
Average Length of Individual Looks	.17	-.09	.40*	.27

† $p < .10$, * $p < .05$, ** $p < .01$

Correlations in the narration print book condition. For children in the narration print book condition, the relation between attention and learning was only apparent for the story comprehension scores (see Table 5). The story comprehension scores were correlated with both the total duration of attention, $r(25) = .47, p < .05$ and average length

of individual looks to the book, $r(25) = .46, p < .05$. That is, longer duration of total attention and longer average bouts of looking at the book were associated with answering more comprehension questions correctly.

Table 5. Correlations between attention measures and learning outcomes in the narration print book condition

	Receptive Word Learning Score	Receptive Noun Score	Receptive Verb Score	Story Comprehens ion Score
Total Duration of Attention	-.07	.11	-.17	.47*
Average Length of Individual Looks	-.04	.07	-.11	.46*

† $p < .10$, * $p < .05$, ** $p < .01$

Correlations in the narration e-book condition. For children in the narration e-book condition, there were no significant correlations (see Table 6).

Table 6. Correlations between attention measures and learning outcomes in the narration e-book condition

	Receptive Word Learning Score	Receptive Noun Score	Receptive Verb Score	Story Comprehension Score
Total Duration of Attention	.25	.09	.29	.25
Average Length of Individual Looks	-.01	-.30	.31	.07

† $p < .10$, * $p < .05$, ** $p < .01$

CHAPTER FIVE

DISCUSSION

The current project revealed learning from print and tablet e-books is complex during the preschool years; there are multiple influences on word learning and story comprehension. This was the first project to examine how preschoolers learn from print and tablet e-books while addressing a previously confounded variable: narration style. Furthermore, the results are consistent with theories of emergent literacy from tablets and computers that suggest e-books and audio narration can be useful scaffolding tools (Neumann & Neumann, 2014; Yelland & Masters, 2007). When we controlled for vocabulary, our first set of analyses replicated prior work. Preschoolers learned more words from e-books than print books (e.g., Segal-Drori et al., 2010), and there was a trend for preschoolers to learn more words from audio narration than a live reader (e.g., Masataka, 2014). That is, our design permitted us to examine how scaffolding tools such as type of book and style of narration, uniquely affected learning. In the current project, e-books and audio narration were beneficial scaffolding tools for fostering word learning.

The results for story comprehension also mirror past research. Even though vocabulary was a strong predictor of comprehension scores, there were no effects of book type or narration style. Prior work has also revealed no effect of book type (print versus computer e-book) on story comprehension in kindergarteners (de Jong & Bus, 2004; Korat & Shamir, 2007; Segers et al., 2004). Notably, children did very well on the story

comprehension assessment, and so it is possible that ceiling effects contributed to the absence of significant effects. Interestingly, unlike word learning, e-books and audio narration were not better scaffolding tools (than print books and live readers) for fostering story comprehension. In addition to examining scaffolding tools, the current project also more closely examined other influences on learning and found the effect of book type on emergent literacy is complex. Multiple factors influence this effect, and our project revealed two important influences on word learning are previous experience with tablets and attention. First, understanding how children's experience with tablet e-books affects their ability to learn from them has yet to be explored, although it has recently been recommended (Salmon, 2014). Notably, the effect of word learning was only apparent for preschoolers *without* shared tablet e-book experience (i.e., prior experience reading or listening to tablet e-books with someone). These children learned more words in the e-book conditions than in the print book conditions. Preschoolers with shared tablet e-book experience learned a similar number of words from the print and e-book. This unique finding may be due to a novelty effect. Preschoolers who have never read or listened to a tablet e-book with someone may have been more motivated to learn from the novel device (although they were not more attentive). Indeed, preschool teachers have acknowledged iPad novelty may be responsible for children's interest in the device (Flewitt et al., 2014). In the current project, it is likely that shared tablet e-book experience familiarized children with the device, thus reducing a novelty effect. When parents read iPad books with their preschoolers, they make comments about the device (Krcmar & Cingel, 2014). Listening to parent commentary about the device may have

familiarized children with the iPad (or other tablet) as a tool for reading. In turn, this eliminated the novelty effect, which may be why, in the current project, learning did not differ as a function of book type for this group. Future research examining the role of novelty is warranted.

The second major contribution of the current project is the role of attention in learning from print and tablet e-books. When attention was included as a predictor, analyses revealed that (a) word learning scores only differed in the live print book condition as a function of attention and (b) story comprehension scores tended to be higher for those in the live reader conditions. Both findings are discussed in detail below.

When attention was included in the analyses, the initial effects of book type and narration style on word learning disappeared, and an interaction emerged. The interaction revealed that only in the live print book condition, preschoolers who sustained their attention to the book for longer periods of time learned more words than those who sustained their attention for shorter periods of time. This was not the first study to have dichotomized children's visual attention to a medium and found attention interacts with the conditions to affect word learning. Krcmar et al. (2007) found that attention moderated toddlers' word learning from television. Thus, under certain conditions, attention helps children learn words from media.

When attention was included as a variable, there was a trend for children in the live reader conditions to have higher story comprehension scores than children in the audio narration conditions. Additionally, these children were more attentive to the experimenter (i.e., the reader). For children in the live reader conditions, attention to the

reader may have facilitated story comprehension because live humans, but not audio narrated devices, provide social contact that elicits attention and motivates learning (Kuhl, Tsao, & Liu, 2003). The fact that the reader was live and present provided a qualitatively different type of social contact than an audio recording of a human's voice. This is consistent with the idea that the shared book reading, regardless of book type, should be between a child and an adult reader and the narration function should be turned off (Hoffman & Paciga, 2014). Indeed, many believe the narration function is distracting and reduces parent's talk (Kim & Anderson, 2008) or not useful for fostering comprehension (Doty, Popplewell, & Byers, 2001).

The current study also added another important contribution to the literature: preschoolers' attention differed as a function of narration style, not book type. Preschoolers were significantly more attentive to the book in the audio narration conditions than in the live reader conditions (and these children were not more inattentive, but rather they spent more time looking at the experimenter). Interestingly, children were equally attentive to print and e-books indicating they were both engaging. This is partially consistent with past research. That is, prior empirical research (Calvert et al., 2005; Moody et al., 2010) and qualitative interviews with early childhood educators (Blackwell, 2014; Flewitt et al., 2014) have revealed tablets and e-books are engaging. Recall that engagement has been defined as children's attentiveness to a storybook (Moody et al., 2010). Indeed, our project revealed that children's attention to e-books was high—but it was just as high to print books (in the audio narration conditions). Therefore, the conclusion about e-books and engagement may be due to the fact that e-books “talk”

to the children, and in prior work e-books have contained audio narration (Moody et al., 2010) or noises and music (Calvert et al., 2005). Traditionally, print books do not “talk.” The current project revealed that when book type and narration style are parceled apart, attention is more strongly influenced by audio narration than book type. Future work examining e-books and engagement ought to include measures of look duration and consider the role of audio narration.

Finally, our exploratory analyses revealed interesting relations between attention and learning. General patterns emerged as a function of narration style. In the live reader conditions, longer looking to the book was associated with higher word learning scores. In the audio narration conditions (particularly the narration print book condition), longer looking to the book was associated with better story comprehension.

Interestingly, the relations between attention and learning were *different* in all conditions. Although this relation has not been examined across book reading contexts, other work has examined the relation between attention and performance in other domains, such as distractibility. Kannass and colleagues have found the relation between attention and performance exists in certain contexts (Kannass & Colombo, 2007; Kannass et al., 2010; Wyss et al., 2012). That is, better performance on cognitive tasks (e.g., puzzle completion) was associated with longer looking to the task, but only when preschoolers worked on tasks in an environment that challenged attention (e.g., when a distractor is present). Similarly, the current project found that the relation between attention and learning was not the same across contexts; the relation between attention and word learning was evident in the live reader conditions, when the child had to divide

their attention between the reader and the book. Specifically, in the live conditions, when children heard a novel word while looking at the reader, they had to disengage from looking at reader, redirect their attention to the book, and search for the referent on the page. This was not the case for children in the narration conditions, as these children had no reason to look at the experimenter. Thus, the current project supports a theoretically important finding: the association between attention and word learning was apparent when children had to divide their attention (i.e., when attention was challenged) but non-existent when children did not have to divide their attention (i.e., when attention was not challenged).

As mentioned the goal of the project was to better understand how scaffolding tools influence literacy development. Our findings are consistent with the theoretical framework suggesting that tablet e-books have the potential to scaffold young children's learning (Neumann & Neumann, 2014; Yelland & Masters, 2007). Expertise with digital technology is a valued skill in our society, and through guided participation, caregivers can scaffold emergent literacy skills in print and electronic contexts. Indeed, theories of emergent literacy support a neo-Vygotskian perspective in that pre-readers learn through interacting with skilled readers (typically teachers and caregivers) (Rogoff, 1990; Sénéchal, LeFevre, Smith-Chant, & Colton, 2001). This learning takes place through a process called scaffolding, in which an adult mediates a child's learning so it can take place at a higher level than what would be possible if that child were alone. Scaffolding has been described as a *technique* and as a *tool* (Yelland & Masters, 2007). Similar to past work (Rosenshine & Meister, 1992), we conceptualized scaffolding as a tool

provided for the learner (see also Yelland & Masters, 2007). Unique to the current study was the manipulation of the scaffold: the book itself and the narration style (a live reader versus audio narration). Although patterns in learning emerged when specific factors were taken into account (prior experience, attention), word learning was better than chance in all four conditions and story comprehension scores were fairly high. Thus, like traditional book reading research in which an adult scaffolds a child's learning (Bus et al., 2000; Dickinson & Smith, 1994), the current project revealed that tablet e-books and audio narration can also act as scaffolders, which is consistent with emerging theories of literacy development in electronic contexts (Neumann & Neumann, 2014; Yelland & Masters, 2007).

An important component of the current project was the presence of an adult to set up the book and keep the child on the correct page *in all conditions*. Indeed, the presence of a teacher is critical when computers are used to scaffold learning with young children (Schetz & Stremmel, 1994; Yelland & Masters, 2007). Thus, while parents may prefer their children to engage with apps, like e-books, without their assistance (Michael Cohen Group, 2012), the current project and theories of emergent literacy in traditional and digital contexts suggests that the presence of an adult is essential for children to benefit from the experience. That is, audio narration may be a useful scaffolding tool, but for scaffolding to be successful it ought to be dynamic, collaborative, and adjustable. Therefore, an adult is essential to scaffold the child's emergent literacy development in all book reading contexts—print, electronic, read aloud, and narrated.

Future Research

Research examining tablet e-books with preschoolers is very limited and future work is warranted. One area for future work is manipulating the live reader. That is, in the current project the live reader was a researcher and therefore a stranger to the children. This may have influenced the children's interest in the live reader more than the book itself. It would be important to conduct the current project in which the reader is a parent, teacher, or another familiar adult.

Conclusion

In closing, there is support for the use of tablet e-books with preschoolers (NAYEC and Fred Rogers Center, 2012; Neumann & Neumann, 2014), and prior work has suggested e-books are superior to print books in fostering engagement (Moody et al., 2010) and supporting emergent literacy skills (Segal-Drori et al., 2010). However, a much more complex picture was revealed in the current study when we (a) parceled apart book type and narration style and (b) considered the roles of vocabulary, prior experience and attention to the book. We urge future research to include these factors and others such as SES in order to build a more comprehensive understanding of how tablet e-books affect learning. In turn, it will help parents, educators, and policy makers create best practices for incorporating technology into our homes and schools.

CHAPTER SIX

GENERAL DISCUSSION

This dissertation sought to better understand how scaffolding tools (print books, tablet e-books, audio narration) facilitated two emergent literacy skills, word learning and story comprehension. The project was motivated by the fact that a large body of work focuses on computer e-books, despite the fact that preschooler's time with computers has decreased while their access and interaction with tablets have increased (Common Sense Media, 2013; Reich et al., 2015). Notably, the current project was conducted with preschoolers as the majority of e-book research has been conducted with kindergartners; 4-year-olds were an important age to investigate because literacy skills emerge before formal schooling and are formative of conventional reading abilities (National Research Council, 1998). The project adds three contributions to the literature. First, by addressing the previous confound between book type and narration style, the dissertation revealed that learning words and story content from print and tablet e-books is complex during the preschool years. There are multiple influences (e.g., the type of book, the style of narration, vocabulary size, prior experience, attention) on how children learn words and story content through this highly valued sociocultural activity. Second, engagement has been defined as attention, but attention was not measured in prior work. By coding and analyzing a variety of attention measures (looking at the book, experimenter looking, inattention, etc.), we expanded the field's understanding of how a component of

engagement (i.e., attention) differed as a function of book type and narration style.

Finally, we conducted analyses to explore the relation between attention and learning and thus, contribute a better understanding of how these cognitive processes are related in different book reading contexts. These contributions are discussed in detail in the present chapter, followed by the theoretical contribution, limitations of the project, and future directions. Comparing and contrasting the current results with past research is emphasized, but this is challenging given the prevalence of confounds in prior experimental work.

A Complex Story: Preschoolers' Learning from Print and Tablet E-books

By parceling apart book type and narration style, we addressed a frequent confound in the literature and in turn, revealed that preschoolers' learning from traditional print books and tablet e-books is complicated. Interestingly, across conditions, receptive word learning scores were above chance, and story comprehension scores were high. Our project supports the utility of print and tablet e-books for supporting literacy when adult is present to monitor the child's progress. Although word and story scores were high across conditions, effects of book type and narration style emerged when children's vocabulary was controlled. In this way, our analyses replicated past work. Preschoolers learned more words in the e-book conditions than in the print book conditions, which is consistent with the literature comparing kindergarteners' learning from print books versus computer e-books (Korat et al., 2009; Segal-Drori et al., 2010). However, as discussed, this literature has confounded book type and narration style; therefore, the current project supports the purported effect of computer e-books with a

different device, the tablet e-book, while controlling for narration style. Additionally, a trend for audio narration emerged. Interestingly, others have suggested that audio narration assists preschoolers' word learning from tablet e-books. Masataka (2014) found Japanese preschoolers learned more kana (Japanese characters) from an audio narrated tablet e-book than from a print book read aloud by an adult. However, in Masataka's (2014) e-book condition, the text was also highlighted, and so the audio narration feature was confounded with text highlighting, another scaffolding tool. It may be that in Masataka's (2014) work, audio narration, text highlighting, or a combination of these tools facilitated kana learning from tablet e-books. Based on the results of the current project, scaffolding tools like tablet e-books and audio narration have the potential to facilitate word learning in 4-year-olds.

Interestingly, the current study revealed a different pattern for story comprehension. There were no effects of book type or narration style on story comprehension scores, which replicates past work examining how kindergarteners learn story content from print and computer e-books (de Jong & Bus, 2004; Korat & Shamir, 2007; Segers et al., 2004). Notably, the type of book and style of narration were confounded in previous research; an adult read the print book and an audio device narrated the computer e-book. Furthermore, this work was also conducted with a computer, not a tablet e-book as in the current project. Despite these methodological differences, the current project replicated the finding that story comprehension did not differ as a function of book type or narration style. An alternative explanation for the

absence of significant effects on story comprehension may be due to a ceiling effect. In general, children performed very well on the story comprehension assessment.

Although we replicated prior work, when controlling for only vocabulary, the current project revealed a very important finding: the effect of book type and narration style on emergent literacy is multifaceted. When other factors are considered, the results just described do not persist. Specifically, prior experience and attention were two important influences on word learning and story comprehension. These factors are discussed below to illustrate the complexity of preschoolers' learning from books.

Prior experience. Understanding how children's experience with tablet e-books affects their ability to learn from them has yet to be explored, although it has recently been recommended (Salmon, 2014). The current study included children's prior experience with tablet e-books in the analyses, and the effect of book type on word learning was only apparent for preschoolers *without* shared tablet e-book experience (i.e., experience reading or listening to tablet e-books with another person). These children learned more words from the tablet e-book than the print book. On the other hand, preschoolers who have prior tablet experience learned words equally well from both books. Interestingly, in our sample, 35% of children had shared tablet e-book experience, and this proportion is consistent with the number of families (with young children) who own an iPad (Common Sense Media, 2013). The interaction between prior experience and book type on word learning may be due to a novelty effect. Preschoolers *without* shared tablet e-book experience may have been more motivated to learn from the e-book device because it was novel. Another possibility is that children without prior experience

may have been more attentive to the tablet e-book than traditional print book. However, attention did not significantly differ between the print book and tablet e-book for those without prior experience. Therefore, it is possible that novelty may be responsible for higher word learning scores; for those without shared tablet experience, the iPad was a new and exciting tool they could interact with as they completed the familiar activity of book reading. In turn, this facilitated learning. Conversely, preschoolers with shared tablet e-book experience have been exposed to the device before, and thus, it was not a novel tool. Given that these children had experience sharing tablet e-books with another individual, it is likely that they have also heard comments about the tablet's format (Krcmar & Cingel, 2014). Their prior exposure to the tablet coupled with hearing adults talk about the device itself could have familiarized these children with the device, thus reducing a novelty effect. In turn, these children learned words equally well from the print and tablet e-book, as both types of literacy tools were familiar to them.

Attention to the book. The current study also included children's attention to the book in the analyses. This was an important contribution because attention to cognitive activities has been measured to understand how attention facilitates word learning. For example, prior work has measured attention to television (Krcmar et al., 2007), but attention to books has not been measured. In the current project, when attention to the book was included as a predictor of word learning, the initial effects of book type and narration style disappeared. Instead, an interaction emerged between the three variables. Preschoolers who sustained their attention to the book for longer durations learned more words than those who sustained their attention for shorter durations but only for those in

the live print book condition. That is, endogenous attention was beneficial for learning in a specific context: when a print book is read aloud by an adult. On the other hand, attention did not facilitate learning in the other book reading contexts. In general, this finding is consistent with past research that suggests, in certain contexts, attention helps young children learn words from media, but in other contexts, attention does not predict learning (Krcmar et al., 2007).

The inclusion of attention also revealed a very important finding regarding story comprehension. Recall in the initial analysis, there was no effect of book type or narration style on story comprehension. However, when attention was included, a trend for children to learn more story content in the live reader conditions than the audio narration conditions emerged. Interestingly, the other effects of narration style in the current project supported audio narration, not the live reader. Those effects, however, were for word learning, not story comprehension. Considering the different attentional strategies and the unique task demands for word learning versus understanding a story may shed light on this. In order to learn words, preschoolers actively search illustrations in books to match what they hear with what they see (Evans & Saint-Aubin, 2013). Audio narration may be beneficial in this context because it drew children's attention to the book, and so when children heard the novel word read aloud, they could begin their search for the referent on the page immediately. For story comprehension, learning tended to be superior when the story was read aloud by a live reader, a skill that does not require children to hear a novel word and map it with a specific referent on the page. Instead, story comprehension requires pre-readers to listen to a story orated, decode the

information provided, and encode that information into memory (van Kleeck, 2008). For children in the live reader conditions, attention to the reader may have facilitated story comprehension because live humans, but not audio narrated devices, provide social contact that elicits attention and motivates learning (Kuhl, Tsao, & Liu, 2003). The fact that the reader was live and present provided a qualitatively different type of social contact than an audio recording of a human's voice. Another possibility for this finding is that children could ask the live reader questions about the story and expect to receive an answer. Children in the audio narration conditions learned the audio narrator could not answer their questions because it was a recording. In turn, this perception of contingency or expectation of support may have motivated story learning in the live reader conditions (e.g., Roseberry, Hirsh-Pasek, & Golinkoff, 2013). It is important to note that the live reader (i.e., experimenter) acted similarly across all conditions (i.e., she did not answer questions), and thus, it is the *perception* of contingency, rather than contingency itself that may have motivated story learning. Overall, our finding supports the idea that like shared traditional book reading, tablet e-book reading should be shared and the text should be read aloud by an adult (not narrated by the device) to foster story learning (Fisch et al., 2002; Hoffman & Paciga, 2014; Labbo, 2009). Indeed, many believe the narration function should be turned off because it is (a) distracting and reduces parent's talk (Kim & Anderson, 2008) and (b) not useful for fostering comprehension (Doty, Popplewell, & Byers, 2001).

Attention as a Component of Engagement

The second contribution of the project was the inclusion of attention measures, and the results revealed that attention differed as a function of narration style, not book type. Preschoolers were significantly more attentive to the book in the audio narration conditions than in the live reader conditions. This does not mean children in the live reader conditions were more inattentive, though. In fact, inattention (i.e., looking around the room) did not differ between the live reader and audio narration conditions. There were differences, however, in the duration of attention to the experimenter. Children in the live reader conditions spent significantly more time looking at the experimenter than children in the audio narration conditions. Thus, children in the live reader conditions divided their attention between the reader and the book, but children in the audio narration conditions spent more time looking at the book. Interestingly, we found children were equally attentive to the print book and the e-book, indicating they were both engaging (Moody et al., 2010).

In the current project, the increase in attention to the book in the audio narration conditions helps explain why many contend e-books are engaging (Blackwell, 2014; Moody, 2010). Despite the fact that engagement has been defined as attentiveness to the book, no work has measured attention nor has prior work compared attention to e-books while parceling book type and narration style apart. The current project suggests that attention (a component of engagement) is influenced by audio narration, a scaffolding tool that has predominately been associated with the e-book, not print book. Thus, the claim that e-books are engaging might be due to the fact that they contain audio narration.

Exploring the Relation between Attention and Learning

The last contribution was our exploratory analyses, which examined the relation between attention and learning—an analysis that has yet to be done in book reading research. Interestingly, the relation between attention and learning was different in all conditions. In the live print book condition, attention was positively associated with higher word learning scores but not story comprehension scores. On the other hand, in the live e-book condition, attention was positively associated with higher word learning and story comprehension scores. Thus, in general, greater attention to the book in the live conditions was associated with more learning (i.e., higher scores). A different pattern emerged in the narration conditions. In the narration print book condition, attention was positively associated with the story comprehension score but not the word learning scores, and in the narration e-book condition, attention and learning were not associated. Thus, in general, greater attention to the book in the narration conditions was associated with learning more story content but only if the book was print.

Although the relation between attention and learning in different book reading contexts has not been explored, researchers have examined the relation between attention and performance in other domains, such as distractibility. Kannass and colleagues have found that the relation between attention and performance exists in certain contexts (Kannass & Colombo, 2007; Kannass et al., 2010; Wyss et al., 2012). That is, better performance on cognitive tasks (e.g., more puzzle pieces correctly placed on a puzzle board) is associated with longer looking to the task, but only when preschoolers work on tasks in an environment that challenges attention (e.g., when a distracting television is

on). When preschoolers worked on tasks in an environment that did not challenge attention, the relation did not exist (i.e., performance is not associated with attention). Similarly, the current project found that the relation between attention and learning varied across contexts; the relation between attention and word learning was evident in the live reader conditions, when children had to divide their attention between the reader and book. Thus, in the current project, attention to the book was challenged in the live conditions but not in the narration conditions. In order to learn words, preschoolers actively search illustrations in books to match what they hear with what they see (Evans & Saint-Aubin, 2013). That is, if a preschooler hears a novel word, they search for a novel object or action on the page. In the current project, preschooler's attention to the book was challenged in the live conditions because they divided their attention between the illustrations (a chance to map a novel word with a novel object or action) and the reader. When they heard a novel word, they may have had to disengage from the reader, redirect their attention to the book, and find the matching referent on the page. This was not the case for preschoolers in the narration conditions, as these children had no reason to look at the experimenter. In general, children in these conditions were already looking at the book when they heard the novel word being narrated aloud. Thus, the current project supports a theoretically important finding: the association between attention and word learning was apparent when children had to divide their attention (i.e., when attention was challenged) but non-existent when children did not have to divide their attention (i.e., when attention was not challenged).

Scaffolding as a Tool: Theoretical Contribution

Recall that the goal of the current project was to understand how various scaffolding tools enhance emergent literacy skills during a coveted and highly valued sociocultural activity, book reading. Our design permitted us to better understand the efficacy of these tools while addressing two variables that are confounded in the extant literature: book type and narration style. In general, the dissertation supports the theoretical framework suggesting tablet e-books have the potential to scaffold literacy development (Neumann & Neumann, 2014; Yelland & Masters, 2007). Specifically, we conceptualized scaffolding as a tool provided for the learner (Rosenshine & Meister, 1992; Yelland & Masters, 2007). Although understanding scaffolding as a technique has provided important insight into how variability in adult reading style facilitates literacy development, we held the scaffolding technique constant to better understand scaffolding as a tool. To maintain the same technique across conditions, an adult was present in all four conditions to set up the story and ensure the child remained on the correct page. She did not ask questions, provide commentary, or engage in any other dyadic book reading behaviors. The presence of an adult in all four conditions was done because we did not want narration style to be confounded with social interaction (i.e., if an adult was absent in the narration conditions, it would be impossible to determine if differences in the outcomes were due to the adult's presence/adult-child interaction or the intended manipulation). Furthermore, we wanted learning to be optimal across conditions, and past research shows the presence of a teacher or adult is critical when computers are used to scaffold young children's learning (Schetz & Stremmel, 1994; Yelland & Masters, 2007).

Thus, when an adult monitors a child's interaction with a book (tablet or print), the child has the potential to learn from the book reading experience.

Interestingly, the current project revealed that different scaffolding tools promote different literacy abilities. Moreover, the benefits of these tools depend on other factors like prior experience and attention. On the surface, it appeared that the scaffolding tools that foster word learning are tablet e-books and audio narration, as children learned more words from the tablet e-book and tended to learn more words from the audio narrator. However, these tools are not uniformly beneficial for all preschoolers. The tablet e-book was only beneficial for the children who had never read one with someone before. That is, a useful scaffolding tool for those without shared tablet e-book experience might actually be the tablet e-book itself. Indeed, this suggests that a novelty effect may be responsible for the interaction between experience and book type on word learning. However, the benefits of a tablet e-book may not persist as word learning scores did not differ as a function of experience. Therefore, like the traditional book, a tablet e-book is a useful tool for promoting word learning in preschoolers, but there is no evidence that tablet e-books should replace traditional print books.

Differences in the utility of the scaffolding tools to foster story comprehension were not as apparent in the current project. Story comprehension was high in all conditions, suggesting that print books, e-books, live readers, and audio narration all facilitate learning story content from books. Interestingly, when attention was taken into account, the current project revealed that live readers tended to facilitate story comprehension better than audio narration. However, attention did not predict or interact

with the other variables to predict story comprehension. The inclusion of attention revealed that audio narration might not be a beneficial tool for fostering story comprehension. It may be that a live reader is better, which is consistent with the recommendation that audio narration ought to be disabled when parents read e-books with their preschoolers (Hoffman & Paciga, 2014). Collectively, the scaffolding tools examined in the current project were not similarly beneficial for promoting word learning and story comprehension, and additional factors such as vocabulary, prior experience, and attention to the book influence how scaffolding tools facilitate these skills.

Limitations

The current project has three limitations that must be acknowledged. First, the lack of diversity is problematic. Research comparing learning from print and e-books with native and immigrant kindergarteners revealed different findings as a function of immigrant status (Segers et al., 2004). That is, word learning did not differ as a function of book type (print versus computer e-book) for native kindergarteners, but the immigrant kindergarteners learned more from a print book (read by a live adult) than the computer e-book (narrated by the computer). It is important to note that the immigrant children in Segers et al. (2004) were from low socioeconomic backgrounds. In general, immigrant children are at risk for literacy outcomes because they enter kindergarten with very limited knowledge of the native language. Specifically, in terms of their vocabulary and comprehension, they severely lag behind (Stoep & Verhoeven, 2000). Furthermore, book reading and access to technology differ as a function of SES. Children from low SES backgrounds have had less access to books (Evans, 2004; Snow & Biancarosa, 2003;

Neuman & Celano, 2001; Smith & Dixon, 1995), and in today's digital age, they also have less access to digital platforms such as computers, tablets, and mobile phones that can display e-books (Common Sense Media, 2011; 2013). Importantly, even though these children have less access to digital devices and technology, the current project revealed that print books are also effective tools for fostering literacy skills in young children. As is discussed in the future directions section, the current project must be replicated with more diverse samples.

Second, although prior experience was taken into account, it was only a dichotomous variable. Instead of asking about time spent with tablet e-books, we only asked if the child did or did not have experience with the device. That is, a limitation of current project was that the duration of interacting with tablet e-books (per day, per week, etc.) was not measured. Relatedly, the exclusion of the parent's report regarding the type of tablet (e.g., iPad, Kindle, Nook, etc.), type of apps (entertainment vs. educational), and category of apps (math, literacy, drawing, etc.) their children utilize is also limiting. By including these data, we can better understand how the quantity and quality of prior experience with tablets and apps influence literacy development from books in different contexts.

Finally, the atypical book reading behaviors of the experimenter reduce the ecological validity of the study. By the time children are 4, they have come to learn that book reading is an activity in which the reader and child engage in extratextural discourse. Parents ask questions, request labels, and elaborate on information (Haden et al., 1996; Ninio, 1983; Scarborough & Dobrich, 1994), and children respond and provide

commentary of their own (Evans, Reynolds, Shaw, & Pursoo, 2011; Morrow, 1988). In the current project, the book reading sessions did not possess this natural flow or give-and-take of information. This was done to ensure that only book type and narration style and *not* social interaction or some other facilitative behavior (e.g., questioning) was altered. Indeed, participants may have been confused or mildly frustrated that their questions, comments, and general interaction styles were not reciprocated in the expected dyadic fashion. This limitation is addressed in the next section regarding areas for future work.

Future Directions

In the present project, four conditions were utilized in order to better understand how scaffolding tools (book type, narration style) affected two emergent literacy skills, word learning and story comprehension. To do so, the reader had to read the story exactly like the audio narrator in order to ensure that narration style was the only variable manipulated. By adhering to a script, we ensured no other book reading behaviors (e.g., providing comments, asking questions, following requests) were manipulated, as these would be potential confounding variables. Future research might examine how scaffolding as a technique during book reading affects learning from print and tablet e-books with and without audio narration. We know adult readers spend more time talking about the features of iPad books (book format) than traditional print books when reading with their preschoolers (Krcmar & Cingel, 2014). However, it is unknown how adult commentary would differ across all four conditions utilized in the current study, and furthermore, how that commentary would facilitate attention and learning.

Another important direction for future work is to conduct the project with a more diverse sample. Recall that Segers et al. (2004) found being at risk affects word learning from print and e-books. Thus, it is essential to conduct the project with preschoolers who are at risk in terms of their vocabulary development, especially because parents of at risk children do not utilize free, online books for preschoolers (van Dijken, Bus, & de Jong, 2011). One population that may benefit from audio-narrated e-books are English language learners (ELLs), as they are at risk for developing poorer literacy outcomes compared with their same-age counterparts who are not at risk. It is warranted to conduct the project with preschoolers whose home language is something other than English because (a) the percentage of bilinguals and ELLs in the U.S. is rapidly growing (Espinosa, 2007; Fry & Gonzales, 2008; U.S. Bureau of Labor Statistics, 2010), and (b) the a tablet e-book may nurture pre-literacy skills, especially if a program on the tablet (e.g., an e-book) can be implemented in the classroom and brought home for added practice. In this case, pre-readers of parents who do not speak English would have the opportunity to develop their reading competence with an audio narrated tablet e-book. Such an intervention would need to be carefully constructed and empirically tested before a “school-to-home” tablet was implemented in early childhood curricula. Nevertheless, the finding that preschoolers learned from audio narrated tablet e-books in the current project provides a promising start.

A third area that warrants more investigation is the role of engagement. The current project revealed that audio narration may elicit more attention than a live reader; however, other scaffolding tools may elicit engagement. For example, hotspots, games,

and other features have been purported to be responsible for enhancing reading engagement (Moody, 2010), but these tools have never been parceled apart and empirically tested. Furthermore, it would be worthwhile and practical to explore if measures of engagement previously utilized (e.g., persistence, enthusiasm, and compliance) (Moody et al., 2010) correlate with attentiveness (i.e., total look duration, average length of individual looks). By doing so, researchers, parents, and teachers will gain a more comprehensive understanding of the components that comprise engagement and whether these components are interrelated or unique facets of engagement.

Finally, research examining the efficacy of tablet e-books is very limited, as only a handful of projects have investigated how 4-year-olds learn from tablet e-books (Krcmar & Cingel, 2014; Masataka, 2014). In the current project, an adult supervised the child's interaction with the print and e-books in all conditions. It would be interesting to see if the effects would be similar if an adult was not present to set-up the story and ensure the child was on the correct page. This is very warranted given that parents prefer children to engage with apps independently, without the help of a parent (versus apps that require parent support and/or assistance to navigate) (Michael Cohen Group, 2012).

Implications

The current project has implications for our perception of technology, particularly in terms of when it is appropriate to use new technology with young children and when it is not. Also, given that preschoolers learned from the tablet e-book in the current project, it also has implications for how the tool can be embedded in early child curricula.

Perception of technology. With regard to the development of young children, there has been some backlash in terms of technology (American Academy of Pediatrics, 1999; 2011; Geist & Gibson, 2000; Zimmerman & Christakis, 2007). Undoubtedly, there are consequences of our electronic world. Radesky and colleagues (2015) question if mobile media (smartphones, tablets) are (a) undermining children's self-regulation development (e.g., a parent give his smartphone to his toddler to prevent a meltdown) and (b) distracting to parents, thus limiting parent-child communication. Other media have also been criticized. Prolonged time watching television has been associated with childhood obesity (Dietz & Gortmaker, 1985), in part due to the unhealthy food ads (Zimmerman & Bell, 2010). Furthermore, when television is on in the background, parent-child interactions are reduced (Kirkorian et al., 2009) and preschoolers get less work done (Kannass et al., 2010). However, not all screen media are perceived negatively (Calvert & Wartella, 2014), and the benefits of educational screen media have been acknowledged (Anderson & Hanson, 2010). One beneficial medium is the e-book (Korat et al., 2013; Masataka, 2014; Neumann & Neumann, 2014; Segal-Drori et al., 2010). That is, the current project supports the utility of the tablet e-book as a tool for supporting literacy development, when book reading takes place between an adult and a child. A tablet should not be used to pacify a child (cf. Radesky et al., 2015).

In short, the current study contributes to the growing body of work that suggests tablet e-books can benefit emergent literacy skills (Flewitt et al., 2014; Kucirkova, 2014; Masataka, 2014; Neumann & Neumann, 2014). Thus, the perception of technology in early childhood is shifting from unequivocally "bad" to context-dependent. It is important

to consider how these technologies are being used and for what purpose. In the current project, an adult set up the e-book and monitored the children as they engaged with the device. It would be irresponsible to suggest that the benefits of the current project extend to when preschoolers independently interact with the device in a separate room or away from adult supervision.

Early childhood curriculum. Although the current project was not conducted with a preschool classroom, the findings have implications for early child curricula, which is quickly becoming an important topic in the field. The federal government has devised a plan that promotes student-centered learning with technology (U.S. Department of Education Office of Educational Technology, 2010). Furthermore, the National Association for Education of Young Children and the Fred Rogers Center for Early Learning (2012) recommends that adults should let their preschoolers and kindergarteners freely explore touchscreens loaded with developmentally appropriate apps.

While tablet e-books should not replace the traditional shared print book reading practice, tablets might be beneficial for early childhood classrooms in that they could replace old computers with outdated software. Computers have been integrated in early childhood classrooms since the late 1970s (Hisrich & Blanchard, 2009). Preschool teachers contend that a major benefit of the tablet is its mobility compared with the desktop computer or even laptop (Blackwell, 2014). Not only are the students not constrained to a desktop area to interact with the tablet, but they can also bring the tablet on fieldtrips and home for additional practice. In addition to mobility, tablets save classroom time compared with conventional computers (e.g., no need to wait for the

computer to boot up, no need to log in with a unique password) (Blackwell, 2014). Others agree. Specifically, tablets are superior to computers in that the touchscreen is easy for children to navigate (Geist, 2012; Neumann & Neumann, 2014). Furthermore, when considering size alone, many more tablets can fit into a classroom than computers, and tablets are cheaper than computers (Blackwell, 2014). Thus, due to their usability, size, and cost, it is highly likely there will be more tablets per early childhood classroom than there have been computers (i.e., typically 1-2) per early childhood classroom

The current project revealed that there are multiple influences on how scaffolding tools (print books, tablet e-books, audio narration) influence emergent literacy development. Tablet e-books may be useful in fostering some skills. As more research on this particular tool is conducted, the benefits and drawbacks of tablet e-books will emerge. In turn, the tablet e-book may be a stimulating and cost-effective replacement for computer e-books in the early childhood classroom.

Summary and Conclusion

In closing, there is support for the use of tablet e-books with preschoolers (Flewitt et al., 2014; NAYEC & Fred Rogers Center, 2012; Neumann & Neumann, 2014), and prior work has suggested e-books are superior to print books in fostering engagement (Moody et al., 2010) and supporting emergent literacy skills (Segal-Drori et al., 2010). However, a much more complex picture was revealed in the current study when we considered the roles of prior experience and attention. Our findings suggest that the novelty of a tablet e-book may initially support word learning, but this effect wanes with more experience with the device. Additionally, audio narration may help children learn

words from books because their attention is directed to the page, but in terms of story comprehension, a live reader may be better. We urge future researchers to (a) more closely examine the scaffolding tools utilized in the current project and include additional tools not examined (e.g., games, hotspots, text highlighting, animation) and (b) include factors like experience, attention, vocabulary, and SES in order to build a more comprehensive understanding of how tablet e-books affect learning. In turn, it will help parents, educators, and policy makers create best practices for incorporating technology into our homes and schools.

APPENDIX A

CHILD QUESTIONNAIRE, WORD TYPE, AND FOCUSED ATTENTION

Child-Report Questionnaire, Word Type, and Focused Attention

Child-Report Questionnaire

In addition to the parent report questionnaire, a child questionnaire was created in order to obtain the child's own report of his or her book reading experience. After completing the PPVT-4, the experimenter administered the child version of the questionnaire verbally, and the child reported his or her experience with traditional print books, tablet e-books, and computer books. Table 7 presents the children's report of their general book reading experiences.

Table 7. Child report of book reading behaviors

	No. Responded	Child Report	
		% Yes	% No
Read print books?	N = 100	99	1
Read print books with someone?	N = 100	89	11
Listen to print books?	N = 99	73	26
Read e-books?	N = 99	43	57
Read e-books with someone?	N = 99	29	70
Listen to e-books?	N = 99	36	63
Read computer books?	N = 99	34	65
Read computer books with someone?	N = 98	29	69
Listen to computer books?	N = 99	28	71
Can name the iPad.	N = 100	66	34

Effect of Word Type (Noun vs. Verb)

We were interested if children learned more nonsense nouns than verbs (e.g., McLeod & McDade, 2011). To investigate if noun and verb receptive scores differed as a function of condition, a mixed model ANCOVA was conducted with Book Type (2: Print, Electronic) and Narration Style (2: Live, Audio) as between-subjects factors, Word Type (2: Noun, Verb) as a within-subjects factor, and PPVT as the covariate. The covariate was significant, $F(1, 95) = 19.74, p = .001, \eta_p^2 = .17$. The analysis revealed similar findings: a main effect of book type, $F(1, 95) = 4.30, p < .05, \eta_p^2 = .04$ and a marginal effect of narration style, $F(1, 95) = 4.07, p = .05, \eta_p^2 = .04$. There were no other main effects or interactions, $F_s < 2.21, ns$.

Duration of Focused Attention

Duration of focused attention was also coded in the same manner as attention. Focused attention is behaviorally manifested in looks of concentration. Prior work has examined duration of focused attention to a medium (i.e., television) (Ruff, Capozzoli, & Weissberg, 1998). This same criteria utilized by Ruff et al. (1998) was utilized in the current project. That is, a child was judged to be in a state of focused attention when s/he displayed decreased motor movements, interested facial expression (i.e., concentration), and active scanning of the book.

A preschooler was not be considered to be in a state of focused attention when they (a) talked to the experimenter or parent, (b) moved their eyes around the entire book, (c) laughed or smiled, (d) engaged in stereotypic, repetitive behavior, or (e) simply looked at the stimulus without signs of engagement or concentration (Ruff & Lawson,

1990). Furthermore, when a child engaged in gross bodily movements (e.g., swinging back and forth, kicking legs, waving arms in the air, bouncing up and down in the chair), he or she was not exhibiting focused attention. If the child was displaying focused attention to a part of the book that was not the image (e.g., the binding of the print book or the border of the iPad), this was not coded as focused attention.

In order to code for this focused attention, the coder pressed a button whenever the child displayed the focused behavior. Reliability was calculated for 25% of the sample by correlating the duration of each individual look for two coders. The average inter-observer reliability was .96 for duration of individual looks (mean difference = 1.4 s). The total duration of focused attention and the average bout of focused attention were calculated and utilized in analyses.

Focused attention results. The results section for focused attention describe: (a) differences in total duration of focused attention and average bouts of focused attention as a function of book type and narration style and (b) the relation between the learning outcomes and focused attention measures.

Effect of book type and narration style on focused attention. The analysis on total duration of focused attention revealed a main effect of narration style, $F(1, 96) = 12.65, p < .001, \eta_p^2 = .12$. Children's total duration of focused attention was longer in the narration conditions ($M = 208.09, SE = 14.42$) than in the live conditions ($M = 135.58, SE = 14.42$). There were no other main effects or interactions, $F_s < 2.49, ns$. That is, total duration of focused attention was similar in the print book ($M = 155.74, SE = 14.42$) and e-book ($M = 187.93, SE = 14.42$) conditions. The analysis on average bout of focused

attention revealed a similar pattern. It revealed a main effect of narration style, $F(1, 96) = 10.10, p < .01, \eta_p^2 = .10$. Children exhibited significantly longer bouts of focused attention in the narration conditions ($M = 18.00, SE = 1.72$) than in the live conditions ($M = 10.27, SE = 1.72$). There were no other main effects or interactions, $F_s < .21, ns$. The average bout of focused attention was similar in the print book ($M = 13.59, SE = 1.72$) and e-book ($M = 14.69, SE = 1.72$) conditions.

Relations between focused attention and learning. The relations between attention and learning when the focused attention measures were utilized as indices of attention were not nearly as strong as the relations between attention and learning when the look duration variables were utilized as indices of attention. The correlations for each condition are described below.

Correlations in the live print book condition. For children in the live print book conditions, the relation between focused attention and learning was only apparent for the receptive word learning score. Specifically, the receptive word learning score was marginally correlated with average bout of focused attention, $r(25) = .39, p = .06$. There was a trend for longer average bouts of focused attention to be associated with higher receptive word learning scores.

Correlations in the live e-book condition. For children in the live e-book condition, the relation between focused attention and learning was only apparent for one of the word learning scores. Specifically, the receptive verb score was correlated with the total duration of focused attention, $r(25) = .41, p < .05$. Longer duration of focused attention was associated with higher receptive verb scores.

Correlations in the narration print book condition. For children in the narration print book conditions, the relation between focused attention and learning was only apparent for the story comprehension scores. Specifically, story comprehension scores were marginally correlated with both the total duration of focused attention, $r(25) = .39, p = .06$ and average bout of focused attention, $r(25) = .36, p = .08$. There was a trend for longer duration of focused attention and longer average bouts of focused attention to be associated with answering more story comprehension questions correctly.

Correlations in the narration e-book condition. For children in the narration e-book conditions, none of the correlations between learning outcomes and focused attention measures were significant.

APPENDIX B
STORY COMPREHENSION QUESTIONS

List of Story Comprehension Questions

1. What was the story about?
2. Where does Sam read his book?
3. What does Sam eat when he is hungry?
4. Why are Sam's arms tired?
5. What is the most important power?
6. Why is Sam excited at the end of the story?
7. Who is Sue?

APPENDIX C
DESCRIPTIVE STATISTICS FOR WORD LEARNING AND STORY
COMPREHENSION

Descriptive Statistics for Word Learning and Story Comprehension

	Mean	Standard Error	Range (low)	Range (high)
Receptive Word Learning Score	4.43	.18	1.0	9.0
Receptive Noun Score	2.11	.12	0.0	5.0
Receptive Verb Score	2.32	.12	0.0	5.0
Story Comprehension Score	4.30	.16	0.0	7.0

REFERENCE LIST

- American Academy of Pediatrics. (1999). Media education, *Pediatrics*, *104*, 341-343.
- American Academy of Pediatrics. (2011). Media use by children younger than 2 years. *Pediatrics*, *128*, 1040–1045. doi:10.1542/peds.2011-1753
- Anderson, D. R., & Hanson, K. G. (2010). From blooming, buzzing confusion to media literacy: The early development of television viewing. *Developmental Review*, *30*, 239-255. doi:10.1016/j.dr.2010.03.004
- Anderson, D. R., & Levin, S. R. (1976). Young children's attention to Sesame Street. *Child Development*, *47*, 806-811.
- Anderson, D. R., Lorch, E., Field, D. E., & Sanders, J. (1981). The effects of TV program comprehensibility on preschool children's visual attention to television. *Child Development*, *52*, 151–157.
- Ard, L. M. & Beverly, B. L. (2004). Preschool word learning during book reading: Effect of adult questions and comments. *Communication Disorders Quarterly*, *26*, 17-28. doi:10.1177/15257401040260010101
- Blackwell, C. (2014). Teacher practices with mobile technology integrating tablet computers into the early childhood classroom. *Journal of Education Research*, *7*, 1-25.
- Bloom (1964). *Stability and change in human characteristics*. New York: Wiley.
- Brackenbury, T. & Fey, M. E. (2003). Quick incidental verb learning in 4-year-olds: Identification and generalization. *Journal of Speech, Language, and Hearing Research*, *46*, 313-327. doi:10.1044/1092-4388(2003/025)
- Brito, N., Barr, R., McIntyre, P., & Simcock, G. (2012). Long-term transfer of learning from books and video during toddlerhood. *Journal of Experimental Child Psychology*, *111*, 108-119. doi:10.1016/j.jecp.2011.08.004
- Bus, A. G., Leseman, P. M., & Keultjes, P. (2000). Joint book reading across cultures: A comparison of Surinamese-Dutch, Turkish-Dutch, and Dutch parent-child dyads. *Journal of Literacy Research*, *32*, 53–76. doi:10.1080/10862960009548064

- Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research, 65*, 1-21.
- Cain, K. & Oakhill, J. V. (1999). Inference making ability and its relation to comprehension failure. *Reading and Writing 11*, 489–503.
- Cain, K., Oakhill, J. V., & Elbro, C. (2003). The ability to learn new word meanings from context by school-age children with and without language comprehension difficulties. *Journal of Child Language, 30*, 681-694.
doi:10.1017/S0305000903005713
- Calvert, S. L., Strong, B. L., & Gallagher, L. (2005). Control as an engagement feature for young children's attention to and learning of computer content. *American Behavioral Scientist, 48*, 578-589. doi:10.1177/0002764204271507
- Calvert, S. L., & Wartella, E. A. (2014). Children and electronic media. In E. T. Gershoff, R. S. Mistry, & D. A. Crosby (Eds.), *Societal contexts of child development* (pp. 175-187). New York: Oxford University Press.
- Chera, P., & Wood, C. (2003). Animated multimedia 'talking books' can promote phonological awareness in children beginning to read. *Learning and Instruction, 13*, 33-52.
- Chiong, C. & Shuler, C. (2010). *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps*. New York: The Joan Ganz Cooney Center at Sesame Workshop.
- Choi, H. P., & Anderson, D. R. (1991). A temporal analysis of free toy play and distractibility in young children. *Journal of Experimental Child Psychology, 52*, 41-69.
- Chomsky, C. (1979). Language and reading. In R. E. Shafer (Ed.) *Applied linguistics and reading* (pp. 112-128). Newark, DE: International Reading Association.
- Ciampa, K. (2012). Improving grade one students' reading motivation with online electronic storybooks. *Journal of Educational Multimedia and Hypermedia, 21*, 5-28.
- Clark, H. H. (1978). Review of linguistic theory: What can it say about reading? *PsycCRITIQUES, 23*.
- Clay, M. (1966). *Emergent reading behavior*. Unpublished doctoral dissertation. University of Auckland, New Zealand.

- Cohen, L.B., Atkinson, D.J., & Chaput, H. H. (2004). *Habit X: A new program for obtaining and organizing data in infant perception and cognition studies* (Version 1.0). Austin: University of Texas.
- Colombo, J. (2001). The development of visual attention in infancy. *Annual Review of Psychology, 53*, 337-367.
- Colombo, J., & Cheatham, C. L. (2006). The emergence and basis of endogenous attention in infancy and early childhood. In R. K. Vail (Ed.) *Advances in Child Development and Behavior* (Vol. 34). San Diego, CA: Elsevier Academic Press.
- Colombo, J., Kannass, K. N., Shaddy, D. J., Kundurthi, S., Maikranz, J. M., Anderson, C. J., Blaga, O. M., & Carlson, S. E. (2004). Maternal DHA and the development of attention in infancy and toddlerhood. *Child Development, 75*, 1254-1267.
- Common Sense Media (2011). *Zero to eight: Children's media use in America*. Retrieved from <https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america>
- Common Sense Media (2013). *Zero to eight: Children's media use in America*. Retrieved from <https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013>
- Couse, L. J., & Chen, D. W. (2010). A tablet computer for young children? Exploring its viability for early childhood education. *Journal of Research on Technology in Education, 43*, 75-98. doi:10.1080/15391523.2010.10782562
- Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program *Blue's Clues* on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 91*, 630-637.
- Davidse, N. J., de Jong, M. T., Bus, A. G., Huijbregts, S. C. J., & Swaab, H. (2011). Cognitive and environmental predictors of early literacy skills. *Reading and Writing, 24*, 395-412. doi:10.1007/s11145-010-9233-3
- de Jong, M. T., & Bus, A. G. (2002). Quality of book-reading matters for emergent readers: an experiment with the same book in regular or electronic format. *Journal of Educational Psychology, 94*, 145-155. doi:10.1037//0022-0663.94.1.145
- de Jong, M. T., & Bus, A. G. (2003). How well suited are electronic books to supporting literacy? *Journal of Early Childhood Literacy, 3*, 147-164. doi:10.1177/14687984030032002

- de Jong, M. T., & Bus, A. G. (2004). The efficacy of electronic books in fostering kindergarten children's emergent story understand. *Reading Research Quarterly*, 39, 378-393. doi:10.1598/RRQ.39.4.2
- Dickinson, D. K., & Smith, M. W. (1994). Long-term effects of preschool teachers' book readings on low-income children's vocabulary and story comprehension. *Reading Research Quarterly*, 29, 104-122.
- Dietz, W. H., & Gortmaker, S. L. (1985). Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics*, 75, 807-812.
- Doty, D. E., Popplewell, S. R., & Byers, G. O. (2001). Interactive CD-ROM storybooks and young readers' reading comprehension. *Journal of Research on Computing in Education*, 33, 374-382.
- Dunn, M., & Dunn, L. M. (2007). *Peabody Picture Vocabulary Test, Fourth Edition*. Minneapolis, MN: Pearson Assessments
- Durkin, D. (1966). *Children who read early*. New York: Teachers College Press.
- Elley, W. B. (1989). Vocabulary acquisition from listening to stories. *Reading Research Quarterly* 24, 174-187.
- Espinosa, L.M. (2007). English-language learners as they enter school. In R.C. Pianta, M.J. Cox, & K.L. Snow (Eds.), *School readiness and the transition to kindergarten in the era of accountability* (pp. 175-195). Baltimore, MD: Paul H. Brookes Publishing Co.
- Evans, G. W. (2004). The environment of childhood poverty. *American Psychologist*, 59, 77-92. doi:10.1037/0003-066X.59.2.77
- Evans, M. A., Reynolds, K., Shaw, D., & Pursoo, R. (2011). Parental explanations of vocabulary during shared book reading: A missed opportunity. *First Language*, 31, 195-213. doi:10.1177/0142723710393795
- Evans, M. A., & Saint-Aubin, J. (2013). Vocabulary acquisition without adult explanations in repeated shared book reading: An eye movement study. *Journal of Educational Psychology*, 105, 596-608. doi:10.1037/a0032465
- Ewers, C. A., & Brownson, S. M. (1999). Kindergarteners' vocabulary acquisition as a function of active vs. passive storybook reading, prior vocabulary, and working memory. *Journal of Reading Psychology*, 20, 11-20.

- Falloon, G. W. (2013). Young students using iPads: app design and content influences on their learning pathways. *Computers & Education, 68*, 505-521. <http://dx.doi.org/10.1016/j.compedu.2013.06.006>
- Falloon, G. W. (2014). What's going on behind the screens? Researching young students' learning pathways using iPads. *Journal of Computer Assisted Learning, 30*, 318-336. doi:10.1111/jcal.12044
- Falloon, G. W., & Khoo, E. (2014). Exploring young students' talk in iPad-supported collaborative learning environments. *Computers & Education, 77*, 13-28. <http://dx.doi.org/10.1016/j.compedu.2014.04.008>
- Fisch, S. M., Brown, S. K.M., & Cohen, D. I. (2001). Young children's comprehension of educational television: The role of visual information and intonation. *Media Psychology, 3*, 365-378.
- Fisch, S. M., Shulman, J. S., Akerman, A., & Levin, G. (2002). Reading between the pixels: Parent-child interaction while reading online storybooks. *Early Education and Development, 13*, 435-451. doi:10.1207/s15566935eed1304_7
- Flewitt, R., Messer, D., & Kucirkova, N. (2014). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*. Advanced online publication. doi:10.1177/1468798414533560
- Fry, R., & Gonzales, F. (2008). *One in five and growing fast: A profile of Hispanic public school students*. Washington, DC: Pew Hispanic Center.
- Geist, E. A. (2012). A qualitative examination of two year-olds interaction with tablet based interactive technology. *Journal of Instructional Psychology, 39*, 26-35.
- Geist, E. A., & Gibson, M. (2000). The effect and public television program son four and five year olds ability to attend to educational tasks. *Journal of Instructional Psychology, 27*, 250-261.
- Gong, Z. & Levy, B. A. (2009). Four year old children's acquisition of print knowledge during electronic storybook reading. *Reading and Writing, 22*, 889-905. doi:10.1007/s11145-008-9130-1
- Goodwin, K. (2012). *Use of tablet technology in the classroom*. New South Wales: Department of Education and Communities.
- Haden, C. A., Reese, E., & Fivush, R. (1996). Mothers' extratextual comments during storybook reading: Stylistic differences over time and across texts. *Discourse Processes, 21*, 135-169.

- Hart, B., & Risley, T. R. (2003). The early catastrophe: The 30 million word gap by age 3. *American Educator*, 27, 6-9.
- Hindman, A. H., Skibbe, L. E., & Foster, T. D. (2014). Exploring the variety of parental talk during shared book reading and its contributions to preschool language and literacy: evidence from the early childhood longitudinal study-birth cohort. *Reading and Writing*, 27, 287-313. doi:10.1007/s11145-013-9445-4
- Hindman, A. H., Wasik, B. A., & Erhart, A. C. (2012). Shared book reading and head start preschoolers' vocabulary learning: The role of book-related discussion and curricular connections. *Early Education and Development*, 23, 451-474. doi:10.1080/10409289.2010.537250
- Hisrich, K., & Blanchard, J. (2009). Digital media and emergent literacy. *Computers in the Schools*, 26, 240-255. doi:10.1080/07380560903360160
- Hoffman, J. L., & Paciga, K. A. (2014). Click, swipe, and read: Sharing e-books with toddlers and preschoolers. *Early Childhood Education Journal*, 42, 379-388. doi:10.1007/s10643-013-0622-5
- Jenkins, J. R., & Dixon, R. (1983). Vocabulary learning. *Contemporary Educational Psychology*, 8, 237-260.
- Jennings, N. A., Hooker, S. D., & Linebarger, D. L. (2009). Educational television as mediated literacy environments for preschoolers. *Learning, Media, and Technology*, 34, 229-242. doi:10.1080/17439880903141513
- Kannass, K. N., & Colombo, J. (2007). The effects of continuous and intermittent distractors on cognitive performance and attention in preschoolers. *Journal of Cognition and Development*, 8, 63-77. doi:10.1080/15248370709336993
- Kannass, K. N., Colombo, J., & Wyss, N. M. (2010). Now, pay attention! The effects of instruction on children's attention. *Journal of Cognition and Development*, 11, 509-532. doi:10.1080/15248372.2010.516418
- Kannass, K. N., & Oakes, L. M. (2008). The development of attention and its relations to language in infancy and toddlerhood. *Journal of Cognition and Development*, 9, 222-245. doi:10.1080/15248370802022696
- Kannass, K. N., Oakes, L. M., & Shaddy, D. J. (2006). A longitudinal investigation of the development of attention and distractibility. *Journal of Cognition and Development*, 7, 381-409. doi:10.1080/15248370802022696

- Kim, J. E., & Anderson, J. (2008). Mother-child shared reading with print and digital texts. *Journal of Early Childhood Literacy*, 8, 213-245. doi:10.1177/1468798408091855
- Kirkorian, H. L., Pempek, T. A., Murphy, L. A., Schmidt, M. E., & Anderson, D. R. (2009). The impact of background television on parent-child interaction. *Child Development*, 80, 1350-1359. doi:10.1111/j.1467-8624.2009.01337.x.
- Korat, O. (2009). The effects of CD-ROM storybook reading on Israeli children's early literacy as a function of age group and repeated reading. *Education Information Technology*, 14, 39-53. doi:10.1007/s10639-008-9063-y
- Korat, O., Levin, I., Atishkin, S., & Turgeman, M. (2014). E-book as a facilitator of vocabulary acquisition: Support of adults, dynamic dictionary and static dictionary. *Reading and Writing*, 27, 613-629. doi:10.1007/s11145-013-9474-z
- Korat, O., Segal-Drori, O., & Klein, P. (2009). Electronic and printed books with and without adult support as sustaining emergent literacy. *Journal of Educational Computing Research*, 41, 453-475. doi:10.2190/EC.41.4.d
- Korat, O., & Shamir, A. (2007). Electronic books versus adult readers: effects on children's emergent literacy as a function of social class. *Journal of Computer Assisted Learning*, 23, 248-259. doi:10.1111/j.1365-2729.2006.00213.x
- Korat, O., & Shamir, A. (2012). Direct and indirect teaching: Using e-books for supporting vocabulary, word reading, and story comprehension for young children. *Journal of Educational Computing Research*, 46, 135-152. <http://dx.doi.org/10.2190/EC/46/2/b>
- Korat, O., Shamir, A., & Heibal, S. (2013). Expanding the boundaries of shared book reading: E-books and printed books in parent-child reading as support for children's language. *First language*, 33, 504-523. doi:10.1177/0142723713503148
- Kouri, T., & Telander, K. (2008). Children's reading comprehension and narrative recall in sung and spoken story contexts. *Child Language Teaching and Therapy*, 24, 329-349. doi:10.1177/0265659008096296
- Krcmar, M., & Cingel, D. P. (2014). Parent-child joint reading in traditional and electronic formats. *Media Psychology*, 17, 262-281. doi:10.1080/15213269.2013.840243

- Krcmar, M., Grela, B., & Lin, K. (2007). Can toddlers learn vocabulary from television? An experimental approach. *Media Psychology, 10*, 41-63. doi:10.108/15213260701300931
- Kucirkova, N. (2014). iPads in early education: separating assumptions and evidence. *Frontiers in Psychology, 5*, 1-3. doi:10.3389/fpsyg.2014.00715
- Kucirkova, N., Messer, D., Sheehy, K., & Panadero, C. F. (2014). Children's engagement with educational iPad apps: Insights from a Spanish classroom. *Computers & Education, 71*, 175-184. <http://dx.doi.org/10.1016/j.compedu.2013.10.003>
- Kuhl, P. K., Tsao, F. M., & Liu, H. M. (2003). Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning. *Proceedings of the National Academy of Science of the United States of America, 100*, 9096-9101. <http://www.pnas.org/cgi/doi/10.1073/pnas.1532872100>
- Levy, F. (1980). The development of sustained attention (vigilance) and inhibition in children: Some normative data. *Journal of Child Psychology and Psychiatry, 21*, 77-84.
- Levy, R. (2009). 'You have to understand words ... but not read them': young children becoming readers in a digital age. *Journal of Research in Reading, 32*, 75-91. doi:10.1111/j.1467-9817.2008.01382.x
- Li, L., Chen, G., & Yang, S. (2013). Construction of cognitive maps to improve e-book reading and navigation. *Computers & Education, 60*, 32-39. <http://dx.doi.org/10.1016/j.compedu.2012.07.010>
- Linebarger, D. L., & Piotrowski, J. T. (2009). TV as a storyteller: How exposure to television narratives impacts at-risk preschoolers' story knowledge and narrative skills. *British Journal of Developmental Psychology, 27*, 47-69. doi:10.1348/026151008X400445
- Lonigan, C. J. (1994). Reading to preschoolers exposed: Is the emperor really naked? *Developmental Review, 14*, 303-323.
- Lonigan, C. J., Schatschneider, C., & Westberg, L. (2008). Identification of children's skills and abilities linked to later outcomes in reading, writing, and spelling. In R. Eden & L. Bernard (Eds.) *Developing early literacy: Report of the national early literacy panel* (pp. 56-105). Jessup, MD: ED Pubs
- Lorch, E. P., Milich, R., Astrin, C. C., & Berthiaume, K. S. (2006). Cognitive engagement and story comprehension in typically developing children and children with ADHD from preschool through elementary school. *Developmental Psychology, 42*, 1206-1219. doi:10.1037/0012-1649.42.6.1206

- Masataka, N. (2014). Development of reading ability is facilitated by intensive exposure to a digital children's picture book. *Frontiers in Psychology*, 5, 1-4. doi:10.3389/fpsyg.2014.00396
- McCormick, C. E., & Mason, J. M. (1986). Intervention procedures for increasing preschool children's interest and knowledge about reading. In W. H., Teale & E. Sulzby (Eds.), *Emergent literacy: Reading and writing* (pp. 90-115). Norwood, New Jersey: Ablex Publishing Corporation.
- McLeod, A. N. & McDade, H. L. (2011). Preschoolers' incidental learning of novel words during storybook reading. *Clinical Research in Preschool*, 32, 256-266. doi:10.1177/1525740109354777
- McMannis, L. D., & Gunnewig, S. B. (2012). Finding the education in educational technology with early learners. *Technology and Young Children*, 67, 14-24.
- Michael Cohen Group (2012). *Young children, apps, & iPads*. Retrieved from <http://mcgrc.com/publications/publications/>
- Mioduser, D., Tur-Kaspa, & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning*, 16, 54-63.
- Mira, W. A., & Schwanenflugel, P. J. (2013). The impact of reading expressiveness on the listening comprehension of storybooks by prekindergarten children. *Language, Speech, and Hearing Services in Schools*, 44, 183-194. doi:10.1044/0161-1461(2012/11-0073)
- Mol, S. E., & Bus, A. G. (2011). To read or not to read: A meta-analysis of print exposure from Infancy to early adulthood. *Psychological Bulletin*, 137, 267-296. doi:10.1037/a0021890
- Moody, A. K. (2010). Using electronic books in the classroom to enhance emergent literacy skills in young children. *Journal of Literacy and Technology*, 11, 22-52.
- Moody, A. K., Justice, L. M., & Cabell, S. Q. (2010). Electronic versus traditional storybooks: Relative influence on preschool children's engagement and communication. *Journal of Early Childhood Literacy*, 10, 294-313. doi:10.1177/1468798410372162
- Morineau, T., Blanche, C., Tobin, L., & Guéguen, N. (2005). The emergence of the contextual role of the e-book in cognition processes through an ecological and functional analysis. *International Journal of Human-Computer Studies*, 62, 329-348. doi:10.1016/j.ijhcs.2004.10.002

- Morrow, L. M. (1988). Young children's responses to one-to-one story readings in school settings. *Reading Research Quarterly, 23*, 89-107.
- Murray, O. T., & Olcese, N. R. (2011). Teaching and learning with iPads, ready or not? *TechTrends, 55*, 42-48.
- Nagy, W. E., Anderson, R. C., & Herman, P. A. (1987). Learning word meanings from context during natural reading. *American Educational Research Journal, 24*, 237-270.
- National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media (2012). *Selected examples of effective classroom practice involving technology tools and interactive media*. Retrieved from <http://www.naeyc.org/content/technology-and-young-children/preschoolers-and-kindergartners>.
- National Research Council (1998). *Preventing reading difficulties in young children*. C. E. Snow, M. S. Burns, & P. Griffin (Eds.). Washington, DC: National Academy Press.
- Neuman, S. B., & Celano, D. (2001). Access to print in low-income and middle-income communities: An ecological study of four neighborhoods. *Reading Research Quarterly, 36*, 8-26.
- Neumann, M. M., & Neumann, D. L. (2014). Touch screen tablets and emergent literacy. *Early Childhood Education Journal, 42*, 231-239. doi:10.1007/s10643-013-0608-3
- Ninio, A. (1983). Joint book reading as a multiple vocabulary acquisition device. *Developmental Psychology, 19*, 445-451.
- O'Toole, K., & Kannass, K. N. (in prep). *Television programs are not uniformly distracting to preschoolers: Effects of adult- and child-directed TV*.
- Paciga, K. A. (2011). *Preschoolers' listening comprehension of digital storybooks* (Unpublished doctoral dissertation). University of Illinois at Chicago, Chicago, IL.
- Paciga, K. A. (2014). Their teacher can't be an app: Preschoolers' listening comprehension of digital storybooks. *Journal of Early Childhood Literacy*. Advanced online publication. doi:10.1177/1468798414552510
- Pemberton, E. F., & Watkins, R. V. (1987). Language facilitation through stories: Recasting and remodeling. *First Language, 7*, 79-89.

- Posner, M. I. & Rothbart, M. K. (1991). Attentional mechanisms and conscious experience. In M. Rugg & A. D. Milner (Eds.), *The neuropsychology of consciousness* (pp. 91-112). London: Academic Press.
- Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015). Mobile and interactive use by young children: The good, the bad, and the unknown. *Pediatrics*, *135*, 1-3. doi:10.1542/peds.2014-2251
- Reich, S., Muskat, T., Campbell, J., & Cannata, D. (March 2015). Preschoolers' learning from enhanced eBooks versus traditional print books. Paper presented at the biennial meeting of the Society for Research in Child Development, Philadelphia, PA.
- Rice, M. L., Buhr, J. C., & Nemeth, M. (1990b). Fast mapping word-learning abilities of language-delayed preschoolers. *Journal of Speech and Hearing Disorders*, *55*, 33-42.
- Rice, M. L., Huston, A. C., Truglio, R. T., & Wright, J. C. (1990a). Words from Sesame Street: Learning vocabulary while viewing. *Developmental Psychology*, *26*, 421-428.
- Rice, M. L., & Woodsmall, L. (1988). Lessons from television: Children's word learning when viewing. *Child Development*, *59*, 420-429.
- Richman, W. A., & Colombo, J. (2007). Joint book reading in the second year and vocabulary outcomes. *Journal of Research in Childhood Education*, *21*, 242-253.
- Rideout, V., & Hamel, E. (2006). *The media family: Electronic media in the lives of infants, toddlers, preschoolers, and their parents*. Menlo Park, CA: Henry J. Kaiser Family Foundation.
- Robbins, C., & Ehri, L. C. (1994). Reading storybooks to kindergarteners helps them learn new vocabulary words. *Journal of Educational Psychology*, *86*, 54-64.
- Roberts, K. L. (2013). Comprehension strategy instruction during parent-child shared reading: An intervention study. *Literacy Research and Instruction*, *52*, 106-129. doi:10.1080/19388071.2012.754521
- Rogoff, B. (1990). *Apprenticeship in thinking: Development in social context*. New York: Oxford University Press.
- Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R. (April 2013). Skype me! Contingent interactions help toddlers learn language. Paper presented at the biennial meeting of the Society for Research in Child Development in Seattle, WA.

- Rosenshine, B. & Meister, C. (1992). The use of scaffolds for teaching higher-level cognitive strategies. *Educational Leadership*, 49, 26-33.
- Ruff, H. A., & Capozzoli, M. C. (2003). The development of attention and distractibility in the first 4 years of life. *Developmental Psychology*, 39, 877-890. doi:10.1037/0012-1649.39.5.877
- Ruff, H. A., Capozzoli, M. C., & Weissberg, R. (1998). Age, individuality, and context as factors in sustained visual attention during the preschool years. *Developmental Psychology*, 34, 454-464.
- Ruff, H. A., & Lawson, K. R. (1990). Development of sustained, focused attention in young children during free play. *Developmental Psychology*, 26, 85-93.
- Ruff, H. A., & Rothbart, M. K. (1996). *Attention in early development: Themes and variations*. New York: Oxford University Press.
- Salmon, L. G. (2014). Factors that affect emergent literacy development when engaging with electronic books. *Early Childhood Education Journal*, 42, 85-92. doi:10.1007/s10643-013-0589-2
- Samuelson, L. K., & Smith, L. B. (1998). Grounding development in cognitive processes. *Child Development*, 71, 98-106.
- Scarborough, H. S. (1998). Early identification of children at risk for reading disabilities: Phonological awareness and some other promising predictions. In B. K. Shaprio, P. J. Accardo, & A. J. Capute (Eds.) *Specific Reading Disability: A View of the Spectrum* (pp. 75-107). Timonium, MD: York Press.
- Scarborough, H. S., & Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental Review*, 14, 245-302.
- Schetz, K. F., & Stremmel, A. J. (1994). Teacher-assisted computer implementation: A Vygotskian perspective. *Early Education and Review*, 5, 18-26.
- Segal-Drori, O., Korat, O., Shamir, A., & Klein, P. S. (2010). Reading electronic and printed books with and without adult instruction: effects on emergent reading. *Reading and Writing*, 23, 913-930. doi:10.1007/s11145-009-9182-x
- Segers, E., Takke, L., & Verhoeven, L. (2004). Teacher-mediated versus computer-mediated storybook reading to children in native and multicultural kindergarten classrooms. *School Effectiveness and School Improvement*, 15, 215-226.

- Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language*, 24, 123-138.
- Sénéchal, M., & Cornell, E. H. (1993). Vocabulary acquisition through shared reading experiences. *Reading Research Quarterly*, 28, 360-374.
- Sénéchal, M., & LeFevre, J. (2002). Parental involvement in the development of children's reading skill: A five-year longitudinal study. *Child Development*, 73, 445-460.
- Sénéchal, M., LeFevre, J., Smith-Chant, B. L., & Colton, K. V. (2001). On refining theoretical models of emergent literacy: The role of empirical evidence. *Journal of School Psychology*, 39, 439-460.
- Sénéchal, M., LeFevre, J., Thomas, E. M., & Daley, K. E. (1998). Differential effects of home literacy experiences on the development of oral and written language. *Reading Research Quarterly*, 33, 96-116.
- Sénéchal, M., Thomas, E., & Monker, J. (1995). Individual differences in 4-year-old children's acquisition of vocabulary during storybook reading. *Journal of Educational Psychology*, 87, 218-229.
- Shamir, A., & Korat, O. (2007). Developing an educational e-book for fostering kindergarten children's emergent literacy. *Computers in the Schools*, 24, 125-143. doi:10.1300/J025v24n01_09
- Shamir, A., Korat, O., & Barbi, N. (2008). The effects of CD-ROM storybook reading on low SES kindergarteners' emergent literacy as a function of learning context. *Computers & Education*, 51, 354-367. doi:10.1016/j.compedu.2007.05.010
- Shamir, A., Korat, O., & Shlafer, I. (2011). The effect of activity with e-book on vocabulary and story comprehension: a comparison between kindergarteners at risk of learning disabilities and typically developing kindergarteners. *European Journal of Special Needs Education*, 26, 311-322. doi:10.1080/08856257.2011.593824
- Shamir, A., & Shlafer, I. (2011). E-books effectiveness in promoting phonological awareness and concept about print: A comparison between children at risk for learning disabilities and typically developing kindergartners. *Computers & Education*, 57, 1989-1997. doi:10.1016/j.compedu.2011.05.001

- Singer, J. L., & Singer, D. G. (1998). Barney & Friends as entertainment and education: Evaluating the quality and effectiveness of a television series for preschool children. In J. K. Asamen & G. L. Berry (Eds.), *Research paradigms, television, and social behavior* (pp. 305-367). Thousand Oaks, CA: Sage Publications.
- Smeets, D. J. H., & Bus, A. G. (2012). Interactive electronic storybooks for kindergarteners to promote vocabulary growth. *Journal of Experimental Child Psychology, 112*, 36-55. doi:10.1016/j.jecp.2011.12.003
- Smith, S. S., & Dixon, R. G. (1995). Literacy concepts of low- and middle-class four-year-olds entering preschool. *The Journal of Educational Research, 88*, 243-253.
- Snow, C. E., & Biancarosa, G. (2003). *Adolescent literacy and the achievement gap: What do we know and where do we go from here?* New York: Carnegie Corporation of New York.
- Stevens, R. J., van Meter, P., & Warcholak, N. D. (2010). The effects of explicitly teaching story structure to primary grade children. *Journal of Literacy Research, 42*, 159-198. doi:10.1080/10862961003796173
- Stoep, J., & Verhoeven, L. (2000). Family and classroom predictors of children's early language and literacy development. *National Reading Conference, 49*, 209-221.
- Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38*, 934-947.
- Strasser, K., Larrain, A., Lissi, M. R. (2013). Effects of storybook reading style on comprehension: The role of word elaboration and coherence questions. *Early Education and Development, 24*, 616-639. doi:10.1080/10409289.2012.715570
- Strouse, G. A., & Ganea, P. A. (2015, March). *Infants' learning from electronic touchscreen versus traditional format books*. Paper presented at the biennial meeting off the Society for Research in Child Development, Philadelphia, PA.
- Strouse, G. A., O'Doherty, K., & Troseth, G. (2013). Effective coviewing: Preschoolers' learning from video after a dialogic questioning intervention. *Developmental Psychology, 49*, 2368-2382. doi:10.1037/a0032463
- Tare, M., Chiong, C., Ganea, P., & DeLoache, J. (2010). Less is more: How manipulative features affect children's learning from picture books. *Applied Developmental Psychology, 31*, 395-400. doi:10.1016/j.appdev.2010.06.005

- Teale, W. H. (1987). Emergent literacy: Reading and writing development in early childhood. *Yearbook of the National Reading Conference*, 36, 45-74.
- Teale, W. H., & Sulzby, E. (Eds.). (1986). *Emergent literacy: Reading and writing*. Norwood, New Jersey: Ablex Publishing Corporation.
- Terrell, S. L. & Daniloff, R. (1996). Children's word learning using three modes of instruction. *Perceptual and Motor Skills*, 83, 779-787.
- Tompkins, V., Guo, Y., & Justice, L. M. (2013). Inference generation, story comprehension, and language skills in the preschool years. *Reading and Writing*, 26, 403-429. doi:10.1007/s11145-012-9374-7
- U.S. Bureau of Labor Statistics (2010). Overview of race and Hispanic origin: 2010. Retrieved from <http://www.census.gov/prod/cen2010/briefs/c2010br-02.pdf>
- U.S. Department of Education Office of Educational Technology (2010). *Transforming American Education: Learning Powered by Technology*. Washington DC: U.S. Department of Education.
- van den Broek, P., Kremer, K., Lynch, J., Butler, J., White, M. J., Lorch, E. P. (2005). Assessment of comprehension abilities in young children. *Children's Reading Comprehension and Assessment*, 107-130.
- van Dijken, M. J., Bus, A. G., & de Jong, M. T. (2011). Open access to living books on the internet: A new chance to bridge the linguistic gap for at-risk preschoolers? *European Journal of Special Needs Education*, 26, 299-310. doi:10.1080/08856257.2011.593823
- van Kleeck, A. (2008). Providing preschool foundations for later reading comprehension: The importance of and ideas for targeting inferencing in storybook-sharing interventions. *Psychology in the Schools*, 45, 627-643. doi:10.1002/pits.20314
- Verhallen, M. J. A. J., Bus, A. G., & de Jong, M. T. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology*, 98, 410-419. doi:10.1037/0022-0663.98.2.410
- Vivas, E. (1996). Effects of story reading on language. *Language Learning*, 46, 189-216.
- Vygotsky, L.S. (1978). *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.

- Westerveld, M. F., Gillon, G. T., & Boyd, L. (2012). Evaluating the clinical utility of the profile of oral narrative ability for 4-year-old children. *International Journal of Speech-Language Pathology, 14*, 130-140. doi:10.3109/17549507.2011.632025
- Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30*, 679-689.
- Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*, 848-872.
- Wood, C., Pillinger, C., & Jackson, E. (2010). Understanding the nature and impact of young readers' literacy interactions with talking books and during adult reading support. *Computers and education, 54*, 190-198. doi:10.1016/j.compedu.2009.08.003
- Wyss, N., Kannass, K. N., & Haden, C. A. (2012). The effects of distraction on cognition task performance during toddlerhood. *Infancy, 1-25*. doi:10.1111/j.1532-7078.2012.00128.x
- Yelland, N., & Masters, J. (2007). Rethinking scaffolding in the information age. *Computers & Education, 48*, 362-382. doi:10.1016/j.compedu.2005.01.010
- Zack, E., Barr, R., Gerhardstein, P., Dickerson, K., & Meltzoff, A. N. (2009). Infant imitation from television using novel touch screen technology. *British Journal of Developmental Psychology, 27*, 13-26. doi:10.1348/026151008X334700
- Zimmerman, F. J., & Bell, J. F. (2010). Associations of television content type and obesity in children. *American Journal of Public Health, 100*, 334-340. doi:10.2105/AJPH.2008.155119
- Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. *Pediatrics, 120*, 986-992. doi:10.1542/peds.2006-3322

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