

## *It's Hard to Wait: Effortful Control and Story Understanding in Adult-supported E-book Reading Across the Early Years*

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## **Abstract**

As technology in various forms is permeating more and more of everyday life, it is important to consider what we know about child development, social interaction, and literacy development as they relate to a child's experience with technology. Caregivers, researchers, and educators are faced with the complex task of determining the quality of an e-book in terms of potential educational value, appropriateness, and suitability for individual children as well as the possibility for adult supports, or the ways in which the adult can verbally or gesturally support the child's engagement with and understanding of digital text. This cross-sectional case study situates and analyzes the e-book reading experience of young children in the context of a supportive adult interaction. The study examines two children's experiences during a shared e-book reading with a parent in order to describe aspects of development, including effortful control, and the role of the caregiver/child interaction as they impact the literacy experience.

**Keywords:** *emergent literacy, e-book, iPad, preschooler, toddler, effortful control, navigation, text understanding*

This is a study of adult-child shared e-book reading. E-books represent one form of media many children experience from an early age; the percentage of six-year olds who report having read an e-book has grown from 28% to 61% from 2010 to 2014 (Scholastic, 2015). Importantly, 72.5% of parents surveyed by Vaala and Takeuchi (2012) indicated that they engage in co-reading e-books with their children, aged two through six years. A large portion of the parents who do not co-read e-books with their children reported that “reading books with child on an e-reader is too difficult” as the reason for not co-reading in an electronic format.

Part of the “difficulty” reported by parents in the Vaala and Takeuchi study likely has to do with the perception that the hotspots and embedded animations in the illustrations, the games, and videos distracts the child from reading, or, that the activity of sharing/reading a book on screen with active characters and animation does not align with their vision of a “bedtime story,” a common context in which parent-child co-reading occurs. Another part of the difficulty likely has to do with the interaction of the child’s development across a range of variables, and the design of the e-book itself. A young child exploring a printed book is free, often, to explore the book by touching and holding and sometimes even tasting the book. He can turn the pages by himself, and attend to parts of the text/illustration as his attention or interest moves. Conversely, when exploring an e-book the parent often controls the device and the page turns may only be accessible to the child after the narration has been read in full, or once he has pressed a hotspot or two. The result of this is that the young child often has to wait for the e-book’s contingent programming to allow for his desired action. And waiting is hard for young children.

Fred Rogers was a pioneer in media for young children and their families. He effectively applied theories of child development to the design and delivery of his television programming, printed media for parents and children, and within his musical compositions. Executive function,

particularly related to the development of a child's effortful control, represents one area Fred Rogers sought to help adults and children understand. In one of his episodes of *Mister Rogers' Neighborhood*, Fred used the Daniel Striped Tiger puppet to model some strategies to think about waiting when it is difficult. Daniel Tiger sang the lyrics for "It's Hard to Wait" (The Neighborhood Archive, n.d., see Figure 1, below) as a tool/strategy to help him get through the challenge of waiting for his friend to help him.

*I think it's very, very, very hard to wait*

*Especially when you're waiting*

*For something very nice*

*I think it's very, very, very hard to wait*

*Figure 1.* Lyrics for "It's Hard to Wait" (Fred Rogers Company, 1982)

While waiting for a friend's help and waiting to turn a page or to explore an e-book are different contexts, the waiting process and the emotions the child feels because of the necessity of the wait could arguably be very similar. For many children it simply *is* "very very hard to wait," no matter the context.

The effortful control required to wait during e-book reading is related to multiple variables, both external and internal to the child reader. In this study, the identified external variables are those related to the content for e-book reading (i.e., the digital media and features of its design) and the context in which the e-book reading experiences are carried out (i.e., the social interaction), particularly the kinds of supports for effortful control offered by the parent. The variables internal to the child include a range of age-related developmental capacities—fine motor development, social and emotional development, language development, emergent and early reading behaviors. In addition, the child's own temperament is a factor in effortful control

(Eisenberg, 2012). This exploratory study examined the (1) nuances of waiting in an e-book reading context related to these external and internal variables, (2) cognitive (i.e., textual understanding) outcomes of the e-book reading experiences, and (3) adult supports for the child's engagement with the activity and understanding of the text with one toddler and one preschooler.

### **Theoretical Frame and Literature Base**

Research involving adults co-viewing e-books with young children is rooted in the perspective that social interaction plays a critical role in (a) child development and (b) mediating the text for children. In other words, this study approaches the exploration of e-books from a sociocultural framework (Vygotsky, 1978, 1986). Using Vygotsky's sociocultural theory (1978) as a framework, the social interaction in e-book reading experiences is both essential and a focus as a point of learning. In sharing the e-book experience, the child has the opportunity to engage in reciprocity, back and forth exchange, with the adult in both the physical manipulative aspects of reading the e-book as well as in verbal language exchange. Additionally, there is shared meaning (Stern, 2000) created within the shared experience, as adult and child are sharing attention and intention through the activity. There is emotional support involved when the child is able to manage navigating the functions of the e-book with increasing independence through scaffolding and gradual release on the part of the adult with managing these tasks. The role of the adult in the interaction involves being sensitive toward the child's drive for autonomy and initiative (Erikson, 1963) and managing the level of frustration they might experience based upon the child's personal temperament, psychology, and context.

In this frame, textual understanding is socially, culturally, and historically situated and is contingent upon language-based social interactions. Because the participants in this particular study are so young, the theoretical underpinnings of an emergent literacy perspective (Teale &

Sulzby, 1986; Whitehurst & Lonigan, 2001) are particularly salient as well. These theories suggest that formal reading and writing skills emerge from birth and are acquired gradually over time through repeated exposures to, interactions with, and production of text. Moreover, theories of emergent literacy suggest that there is a general sequence in the appearance of foundational skills (e.g., phonological awareness, phonics, print awareness) and other more broadly conceptualized constructs (e.g., vocabulary, syntax), but that not all children follow that sequence in lock-step patterns (Teale, Paciga, & Hoffman, 2010); learning is something different for each child, and requires a plan that meets each child's needs in the physical, social, emotional, cognitive, and linguistic domains of development. In the paragraphs that follow, we outline some relevant literature that we believe may affect the child's e-book co-reading experiences.

### **Developmental capacities related to shared e-book reading**

The shared e-book reading experience can be viewed through Rogoff's (2003) concept of guided participation in sociocultural activity. Guided participation involves social partners sharing an experience (e-book reading) to bridge perspectives using culturally available tools (in this case language and technology). There is mutual structuring between participants in the activity to facilitate engagement (p. 285). The two basic processes of guided participation involve mutual understanding of ideas and efforts and the adjustment of the participants to maintain engagement in the task, which in the shared e-book experience makes the presence of the caregiver essential in scaffolding the experience related to the child's developmental capacities.

The facilitation of the caregiver during the shared e-book reading is contingent in some ways upon the individual child and the caregiver-child relationship. Temperament is the style in

which a child interacts with the world and the people in it. Temperament is thought to be biologically based, early appearing (usually stabilized by around four months of age) and unique to each child (Sturm, 2004). Two dimensions of temperament that are frequently identified are reactivity (emotional and attentional) and self-regulatory capacities. The goodness of fit between the caregiver and child in terms of temperament can affect the quality of interactions and the capacity of the caregiver and child to engage in co-regulation required for a shared book experience (Carlson, Feng, and Harwood, 2004). For the child who is more highly reactive and has difficulty with regulation, the caregiver may struggle to remain regulated, and sustain engagement in the experience. For the highly inhibited child, the caregiver may have to more regularly prompt and encourage the child to react.

A child's brain undergoes rapid development during the first five years of life. The "thinking part" of the brain, the cortex, is the least developed at birth, but as a result of childhood experiences undergoes synaptic exuberance during the first few years as connections between neurons are rapidly created. During the preschool years executive function improves in areas such as planning, memory, and effortful control (Eliot, 1999) "Effortful control pertains to the ability to willfully or voluntarily inhibit, activate, or change (modulate) attention and behavior, as well as executive functioning tasks of planning, detecting errors, and integrating information relevant to selecting behavior" (Eisenberg, et al., 2011, p.263). The wait time involved in the e-book reading experience involves both inhibitory control as well as activational control in that children need to control the impulse to tap repeatedly on the screen while waiting, and also activate certain behaviors when the wait-time is over.

Cognitively, children two through five years of age rapidly develop knowledge about language and print across a range of content areas that are often tied to the child's interests

(Johnson, et al., 2004). Study of children in naturalistic environments in which they interact with print and language have resulted developmental trajectories that are fairly consistently observed at specific age ranges (e.g., Ferreiro & Teberosky, 1982; Teale & Sulzby, 1986). Because of the consistency in these trajectories, the trajectories are often presented as benchmarks against which educators, parents, physicians evaluate the pace of cognitive development.

A common method to determine a child's understandings of narrative text is to solicit an "emergent reading" of a favorite storybook (Sulzby, 1985) by asking the child to "read me this story." A book qualifies as a favorite storybook after a child has heard it read aloud to them several times, usually by a parent, teacher, or care provider. As the child emergently reads a favorite storybook, the adult can often infer the child's understanding of (1) oral and written language structures, (2) narrative elements of character, setting, plot (i.e., problem/solution), dialogue, and (3) awareness of the function of print.

In their studies of emergent readings in the early years Sulzby (1985) and Teale and Sulzby (1986) identified children at different age ranges included varying evidence of language understanding (i.e., story-like language vs. oral conversation/spoken language) and attention to print in their emergent readings of favorite storybooks (see Figure 2). Sulzby (1985) found that two-year-old children produce dependent reading (i.e., relying on adult to facilitate the reading). Three- and four-year-olds generally produce emergent readings that can be picture-governed, form an oral-story, or contain a story with written-like language. Most children at the end of Kindergarten (five- and six-year-olds) produce emergent readings that are governed by print.

Print awareness, or the child's understanding that (a) print carries meaning; (b) images represent objects and action; (c) that letters comprise words and words comprise sentences, is typically fully developed by the time the child is six years of age (Clay, 2006). When children

have less print awareness, they are less likely to produce a print-governed emergent reading of a favorite storybook (see Figure 2).

Regarding the e-book format, specifically, we know that a child's general story comprehension is often better when reading traditional books compared to e-books (e.g., Krcmar & Cingel, 2015; Parish-Morris, et al., 2013), but we also know that intentionally designed e-books can positively impact the child's capacity to make meaning from the text (e.g., Korat & Segal-Drori, 2016). In other words, a child's understanding of electronic text is, in part, related to the design of the media itself and the ways in which its design impacts the child-adult interaction.

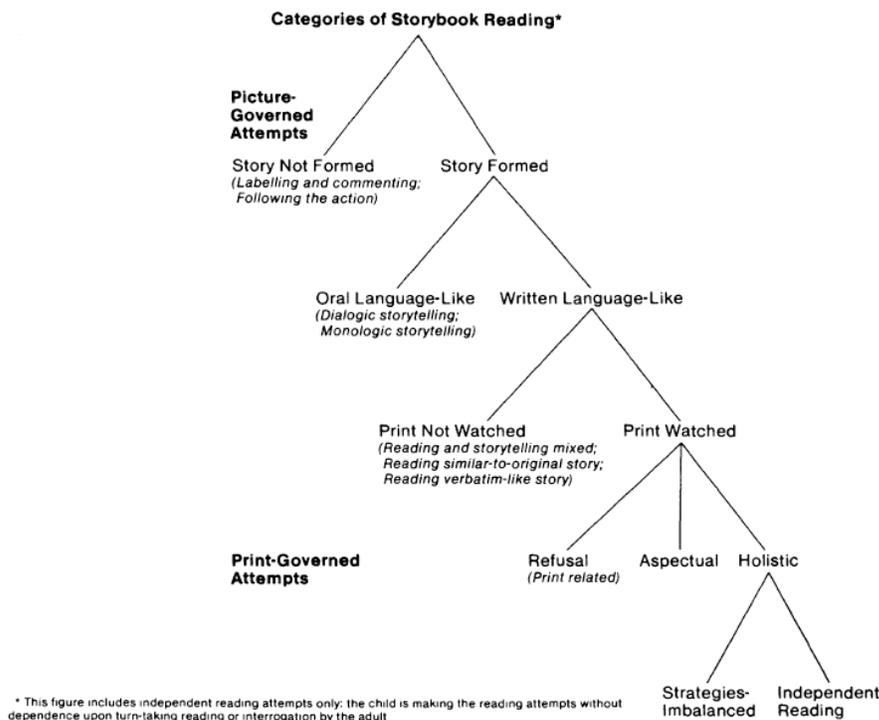


Figure 2. Classification scheme of emergent reading of favorite storybooks (Sulzby, 1985<sup>1</sup>)

Figure 2 (Sulzby, 1985) is reprinted with permission from the International Reading Association.

### **How can an adult support children's early reading experiences?**

There is a long history of research on printed text that can inform the ways we, as a field of scholars, teachers, and parents, are developing our understandings of digital reading. These histories surely correlate, but analog processes for making sense of digital text do not necessarily match the processes for action and comprehension in digital media (e.g., Leu, Kinzer, Coiro, & Cammack, 2004).

We know, for example, that joint visual attention to an object from an adult sustains an infant's attention to that object (Yu & Smith, 2016). We know that reading aloud to children is an effective means to facilitate vocabulary development (Blachowicz & Fisher, 2007), and to learn about their world. We know that kids who do not have access to books to read in their homes and communities are less frequent readers (e.g., Neuman, 1996; 1999), and we also know that less frequent readers are less successful students (Mol & Bus, 2011). These profiled differences persist from the early years through to the 4<sup>th</sup> grade (e.g., Juel, 1988) and beyond.

The rich history of the study of reading aloud to young children clearly identifies the following methods for effective reading outcomes: (1) dialogic reading; (2) repeated reading; and (3) interactive reading. Joint attention between the adult and the child is held in common across all three of these methods. Dialogic reading is an approach in which the adult poses the child with distancing questions. Through these questioning approaches, the adult prompts the child to say something about the book. The adult evaluates the child's response, expands on the child's responses by rephrasing and adding on to it, and then the adult repeats the prompt to make sure the child has learned from the expansion. Dialogic reading approaches have demonstrated efficacy in supporting the child's comprehension and expanding the child's language related to

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the story (Arnold & Whitehurst, 1994). These results are observable in intervention research (e.g., Wasik & Bond, 2001), across languages (e.g., Niklas & Schneider, 2015) and with diverse populations (e.g., Crain-Thoreson & Dale, 1999).

Repeated readings of the same text represent a second research-supported means to improve reading outcomes. Morrow (1988) investigated the use of repeated one-on-one readings to preschoolers by comparing the number and quality of children's responses to story readings between three groups: those who listened to a different book each week for 10 weeks, those who listened to three different books three times each, or the control group who participated in traditional reading readiness activities. Morrow found that the one-on-one story readings increased the number and complexity of questions and comments made by the children in both experimental groups as compared to the group reading readiness activities, but those with repeated readings made more interpretive responses and more responses focused on print and story structure. Many subsequent studies have incorporated repeated readings as a vocabulary and comprehension support (e.g. Brabham & Lynch-Brown, 2002; Justice, 2002; Schwanenflugel, et al., 2005), and repeated readings have since become a commonly recognized component of read aloud instruction for young children (McGee & Schickedanz, 2007).

While repetition is beneficial, there is also evidence suggesting that interactive reading (Hoffman, 2011) contributes additional benefits, beyond those observed in simply repeating the read aloud, to children's meaning making capacities. In an interactive read aloud, the adult solicits responses from the children and invites them to recreate and even analyze the story with the adult reader during the read aloud experience. Adults support vocabulary understanding through gestures, pointing to parts of illustrations, comparing and contrasting, providing definitions, or acting out/animating words (McGee & Schickedanz, 2007). Children demonstrate

engagement through oral responses to text and the adult's prompts, emotional responses as documented by facial expression and gestures, and dramatization of the story as it is read aloud (e.g., Sipe 2002).

We know that there are more and less effective supports for maintaining student engagement and attention in the read aloud as well. For example, Paciga (2009) and Paciga and colleagues (2015) documented that the pacing and duration of the read aloud and discussion could predict student engagement levels. We also know that children become more frequently engaged in higher-level discussion of text when there is space for dialogue and discussion (e.g., Collins, 2013). There is also a documented history that demonstrates how print referencing strategies, or the techniques that can be used during storybook reading to draw children's attention to the meaning and function of print using either nonverbal or verbal cues (Justice & Ezell, 2004), can facilitate children's engagement with the printed text as it is highlighted and tracked by the adult.

### **What e-book features might impact the child's experience?**

Despite a long history of proven methods of supporting understanding and engagement in reading printed books, there is significantly less evidence about how adults support understanding and engagement in adult-child co-reading of e-books. E-reading observations demonstrated that parents used fewer distancing prompts during e-reading than parents with traditional reading (Parish-Morris, et al., 2013) and also documented that when there are hotspots in the e-books a battle over behavior begins. In this battle, a parent's behavior management talk typically replaces dialogic interactions. This phenomenon becomes particularly salient when parents are working against the child's desire to engage with and control the interactive features of the e-book's design (Parish-Morris, et al., 2013). Research has also documented that the

design of the e-book itself can impact the ways in which the adult supports for emergent literacy can change, becoming more frequent, when the parent/adult supports are designed into the e-book media (Rees, Rvachew, & Aparna, 2015; Rvachew, et. al., 2015). With respect to print tracking features contained in e-books, it is an obvious leap to assume that the print tracking embedded in many e-books functions similarly to the adult pointing during a read aloud, and therefore, impacts the child's print awareness. Research by Moody and colleagues (2014) found that children exposed to e-books with adult print-referencing supports outperformed peers without the additional print-referencing support from the e-book and adult interaction.

In their study of the impact of device type on the child's behavioral engagement in digital reading experiences, Roskos, Burstein and You (2012) determined that the child's level of behavioral regulation impacts their engagement in teacher-led e-book reading experiences. Moreover, they determined that the device type is related to the child's level of engagement in the e-reading task. Roskos and colleagues hypothesized that the degree of control the child experiences as the device changes is directly related to the observed changes in children's level of engagement, particularly the looking, touching and gesturing forms of engagement; smaller screen sizes found in the iPod touch encouraged more control and ownership of the action within the text and, therefore, yielded more touches and gestures.

Marsh (2013) and Merchant (2015) corroborate Roskos, Burstein and You's (2012) findings. In their observations of toddlers, both Marsh and Merchant found children exhibited a range of movements when utilizing iPads—stabilizing movements, control movements, deictic movements. Stabilizing movements were those directed at ensuring the device (iPad) was not switching orientation. Control movements were those in which the goal was to engage with an interactive feature on screen. Deictic movements were pointing or gestures toward a portion of

the screen. Deictic movements often led into control movements in both Marsh's and Merchant's studies.

From the extant research with interactive e-books and young children on desktop computers and iPads we have learned much that can help us think about how children navigate these interactive texts with control movements and considerations of the media's design—how design impacts the child's navigation and, likely, their meaning making. For example, Hirsh-Pasek and colleagues (2015, p.12) suggest that contingent interactions, or clicks that are required to move the action of the story forward, contribute in positive ways to story understanding:

The contingent interactions that apps afford are perhaps the most basic element of engagement with a touch screen. When each touch or swipe is met with an immediate response, children feel in control, maintain their focus, and continue the interaction. This sort of responsiveness is a core element of user-interface design in the field of human-computer interaction (Nielsen, 1993/2014). It is also a growing subject of investigation among researchers interested in educational media (Lauricella, Pempek, Barr, & Calvert, 2010). For example, experimental manipulations that required children to use a computer to move the story of *Dora the Explorer* forward at preselected points were linked to children's increased understanding of story content (Calvert, Strong, Jacobs, & Conger, 2007) (p.12).

Although this is true of the programming and design end, we know from research in emergent reading behaviors that our youngest children seek out ways to jump through the e-book (i.e., quickly paging through and not following a linear path through the text). Similar book browsing behaviors are also observed in infants with printed board books. In e-reading contexts, a child utilizes a home, or menu feature, within the e-book application to facilitate these actions,

when the design of the application offers such an option. Other times, children utilize the home button on the device to initiate a change of direction in the activity (Marsh, 2013; Merchant, 2015). In addition to moves toward home and beyond the edges of the e-book with the home button on the iPad, children are also observed activating hotspots with haptic touches on screen.

### **Research Questions**

Research through the US Department of Education's Ready to Learn initiative (Cohen et al., 2011) found, "children's initial reaction to touch screen devices is characterized by fascination and immediate engagement, and is shaped by: child's developmental level, previous experience with touch screen devices, and the App interface design and game/play" (p.5). The research reviewed here clearly indicates that the child's developmental level is a factor in their e-book experience and is an important consideration in design, but what about the role of social interaction with a caregiver during the experience? Given the research reviewed above and the sociocultural theory framework (Vygotsky, 1978), we sought to determine the following:

- How does the parent support her children in developmentally appropriate ways during a shared e-book reading experience?
- What differences in the interaction could be attributable to each child's developmental differences?

### **Method**

This exploration employed a cross-sectional case study framework (Borman, Clarke, Cotner & Lee, 2006) for examining an adult's use of supports for young children's understanding of a familiar e-book. The cross-sectional design is useful to examine different groups of people who differ in the variable of interest but share other characteristics, such as socioeconomic status, educational background, and ethnicity. The groups are observed

separately, but during the same point in time. The researcher does not manipulate any of the variables in an experimental fashion, and, thus, cannot draw conclusions of causality. This design is commonly used to study development across spans of age groups. In this case, the researcher examines e-reading behaviors in parent-child dyads.

### **Participants**

The study participants were siblings from an upper-middle class SES. The first participant was a male, 54 months old, Charlie. The second was a female, 30 months old, Annie. Each child was read to every night and was immersed in language and literacy. The family had an iPad and two iPhones and the children and parents often sat and played app-based games, watched videos, and read stories on the devices. These screen-time experiences were typically co-viewing, or joint engagement, experiences (Takeuchi & Stevens, 2011) in which the children's and adults' attention and conversation were centered jointly on the on-screen media. Children and the adult were typically situated in close proximity to the same screen. The researcher was also the children's parent, but the children were aware their interactions were being recorded "for mommy's work."

### **Materials**

To investigate how the adult's supports differed across the two children, each child engaged in three different e-book reading experiences with the same text. The text chosen for the study was an iPad application titled *The Three Little Pigs: A 3-D Fairy Tale* (Nosy Crow, 2011). It is an award-winning (Children's Technology Review, 2011) interactive version of the traditional fairy tale told in part by text at the bottom of the screen, but in part by conversation presented in speech balloons that appear when the reader touches a hotspot (an area of the screen that, when touched or selected, presents some audible or visible new action on screen). Children

can “blow into the microphone to blow down the pig’s houses, tilt the device to see more of the scene, zoom in to reveal hidden details, and tap the screen to trigger hundreds of funny interactive surprises” (Nosy Crow, 2011). Marsh (2013) classified this particular app as commendable in their consideration of scaffolding and consistency in the child’s finger-hand actions within the story.

### **Procedure**

Each child experienced three individual (i.e., one adult to one child) e-book reading experiences, or exposures, with the same text with the parent as a facilitator and co-reader. The story was read in its entirety each time. Each child experienced the same supports for navigation, comprehension, vocabulary and prompting during the first two readings of the e-book.

Each exposure was video recorded and then transcribed for data analysis. In the first exposure, the adult selected the “Read by Myself” mode. During this exposure, the adult controlled the page turns and hotspots and thought aloud about her navigational moves (e.g., “Oh, look at that blue dot [pointing to a hotspot]. I’m going to press it to see what happens.”). The adult read aloud supporting each child’s vocabulary and comprehension as recommended for a first reading in McGee and Schickedanz’s article (2007) on repeated interactive read alouds (i.e., introducing the book, supporting specific vocabulary understanding, modeling analytic thinking to support and strengthen comprehension, and post-reading discussion). The “Read and Play” mode was explored during the second exposure. In this mode, the narrative on-screen text is read aloud, but the hotspots are optional (i.e., the child may advance the pages without clicking on any hotspots). For this exposure, the adult continued to support the same vocabulary and modeled analytic thinking to support comprehension. The adult prompted the child to touch the screen to activate selected hotspots and to turn the pages. In the third exposure, the child was

permitted to select the mode for the book-reading experience. The adult integrated a predetermined guided reconstruction for this reading (McGee & Schickedanz, 2007) with prompts for vocabulary and comprehension that are commonly applied in dialogic reading (Arnold & Whitehurst, 1994). Questions like, “What is happening here?” or “What will happen next?” or “Why did she say that?” were employed to assess the child’s story understanding and questions like “Who likes to eat straw?” were used to assess language/vocabulary understanding during the reading experience. Immediately following this third exposure, the parent opened the e-book to one scene and solicited an emergent reading for that page.

**High teaching focus.** Because of the parent/researcher’s attention to vocabulary and comprehension across all three exposures, it can be said that the approach embodied a high teaching focus in her interactions with the two child participants. This approach was relevant because of the findings documented by Fender, Reichert, Robb and Wartella (2010). This research team observed parents and their infant children co-viewing educational DVDs and examined the language learning outcomes of the children. Their observations indicated that there were three main groups of parents identifiable by the differences in the ways they supported the infant’s vocabulary learning. The group of interest to the present study was labeled the High Teaching Focus parents. These parents “presented the greatest variety of words highlighted in the DVD, were most likely to label or describe what was on screen, and had the least amount of non-DVD related talk. Children of High Teaching Focus parents had the highest degree of engagement with the DVD. These children also said the greatest number and variety of target words and were most likely to say new words during the co-viewing session” (p.613). Below is a snippet from the e-reading experiences from the current study that illustrates the high teaching focus (see bold and italic font) and contextualizes some of the social interaction surrounding the

e-reading/listening events (A is Annie, K is Katie [the parent/researcher], B is the e-book narration).

A: She make it. [A starts pressing on pig again and swings finger around in a circle, accidentally pressing the back icon, so the page starts over/reloads]. (4:48)

B: The second little pig found a piece of land and she built herself a house made of sticks. [A pressing 9 times and slowly dragging finger sideways across screen.]

K: [leaning in quietly and holding her arm] Press it one time like this. [A gets it after 3 hard presses.]

B: That's a good start.

K: One time. [K points to pig. A activates next action successfully after 2 taps.] Good girl.

B: La, la, la. I'll have this ready soon.

K: *She's almost done, isn't she?* [A taps 3 times quickly on pig.] One more. Press it one time. There you go! *Good! Oh, look, she's got a ramp and some railings (pointing to illustration). And a roof. A roof that's arched (traces arch with finger).* [A taps on the house 8 times rapidly.] Press on her. See what she has to say now. She's done. [A is unsuccessful in one try and gives up. K presses it for her.]

### Analysis and Results

The first step of data analysis involved coding the transcripts of the videos of each child's 3<sup>rd</sup> exposure to the e-book. While there were differences in the length of each child's e-book experience—Annie's experience was lengthier than Charlie's (20:21 and 13:01, respectively)—the transcripts both included the entirety of the e-book interactions from start to end. To explore

the verbal interactions and the kinds of support the adult provided each child, we applied the coding method used by Krmar & Cingal:

Verbal comments themselves were coded as one of six verbal categories (Haden, et al., 1996): evaluative comments (e.g., “This bunny is so cute.”), questions (e.g., “Do you know how to turn the page?”), directives (e.g., “Go ahead, turn the page.”), correctives (e.g., “Don’t touch the scissors!”), affirmations (e.g., “That’s right! An owl!”), and answers to direct questions from the child (e.g., “It’s a farm.”). The comment type could further be identified by reference type; that is, comments referred to the actual story line and book content (e.g., “The bunny likes his new friend”), to the book format (e.g., “Don’t touch the iPad” or “Press there to turn the page”), or to the environment (e.g., “Please don’t climb on me”). Thus, each comment made by a parent was coded as one of 18 comment types: one of six types of verbal categories, and then one of three reference types. (2014, 271-272).

Codes for verbal interaction were determined at the phrase level, meaning an entire phrase was coded into one of the 18 categories. Narration of the story (i.e., reading the text) was not coded, but oral reconstructions were included in the coding, often falling into the questions-content and answers-content categories.

Second, we examined the videos and tallied for each of the kinds of movements Marsh (2013) and Merchant (2015) observed in their studies of toddlers and e-books: stabilizing (e.g., managing and balancing the iPad; adjusting screen orientation), control (e.g., finger swipes or taps to turn pages, finger clicks to activate hotspots), and deictic (e.g., pointing to a part of the e-book on screen) movements. Tables 1 and 2 outline the frequencies (i.e., raw number) of each

verbal interaction and movement for each child throughout the entire e-reading experience. The parent's interactions for each child are included parenthetically in each cell. Note that the children's deictic movements were not tallied in Table 2 because the majority of the deictic movements (i.e., pointing gestures) turned into control movements. In this row, the number of deictic movements tell the number of times the parent pointed (without activating) to a part of the screen, usually to help the child identify a hotspot he or she could press, or as accompanying a prompt or question for text understanding.

*Table 1. Frequency of verbal interactions in e-book reading experiences\**

Type	Annie (30 months)			Charlie (54 months)		
	Content	Format	Environment	Content	Format	Environment
Evaluative comments	10 (13)	0 (1)	0 (0)	5 (2)	0 (0)	0 (0)
Questions	0 (35)	0 (1)	1 (0)	2 (43)	0 (1)	0 (0)
Directives	3 (9)	3 (22)	1 (1)	3 (4)	1 (6)	0 (0)
Correctives	0 (6)	1 (4)	1 (1)	1 (2)	1 (0)	0 (0)
Affirmations	0 (11)	0 (10)	0 (0)	2 (27)	0 (4)	0 (0)
Answers	21 (0)	0 (0)	0 (0)	45 (2)	0 (0)	0 (0)

\* The parent's verbal interactions are included parenthetically in each cell.

*Table 2. Frequency of movements in e-book reading experiences\**

<b>Movement</b>	<b>Annie (30 months)</b>	<b>Charlie (54 months)</b>
Stabilizing	0 (0)	0 (0)
Control	68 (56)	46 (3)
Deictic	XX (21)	XX (5)

\* The parent's movements are included parenthetically in each cell.

Third, we conducted a more in-depth analysis of the control movements by counting the number of attempts it took each child to trigger the actions on screen. As part of this analysis, we attended to the ways in which the adult responded earlier and later in each child's e-reading experience. The early designation was determined by dividing the total elapsed time for e-reading experience in each case into thirds. Early was the first third of the total elapsed time. For Annie's reading, the "early" part consisted of 6:46 of run time on the video (see Table 3). For Charlie's reading, the "early" part consisted of 5:19 of run time on the video (see Table 4). Note that Table 3 is not an exhaustive account of all of Annie's attempted control movements during this sample. There were too many to include the full list of movements. Table 3 includes approximately 75% of all of her attempts with a stratified sample from page turn movements and hotspot control movements. Table 4, on the other hand, is entirely exhaustive, representing all of Charlie's attempted control movements early in the e-reading experience.

*Table 3. Annie's control movements early in e-reading experience and contingent parent response*

<b>type of control movement</b>	<b>elapsed time</b>	<b># attempts</b>	<b>attempt success</b>	<b>parent response</b>
hotspot	0:34	9	no	no help
page turn	0:49	1	yes	no help
hotspot	2:31	1	yes	no help
page turn	2:37	1	yes	pointed to arrow
hotspot	2:40	9	no	pointed to correct spot
hotspot	3:08	6	no	controls for the child
hotspot	4:06	7	no	no help
hotspot	4:31	5	no	joint physical control
hotspot	4:49	9	no	models "press one time"
page turn	6:04	no attempt	no	point + "press here"
hotspot	6:25	no attempt	no	point + "press here"
hotspot	6:28	6	no	"wait for it to go"
hotspot	6:35	8	no	controls for the child

In addition to these more technical analyses related to the child's navigation and interaction with the e-book, we also examined each child's informal understandings of story vocabulary, plot, and social and emotional reactions to the story. Each child's emergent reading of one scene of the e-book served as proxies for comparing and validating each child's story understanding to the larger scope of other children within the same age groups (i.e., compared to

emergent reading ratings of same-aged participants in de Jong & Bus, 2004; Sulzby, 1985).

These results are presented and discussed later in the paper.

*Table 4. Charlie's control movements early in e-reading experience and contingent parent response*

<b>type of control movement</b>	<b>elapsed time</b>	<b># attempts</b>	<b>attempt success</b>	<b>parent response</b>
page turn	0:20	1	yes	no help
hotspot	1:16	1	yes	no help
page turn	1:53	1	yes	no help
hotspot	2:28	3	yes	no help
page turn	2:32	1	yes	no help
page turn	3:20	3	no	held back hand
page turn	3:38	1	yes	no help
hotspot	4:14	2	yes	no help
page turn	4:30	1	yes	no help
page turn	4:47	3	yes	no help

### **Verbal Interactions**

Affirmations for Charlie were largely content (i.e., text understanding) related whereas affirmations for Annie focused more on navigating the text format (i.e., prompts to turn page, press here or there, etc.). Below is an example of the parent and Annie's interaction in one of the "I'll huff and puff and blow your house down scenes." Note Annie's gaze remained fixed on the screen throughout entire the interaction displayed below—she never looked up from the screen. Katie did not attempt to make eye contact with Annie because the child was seated in front of the

adult with the screen in front of the child. Katie's hand touched Annie's shoulder at the first exchange.

**K: See it's not time yet. You still have to wait. The microphone's not there (pointing to area on screen where microphone appears). We'll have to turn the page.**

B: I just want to say hello. He's very big and very bad. Isn't he? [K taps pig again]. Leave us alone.

**K: Turn the page now** and then we get to huff and puff. [A does so.] (11:30)

B: So the wolf huffed

A: (makes blowing noises) /ffff/, /fff/

B: and he puffed

A: (makes blowing noises) /ffff/, /fff/

B: and he blew the house down.

**K: Ready? See the microphone? (K points at the microphone on screen.) Blow.**

A & B: (make blowing noises) /ffff/

K: Blow!

A & B: (make blowing noises) /ffff/

K: Good! **One more. Blow!** Good!

A & B: (make blowing noises) /ffff/, /fff/

K: Oh no [K turns page in e-book (11:54)]. Do you remember where they're going now?

[A taps continuously on the page to make pigs run faster]

B: The pigs went squealing off to their brother's house with the wolf racing after them.

[A still tapping with no success to make the pig speak.] He's getting closer. [K

presses van/wolf.] Mmm. You look good enough to eat. [K presses pig.] He's going to catch up.

K: Oh. **Turn the page.** Hurry! [A does so.] You've got it. (12:27)

B: The wolf knocked at the door of the third little pig. [A taps three times in sync with the wolf's knocking.] Little pig, little pig, may I come in?

A: No!

B: Not by the hair of my chinny, chin, chin.

A: Chinny, chin, chin (looking at K).

K: Chinny, chin, chin.

In the above sample, you see just how much verbal scaffolding Annie required to wait for the microphone interactive to become enabled and then subsequent prompting to interact, or blow (these verbal prompts are in bold font). In the next 30 seconds, Annie attempted to abandon the e-reading activity, choosing to get up and walk away. In that one scene Annie required 5 prompts to wait (i.e., inhibit behavior) or to navigate the text format (i.e., activate behavior). Annie's gaze only moved from the screen to the parent when she got up and tried to walk away from the e-reading experience. In the same interactive sequence for Charlie, he only required prompting twice, demonstrating the differences in each child's ability to navigate the e-book format and the differences in verbal scaffolding required to co-regulate each child's engagement in the activity. His gaze moved from the screen to the parent more frequently, usually occurring when the parent posed a comprehension/discussion question.

K: What do you think? He might eat the pigs... [C turns page (5:08)] What happens here? "the wolf..." [C knocks his hand on floor]. He knocked. And what did he say? Do you remember what he says? "Little pig, little pig let me in." And the pig says?

C: Not by the hair... [then C advances the page before he finishes narrating (5:28)]

K: (finishing C's statement)... of my chinny, chin, chin. And so the wolf huffed [C taps blowing hotspot], and he puffed [C taps blowing hotspot] and..." What did he do?

C: (looks up at K)...he blew the house down.

K: That's right. Help him. **Touch and blow.**

C: [Taps one time] (blows) /fffff/

K: (laughing) **One more time!**

C: [Taps one time] (blows) /fffff/

K: What do you think that pig was thinking when he ran away?

C: [Taps to turn the page (5:56)] He's scared. (looks up at K)

K: Yeah.

C: He's going to his sister house.

K: Yep. " The little pig ran squealing to his sister's house with the wolf racing after him."

C: Why is that car there?

K: Well. I don't know. Do you think that wolf, um, thinks he's faster in a car?

C: Uh-huh.

Another observation about the verbal interactions (Table 1) relates to the parent's use of affirmations. There is a noticeable difference in the focus of Affirmation reference type. The parent's affirmations referenced the content less frequently, and the format more frequently, in Annie's experience than in Charlie's.

A final observation from the data presented in Table 1 is that Annie's verbalizations focused more on the environment than Charlie's did. All three of the times Annie spoke about the environment were instances in which she got up and walked away from the e-book and iPad,

focusing on other things in the immediate environment. A deeper discussion of this follows in the next section.

### **Movements**

The lack of observed stabilizing movements in Table 2 could be attributed to the positioning of the iPad—resting on the hardwood floor, with the child either sitting or laying in front of the screen, or with the child sometimes sitting on the parent’s lap. This contextual factor reduced the possibility of the children turning the screen rotation when holding the iPad on their laps. As a result of this, and perhaps the parent/researcher’s moves to maintain the children’s engagement in the story, neither child engaged in pressing the iPad’s “home” button to exit out of the e-book.

From Tables 2, 3, and 4, above, it becomes clear that (1) Annie engaged in many more of the hotspot interactive features of the e-book than Charlie, and (2) Annie was much less successful in her control movements than Charlie. As a result, you see the parent/researcher assisting Annie much more than you see her assisting Charlie. The types of help and assistance ranged from outright modeling (parent controlled the action for the child), verbal prompts (i.e., “press there,” “turn the page now”) to physical prompts (i.e., holding the child’s finger to press jointly with the child).

With Annie, it was obvious that many of her unsuccessful attempts early were because she was not able, or did not wish, to wait until after the narrative text was read aloud on the page (despite that context being provided in reading 1 and 2 of the e-book earlier in the week); she was attempting to tap through to the interaction, despite reminders that she had to wait for the text to be narrated before she could interact with the characters in the story. Because of this, there were many unsuccessful actions, and the parent elected to provide assistance with a

mixture of verbal (i.e., “now press here”), deictic (i.e., pointing) or physical prompts (i.e., jointly tapping). After these prompts, we observed Annie experiencing some independent successes resultant from the parental supports for navigation and interaction. At the 6:43 mark, Annie quickly tapped the illustration three times, before anything started going on screen. With big arm movements, Annie raised her hand up above head and came down hard onto the screen. Her brow furrowed and eyes looked toward her parent at this point. She said, “You do it,” and walked away from the screen.

Also, the parent engaged in significantly fewer control movements early in Annie’s e-reading experience compared to later, while there was little difference observed in parent control movements in Charlie’s early and late e-reading experiences. In Annie’s early reading experiences, she attempted 24 hotspot interactives with touch. Of those, nine were met with short, repetitive touches (see Table 3, number of attempts). We argue that these unsuccessful attempts resulted in frustration and attempt to abandon the e-reading experience all together. Frustration point number one occurred at 6:47 into the e-reading interaction:

K: Whoops. You started it [the page] over. You crashed it.

B: The third little pig decided to build a house made of bricks. He worked hard and his house took a long time to build.

A: Press it. [Starts to stand up and walk away 6:47]

K: You want me to press it? Nope leave the camera alone.

B: Oof! These bricks are really heavy!

A: You do it. [K presses to advance action and comments.] Boom. [K presses to advance action and comments.] Boom.

B: I’m going to need some more cement. [K presses.]

K: Here comes the roof! Yeah!

B: That was hard work. But it's a great house. [A presses pig 5 times quickly and then it goes.]

After this indication of frustration with navigation the parent stepped in and offered unsolicited assistance to Annie's navigation much more frequently, reducing the number of hotspot and page turn clicks initiated by the child. In this support, the parent/researcher's objective was to maintain Annie's interest through the interaction, operating on theory evolved from dissertation study that navigational challenges/difficulties can interfere with child's engagement in the e-reading experience.

With Charlie, the number of attempts he made prior to successful actions was fewer. As a result, the parent did not elect to provide supports as frequently as she did to Annie. When the parent did provide Charlie a navigational support early on, it was a control move in which the parent requested him to wait for the programming to catch up.

### **Text understanding**

Despite the differences in each child's navigation through the e-book format, and the parent/researcher's differing supports, both children exhibited age-appropriate text understandings as evidenced by (1) solicited emergent readings of one page of the text, and (2) observations of their expressive engagement within the reading experience.

**Emergent readings.** When we analyzed Annie's emergent reading of the text where the wolf came to blow down the second pig's house, we determined that the language aligned to Sulzby's "Story Not Formed" classification from her study of emergent readings of familiar storybooks (1985). This classification is similar to the emergent readings constructed by the majority of two-year-old children in Sulzby's study (see Figure 2). Charlie's emergent reading

demonstrated language structures that wavered between “Oral and Written-Like Story”

classifications, similar to the majority of four-year-old children observed in Sulzby’s study (see Figure 2).

**Plot.** With respect to the children’s understandings of the plot, we noted that Annie made several successful predictions about the next events in the story, demonstrated empathy for characters, produced emotional responses to overall mood of the story (i.e., she put her hands to her face when the wolf was chasing the pigs and during the fire scene in the 3<sup>rd</sup> pig’s house). Moreover, we observed Annie engaged in dialogue with the characters in the story (i.e., talking back, Sipe, 2002) by directly responding to the characters’ questions (e.g., B: do you like my plant? A: yes.). In all, Annie reported she enjoyed most when she got to blow the house down.

Charlie also made many successful predictions about the next events in story. In addition, he also demonstrated some higher level thinking when he questioned the rationale for character’s motivations and when he began to explore author/illustrator purpose. In contrast to Annie’s identification of a favorite part of the story, Charlie reported he enjoyed most when the pigs caused harm to the wolf.

Despite this evidence of plot understanding, both children showed some misunderstandings, with Annie sharing many more misunderstandings than her older brother, Charlie. For example, Annie says they are going to a party (we think because pig says that in 1<sup>st</sup> scene of e-book; and example of one misleading hotspot in the book). At another point in the story, Annie was observed blowing down houses at times unaligned to the actual narration in e-book. When discussing the characters’ state of emotions, Annie says the fire is making the pig scared, when it’s actually the wolf coming down the chimney causing the pigs’ fear. Finally, Annie thought that the wolf’s tail in the chimney was a squirrel. This misunderstanding relates,

likely, to her less developed sense of character permanence in the plot. Charlie's misunderstandings, on the other hand, were solely related to definitions of particular words used in the story.

**Language and vocabulary understanding.** Both children demonstrated understanding of various vocabulary words presented in the story. We attempted to capture whether each child understood the meaning of targeted words—*straw*, *sleepy*, *cement*, *angry*, *scared*, and *boil*—and utilized the transcript and gestures in the video recordings to assess language understanding. Results of this analysis show Annie demonstrated less depth of knowledge than Charlie for many of the words targeted in the 3<sup>rd</sup> reading, and also exhibited incorrect understandings more frequently than her older brother. Metaphorical meanings (e.g., why is smoke coming out of the wolf's ears?) were difficult for Annie, although she was able to correctly infer the wolf felt angry because he says “grr, ahh.” Charlie's understanding of word meaning was more complex: he correctly identified synonyms and functions of key targeted vocabulary when prompted.

### **Discussion**

The case offers insights into the interaction between normative developmental differences, individual child differences, and caregiver response with differential supports as it relates to the e-reading experience. The differences observed between the two children could be attributed to their different developmental levels and possibly also to individual differences, and the parent/researcher responded with different supports to each child.

Developmentally at age two, children typically are both asserting autonomy and independence and also in need of comfort and reassurance from a caregiver (Lieberman, 1995). At age four children typically are focused more on their growing competence in planning and accomplishing tasks and their drive for initiative reflects this interest (Erikson, 1963)

Additionally, the physical ability to precisely navigate the page-turns and hot spots within the e-book are much more accessible at age four than at age two. The children in this study reflect these normative developmental traits, in that Annie at 30 months is interested in attempting to navigate the e-book autonomously, but also seeks the safety and comfort of her caregiver when the task becomes frustrating or taxing on her capacity for attention. The focus of the interaction frequently centered on the navigation as this was a more frequent point of frustration for her. Her verbalizations focused on the environment were aimed at eliciting support from her parent (see Table 1). Charlie at 54 months is both more able to attend and more interested in his ideas about his understanding of the story being validated as he is exhibiting initiative in his thinking about the story.

Similar to the findings of Kim and Anderson (2008), the role of the adult is different when interacting with a younger child compared to the role the adult takes on with an older child. This is likely because the self-regulatory and cognitive capacities at each age are quite different, among other developmental markers. “Providing the experiences, supports, and encouragement that enable children to take over and self regulate in one area of functioning after another is one of the most critical elements of good caregiving” (Shonkoff & Phillips, 2000, p. 121). With the two year old, the adult engages in much more of a co-regulatory role due to attention and emotional regulation skills that are still developing. For the four year old child, these regulatory capacities, while still developing, are much improved, and the adult functions in a different way, offering support and redirection when necessary, but allowing the child to have more responsibility over their own self-regulation. This improvement in inhibitory or effortful control is due in large part to the developing brain (Shonkoff & Phillips, 2000).

Also involved in the variation between any two children are individual differences. The differences in each child's temperament, for example, creates both differences in style and ability to self-regulate, as well as prompts different responses from adults in the environment (Sturm, 2004; Carlson, et al., 2004). For example, we believe that the higher number of affirmations related to content for Charlie (see Table 1) may reflect a temperamental difference—the need for a lot more external validation. Thus, individual differences also prompted differential response on the part of the parent/researcher.

Effortful control typically improves noticeably during a child's third year and individual differences in the development of effortful control can be related to temperament and heredity, but also can be “associated with the quality of mother-child interactions” (Eisenberg, 2012, p17). An attuned caregiver who offers scaffolding for both inhibiting and activating behaviors as the context and interaction requires is supporting development of this important self-regulatory function, and gradually releases responsibility for effortful control to the child as they are developmentally ready. The parent/researcher in this case offered unsolicited support for navigation for both inhibiting and activating behaviors when it became apparent that the frustration resulting from waiting (for example, waiting for the e-book read all the text before hotspots were activated, or to accurately tap the correct spot to turn the page) was prompting Annie to walk away from the e-book. For young children it is very, very hard to wait, but with a responsive adult offering supports children develop this important self-regulatory capacity.

### **Limitations and Future Directions**

As e-book media on iPads and touch screen tables are historically juvenile, this research is largely exploratory and descriptive in nature and is not without limitations. The first is that each child chose to use different modes of interaction on their third, and final reading of the text.

In doing so, the planned comparison of verbal interactions and control movements were less valid than they would have been had both children chosen the “read to me” mode. Also, while the parent is held constant across the two dyads observed here, the children differed in age, temperament, and gender. Because of the children’s differences in these, we know that our comparative conclusions will not generalize to all 30 month and 54 month children. Our analysis makes comparison across age to begin to explore the relationship between the child’s development, parental support, and the child’s literacy development.

A second limitation was that the parent (the first author of the study) was also the researcher and is knowledgeable in early language and literacy development with a specialization in e-books. A less knowledgeable parent could have delivered different types of supports. It is probable that different supports would have yielded very different behaviors and that different results could have been observed in other social or cultural contexts. Parent-child interactions are driven by goals for development that are shaped by the cultural context, thus the e-book reading event (i.e., where and how the parent and children sat with the iPad/e-book; the gestural interactions that were effective for communicating from parent to child and child to parent; the appropriateness of the selected story) may look very different in international contexts. A knowledgeable parent who spoke the same language as the text was read, with a background in literature and teaching established the context for communication in this case. While each parent-child dyad and context will bring unique differences to an e-book reading interaction, this case provides insights into the complex interplay of children’s overall development, language and literacy development, effortful control, and temperament with responsive support on the part of the parent as they influence the e-reading experience. The role of the parent in adjusting the type

of support offered based upon developmental and individual differences seem to be a salient factor in sustaining a cognitively and socially positive e-book reading experience

Like other research, this study, with a small sample size, has demonstrated that e-book reading can be a highly engaging and enjoyable learning experience for both the adult and child (Labbo, 2009; Smith, 2001). The scaffolds an adult uses to support a two-year-old child's story understanding differ from the scaffolds used to support a four-year-old child's understanding. This may be a function of the children's differences in print awareness, emergent reading skills, facility with technology, or some combination thereof. Society is becoming increasingly digitized, and adults can use digital media like e-books to introduce young children to this ever-expanding part of our culture (Roskos & Brueck, 2009). But, e-books function in different ways from printed texts and therefore children can learn new and important skills and literacies that are absent from interactions with printed texts.

It is important that we, as literacy researchers, parents, and educators, begin to deepen our understanding of how to support young children's understanding of the electronic and interactive media we share with them with development in mind. The issue is an important one, especially because these media have become more prevalent in today's society—it is becoming ever important that e-book developers creating interactive media for young children consider the range of development present in the targeted audience as well as the role of caregiver/child interaction as part of the design. Recognizing that different strategies are needed to support children of different ages and considering child development are critical as we continue to understand how these media intersect with the learning and teaching that are part of human interaction.

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