The Influence of an Enhanced, Dialogic eBook on Parenting Behaviors During Shared Reading

By

Zachary Stuckelman

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Approved:

Georgene Troseth, PhD

Amy Booth, PhD

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Introduction

The old proverb, "it takes a village", certainly applies in the case of rearing children. However, parents play a central role in contributing to their child's learning and development, whether in a beneficial or detrimental way. From the time children are born, parents guide children in learning about themselves and the world around them (Spera, 2005). Thus, a central area of developmental research has emerged looking at the variety of ways that parents and caregivers interact with and behave towards their children, as well as how children react and grow in response to how their parents care for them (Baumrind, 1967; Hill, 2001;Parke & Buriel, 1998)

Parenting practices during development affect children throughout their lifespan. In infancy, for instance, the frequency of early mother-infant interactions strongly affects fine and gross motor development, as well as social development (Gutman & Feinstein, 2010). At elementary school age and adolescence, parents' positive beliefs about academic achievement have a significant impact on school achievement, persistence in effort towards academics, and consistent performance (Lee, 1985; Prom-Jackson, 1987; Wigfield, 1993). In contrast, parents who consistently try to control their children from a young age see significant negative outcomes, such as externalizing behaviors, academic struggles, and substance abuse. Similar effects are found with parents who forgo their parenting responsibilities and allow their children an inappropriate level of autonomy (Baumrind, 1991; Lansford, Malone, Dodge, Pettit, & Bates, 2010; Wight, Williamson, & Henderson, 2006). These findings above, as well as a plethora of additional literature, indicate that, of all the relationships present from birth, it is the parent that has the most significant and long-lasting effect throughout their child's life.

Depending on the larger culture the family unit is a part of, more parental control may not always lead to negative outcomes. Although warm, responsive parenting techniques are most effective in majority Western cultures, parental use of strict limits and unilateral decision making has been shown to keep African American adolescents away from deviant behavior, such as drug abuse and crime, and to promote academic achievement (Dearing, 2004). Also, relatively critical or harsh parenting behaviors have a more positive impact on child outcomes in eastern cultures including Chinese culture (Cheah, Leung, Tahseen, & Schultz, 2009; Deater-Deckard & Dodge, 1997; Zhou, Wang, Deng, Eisenberg, Wolchik, & Tein, 2008). Chinese mothers are stricter and require higher levels of obedience from their children. Yet these behaviors do not produce many negative outcomes in Chinese culture prior to adolescence, as opposed to when they are used in Western cultures (Chao, 1994). Nevertheless, the use of positive parental discipline is very common across cultures, and when used, leads to positive effects (Pastorelli et al., 2016).

It is not just that parents influence their children; in areas such as social or emotional development, children also strongly influence the behavior of their parents, as this relationship is bidirectional (Boldt, Kochanska, & Jonas, 2017; Holden, 2015; Kuczynski & De Mol, 2015). Children who are more timid or use more agreeable and positive behaviors elicit more caring responses by their parents, as well as more reciprocal engagement (Lengua & Kovacs, 2005; Moilanen, Rasmussen, & Padilla-Walker, 2015). Likewise, children with this kind of demeanor respond to more indirect parental direction, as well as more subtle tactics in parenting (Kochanska, Aksan, Prisco, & Adams, 2008; Mesman, Van Ijzendoorn, & Bakermans-Kranenburg, 2012;). However, as children reach middle childhood and adolescence, parents tend to increase their use of unilateral decision making and strict socialization strategies with youth who are non-compliant or exhibit persistent negative affect (Achtergarde, Postert, Wessing,

Romer, & Müller, 2015; Ganiban, Ulbricht, Saudino, Reiss, & Neiderhiser, 2011). As the child begins to grow and change, so too does the parent's behavior towards them, as well as how each party conducts themselves in their relationship.

Parenting Behaviors and Their Effects on Development

Certain parent-based behaviors and qualities are associated with positive developmental outcomes. For instance, Diana Baumrind (1967, 1991) identified the "authoritative" parenting style as significantly related to the most positive developmental outcomes in participating families, including high academic performance and high child competence. Authoritative parents provide warm, constructive feedback, reason by induction, and invite democratic participation, which allows for a reciprocal, safe, and positive environment for the child to explore and learn from the parent themselves, as well as from the world around them (Robinson, Mandleco, Frost Olsen, & Hart, 2001). Baumrind classified parenting behaviors and interactions with the assumption that they are stable and consistent throughout a child's development.

In recent literature, a more dynamic model has emerged reflecting a broader set of parenting behaviors and attitudes linked to the child's growth (Belsky, 1984; Coatsworth, Timpe, Nix, Duncan, & Greenberg, 2018). For instance, the positive behavior of parental *responsiveness* includes how sensitive, warm, and encouraging parents are toward their children, as well as how reciprocal their overall relationship is. The positive effects of parental responsiveness are now well-documented across many developmental domains (Landry, Smith, Swank, Assel, & Vellet, 2001; Mathis & Bierman, 2015; Spera, 2005).

There are clear connections between responsive-compassionate parenting and important developmental outcomes in early childhood, such as emotion regulation and other crucial

executive functioning skills (Calkins & Marcovitch, 2010; Ferrier, Bassett, & Denham, 2014). In one recent study, middle-class European American mothers' responsiveness was directly linked to their infants' later development of executive function skills as toddlers (Bernier, Carlson, & Whipple, 2010). Responsive parenting observed during a structured parent–child interaction when the child was two years old reliably predicted better observational learning skills at the age of four (Hughes & Ensor, 2009). Additionally, high levels of responsive and positive parenting behaviors early in development can be protective as children reach middle childhood and adolescence. Maternal responsiveness in the early years of development is linked to a significantly decreased risk of conduct problems in middle childhood (Wakschlag & Hans, 1999; Walton & Flouri, 2010). While Baumrind's initial model of parenting styles may no longer be the standard, many of the broader qualities of parenting she discussed in her 1967 paper are still researched and valued today.

Just as there are parenting qualities that promote positive outcomes, some parenting traits tend to stifle development. Parents who use constant control, expect high levels of obedience, consistently intrude on their child's life, and are easily frustrated may have a detrimental impact on their child's development. (Grolnick, 2003; Grolnick, Friendly, & Bellas, 2009; Soenens & Vansteenkiste, 2010). And while difficult children elicit more critical parenting, approaching children using negative affect or control can lead to disruptive, disagreeable child outcomes, such as hostility, recklessness, and other conduct problems (Dishion, French, & Patterson, 1995; Lipscomb et al., 2011; Lorber & Egeland, 2011).

Harsh parenting behaviors can also impact children's development of academic skills. In one set of studies, a negative link emerged between directive-critical parenting behaviors and the ability of ethnically diverse (Euro-America, African-American, and, Hispanic) Head Start

children to focus and maintain attention, as well as regulate their emotions (Bernier et al, 2010; Mathis & Bierman, 2015). This kind of parental invasiveness and control can inhibit children's academic performance and engagement at home and at school (Darling & Steinberg, 1993; Kochanska, Boldt, & Goffin, 2019). Parents who use higher levels of directive prompting less often provide rationales and engage in reasoning with their child, parenting behaviors that can increase parent-child closeness and positive outcomes throughout development (Calkins, Smith, Gill, & Johnson, 1998; Eisenberg et al., 2010). Moreover, a lack of parental responsiveness when young children need support has a direct negative effect on children's willingness to cooperate and engage in shared interaction in the future (Landry et al., 2001). In Grolnick's 2009 study, the use of negative parenting practices increased the likelihood of irritability on the part of both parent and child; this irritability was significantly higher during learning activities compared to other shared activities. It is clear that the way parents interact with their children has a significant impact, whether positive or negative, on how they develop and learn across a variety of critical contexts.

Parenting and Shared Reading

As in any context, how the parent approaches reading with their child can make or break the value of the overall experience. Particularly in the early years of life, many parents and children engage in shared reading experiences for both educational and enjoyment purposes. These shared reading interactions are a key contributor to early language and literacy development (Sénéchal, 2008; Wasik, Hindman, & Snell, 2016). During shared reading, children can become familiar with a variety of different words, thematic concepts, and strategies that are crucial for later school achievement (; Bus, van Ijzendoorn, & Pellegrini, 1995; Mol & Bus, 2011; Sparks &

Reese, 2013). Parents who establish a shared book reading routine early on in childhood expose their child to a large assortment of significant linguistic input. This increased input predicts increases in language growth and reading motivation (Duursma et al., 2007). Through consistent shared book reading, parents become more aware of their child's cognitive and linguistic abilities and limitations, thus allowing them to optimize the reading experience for the child (Bergman, Deitcher, & Johnson, 2015; Fletcher & Reese, 2005).

Positive parent attitudes and behaviors toward reading are linked to better child outcomes. Bonding with children is described by parents as an extremely important goals for parent-child reading (Audet, Evans, Williamson, & Reynolds, 2008). Further, parents believe that shared reading interactions not only benefit children's language skills, but also increase children's future engagement in literacy (DeBaryshe, 1995). Use of positive parenting behaviors, previously described as the caregiver's use of *warm*, *sensitive*, and *responsive* tactics with his or her child, strongly predict language and literacy outcomes (Bornstein & Tamis-LeMonda, 1989; Landry et al., 2001; Leigh, Nievar, & Nathans, 2011; Snow, Burns, & Griffin, 1998; Tamis-LeMonda, Briggs, McClowry, & Snow, 2009; Wakschlag & Hans, 1999). Moreover, warm and responsive parents have children who engage in more cooperation during shared reading (Hindman & Morrison, 2012).

In a study by Roberts and colleagues (2005), children's emergent literacy was evaluated annually between age two and age five. Mothers who used more positive and responsive behaviors in general toward their children at home also engaged in these behaviors during book sharing. These mothers were found to share reading with their children more often, to engage in more shared talk around the books, and to have children with more positive literacy attitudes. Finally, the more positive and warm mothers had children whose school-entry language

and literacy skills were significantly higher (Roberts, Jurgens, & Burchinal. 2005). Research has indicated that active and meaningful engagement during shared reading is related to parents supporting their child's academic performance and success (Deming, 2009; El Nokali, Bachman, & Votruba-Drzal, 2010; Wood, 2002). With shared reading being so integral to children's literacy and language development, it is clear that parents' attitude during reading should not be passive indifference but warmth, enthusiasm, and openness.

The Role of Dialogic Reading

One method of shared reading that may naturally promote positive and responsive parenting is *dialogic reading*. Developed by Whitehurst and colleagues (1988), dialogic reading trains parents to use different types of conversation prompts during shared reading to get children expressing themselves about a story. As children become more familiar with the story across repeated readings, adults are instructed to increase the challenge of their prompts. Over time, these prompts can be tailored to children's growing literacy and language abilities. Yet dialogic reading is not solely about asking questions. Parents are also encouraged to provide responsive feedback to children and to model complex answers themselves, exposing children to advanced language (Whitehurst et al., 1988). Research indicates that early language and literacy development depends not just on quantity of reading, but also the *quality* of parent-child talk (Mol, Bus, de Jong, & Smeets, 2008). In essence, the aim of dialogic reading is to encourage parents and children to have richer, higher quality, and more fulfilling conversations during shared read.

In dialogic reading, parents are typically trained on two mnemonic devices that contain specific tactics to scaffold children's mastery and use of complex vocabulary, as well as structure

their shared interactions and parent prompting. The first mnemonic, P-E-E-R, reminds parents to *prompt* their child, then *evaluate* the child's response, *expand* on the child's response, and then *repeat* the initial prompt to ensure the child understood. A second mnemonic, C-R-O-W-D, provides a variety of different ways that parents can prompt their child to talk about the story. *Completion* involves asking children to "fill in the blank" in the parent's statement. *Recall* prompts children to remember previous story events (i.e. "What happened at the beginning of the story?"). *Open-ended* prompts include *Wh-* questions, such as "What do you think is going to happen?" *Distancing* prompts connect the story content to the child's own life and increase children's engagement around reading (Whitehurst, Epstein, Angell, Payne, Crone, & Fischel, 1994). Following these dialogic reading strategies, parents might automatically engage in more positive parenting practices, encouraging children to share their thoughts about the story in a variety of ways through C-R-O-W-D, then immediately providing warm and understanding evaluations and responses with the remaining steps of P-E-E-R.

When parents engage in dialogic reading, children show gains in many areas of development. Significant improvements have been found in children's expressive vocabulary skills from ages 2 to 5 when families use dialogic reading (Arnold, Lonigan, Whitehurst, & Epstein, 1994; Dickinson & Tabors, 2001; Strouse & O'Doherty, & Troseth, 2013; What Works Clearinghouse, 2007; Whitehurst et al., 1988; Zevenbergen, & Whitehurst, 2003). These benefits extend to families of low income, English language learners, and children at risk for reading impairment (Brannon & Dauksas, 2014; Crain-Thoreson & Dale, 1999; Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Hargrave & Sénéchal, Pagan, Lever, & Ouellette, 2000; Lonigan & Whitehurst, 1998; Opel, Ameer, & Aboud, 2009; Tsybina & Eriks-Brophy, 2010; Vally, Murray, Tomlinson, & Cooper, 2015; Whitehurst et al., 1994; Whitehurst, Zevenberg,

Crone, Schultz, Velting, & Fischel, 1999). Other positive outcomes of dialogic reading with a parent include higher receptive vocabulary and story comprehension (Roberts, Jurgens, & Burchinal, 2005; Strouse, O'Doherty, & Troseth, 2013). Parent training in dialogic reading has a long-lasting impact on children's early literacy, as families still engage in the techniques up to two years after initial exposure (Huebner & Payne, 2010).

However, dialogic reading is not without its challenges. There are limitations in the degree to which positive outcomes are achieved by children who are at risk of literacy and language difficulties, as parents of these struggling children read significantly less than more affluent, educated families. This could be due to parents' beliefs about the value of reading, parents' own lack of enthusiasm for reading, or the press of many responsibilities to provide for the family (Janes & Kermani, 2001). Lack of engagement in literacy experiences produces a learning barrier for these children once they reach school age (Hoff, 2013; Mol, Bus, de Jong, & Smeets, 2008; Nores & Barnett, 2014; Zill et al., 2006). Given the complex training that is required for parents to accurately use to dialogic reading, the method as currently implemented may not be accessible for all families. Therefore, one of the central questions about dialogic reading is how to make the method both easy to understand and convenient. One potential solution is offering modeling of dialogic techniques through interactive digital media.

How Parenting, Digital Media and Dialogic Reading Can Interact

Parents tend to think of children's use of media as a solitary play time rather than an opportunity to actively engage with their children (Barkin, Ip, Richardson, Klinepeter, & Krcmar, 2006; Nathanson, 2001). In many families, the purpose of digital media (TV, video, and touchscreens) is to serve as a temporary babysitter to entertain children while parents take a

shower, enjoy a restaurant meal, or get some chores done (Guernsey, 2007). However, research indicates that watching certain educational television programs, such as Sesame Street, is linked to positive academic achievement throughout childhood and adolescence (Linebarger, Barr, Lapierre, & Piotrowski, 2014; Mares & Pan, 2013; Wright et al., 2001). These positive outcomes are strengthened when high quality media and technology are used as a part of a shared interaction with the parent (Linebarger & Walker, 2005; Reiser, Tessmer, & Phelps, 1984; Rice, Huston, Truglio, & Wright, 1990).

One concern about children's use of media has been that it displaces time spent engaging with parents (American Academy of Pediatrics, 2016), time in which family interaction and talking together builds a child's language abilities (Linebarger & Piotrowski, 2010). However, if parents and children share interactions around educational media and technology, these can be opportunities to build children's language skills as well as their background knowledge. In particular, the incorporation of dialogic reading—prompts for conversation and encouragement for children to talk—could turn media use into a situation that fosters engagement, learning, and close, warm interactions between parents and children.

Previous research shows that dialogic reading is effective when used with digital media. In a 2013 study, Strouse Troseth, and O'Doherty trained parents to use dialogic reading methods while watching lightly animated, narrated video storybooks with their children. Parents were initially brought into a lab to receive training, and then were given the storybook videos to practice with at home over four weeks. Across the month, children increased their knowledge of the story-specific vocabulary, as well as their story comprehension, relative to a watch-as-usual control group. Furthermore, children whose parents were trained on dialogic reading techniques with video showed immense growth in expressive vocabulary over the 4-week procedure. By

adopting the open-ended questioning and supportive follow-up style of dialogic reading, parents changed their typical interaction style around media and technology, and produced a more enriching experience for the child. This result is especially encouraging because parents had to learn to pause a video and intervene positively in the flow of the story—something that parents in the control group almost never did.

In this study, the researchers also incorporated a condition that had an onscreen character ask children questions (similar to Dora the Explorer). The onscreen questioner was created to study if children learned as much when a questioner could not engage in reciprocal interaction with viewers, as children could when engaging with their parents. This questioner (a female adult) appeared in the corner of the picture book video on screen to ask children open-ended questions. The parents in this group were told to simply watch the video along with their child. The on-screen dialogic questioner could not offer social feedback to the child's direct responses, and did not have any way to cooperate with the child to guide understanding and engagement. Following the pattern of adapting prompt difficulty to children's growing experience with a book, the on-screen, dialogic questioner provided relatively easy prompts in the video used for the first week. In the second week, the children watched the same storybook video but the onscreen questioner asked more challenging dialogic questions. This pattern was repeated with a different storybook video for two additional weeks.

Strouse and colleagues were intrigued to find that children's learning in this condition fell between that of the control group and the dialogic training group. They concluded that there may be some benefits to children's use of this kind of "quasi-interactive" technology, but that the best results might come from having parents engage in dialogic reading with the help of an on-screen model and questioner (Strouse et al., 2013). The presence of a character who models strategies

without explicit teaching might help parents learn this method of engaging children in conversation in an approachable way that may be more natural to their daily life and technology use. Rather than having to remember complicated mnemonic devices about dialogic reading, parents could receive helpful clues and prompts that they may not have realized they could ask their child while reading. The goal would be that parents use these hints as a springboard for additional, independently generated discussion. The development of electronic books (eBooks) with in-the-moment interactivity for use on tablet devices suggests a platform for such a tool.

eBooks in a Parent-Child Shared Reading Context

Use of eBooks has dramatically increased over the past decade (Cingel & Piper, 2017). Digital devices that can display eBooks have been adopted by families from all socioeconomic groups in the US (Smith, 2013). Parents report that 96.6% of children have used mobile devices before the age of one year, and 83% of children under five have a tablet computer in their home (Kabali et al., 2015). Earlier, CD-ROM versions of eBooks promoted literacy and language skills in preschool and elementary children (Ihmeideh, 2014; Littleton, Wood, & Chera, 2006; Shamir, Korat, & Barbi, 2008). And modern, tablet-based eBooks spark increased positive engagement and content-related talk between parents and children (Moody, Justice, & Cabell, 2010; Strouse & Ganea, 2017). Studies looking at children of various ages reported better vocabulary outcomes when using educational eBooks over print books, as well (Bus, Verhallen, & deJong, 2009; Ihmeideh, 2014; Richter & Courage, 2017; Shamir & Korat, 2007). Enhancements such as built-in dictionaries and story-related animations directly support the development of literacy skills and positive literacy attitudes. These features have been shown to benefit the aforementioned outcomes at an even greater extent than print or electronic books without these enhancements

(Bus & Neuman, 2009; Korat, Levin, Atishkin, & Turgeman, 2014; Korat & Shamir, 2012; Verhallen, Bus, & de Jong, 2006). Recent meta-analyses support that, through relevant audiovisual feature (targeted animations and sound effects related to the text) and other enhancements (i.e. on-screen questions), children's story comprehension and vocabulary learning from eBooks exceed that resulting from the use of print books (Takacs, Swart, & Bus., 2015).

Certain types of enhanced and interactive electronic books, though, can be distracting and inhibit young children's learning (Chiong, Ree, Takeuchi, & Erickson, 2012). Takacs, Swart, and Bus (2015) found that hotspots and games inserted into eBooks were particularly harmful for children's learning. Hotspots were defined as places on the eBook screen that children could have a physical contingent interaction, with the eBook providing some rewarding outcome in response to the child's touch. These points of interactivity typically are only loosely related to story content. In a majority of the 43 studies sampled in Takacs, Swart, and Bus's 2015 meta-analysis, hotspots were found to detract from children's learning. These findings have been further supported by other studies (Bus, Takacs, & Kegel, 2015; Richter & Courage, 2017).

Additionally, eBooks with distracting features can negatively impact the parent's role in shared reading interaction. In a group of sampled parents, 70% only gave their child an eBook to read if they, themselves, were busy doing something else. Furthermore, these parents voiced that eBooks on tablets are used primarily as games, and that they spend more of their shared reading time with traditional print books (Vaala & Takeuchi, 2012). Therefore, a majority of the time eBook use may occur in a non-shared capacity.

There is a clear contrast between how parents and children view eBooks, and media in general. In a recent study, it was found that children tended to choose digital media over print when deciding how they want to receive information. However, surveyed parents did not believe

that media would be as helpful as print, and felt that print reading experiences would be more preferred by the child (Strouse, Newland, & Mourlam, 2019). With these beliefs in mind, and interactive features potentially distracting children from interacting with their co-reading parent, it stands to reason that parents could use different parenting behaviors when reading eBooks with their children as opposed to print books.

Parents reading eBooks are less engaged and responsive when talking with their child, leading to a less rewarding interaction (Krcmar & Cingel, 2014; Nathanson & Rasmussen, 2011). In a study by Korat and Or (2010), mothers of kindergarteners read either an educational eBook, a commercial eBook, or a print book to their child. Mothers initiated less discussion, responded less, and expanded the conversation less when using the eBooks than the print book. Although mothers defined words more often when reading the educational eBook than the commercial e-book, mothers engaged in less complex and engaging discussion with both eBooks in comparison to reading the print book. If parents view eBooks as games, this may hinder shared discussion of story content with their children. Parents may not see the potential in shared eBook reading to produce warm and productive interactions with their child.

Incorporating Dialogic Reading into eBooks

Therefore, researchers have attempted to develop eBooks that, through the incorporation of dialogic modeling, provide relevant, non-distracting assistance to the parent and child for rich, productive conversation. In a study conducted by Troseth, Strouse, Flores, Stuckelman, and Russo-Johnson (2019), parents and their 3-to-5-year old children from low-income households were given an experimental eBook with an embedded character that modeled dialogic prompting and conversational techniques. Working with the Fred Rogers Company, the research team

modified a publicly available, narrated eBook based on a PBS children's television program (*Peg + Cat's* "*The Big Dog Problem*") by adding the dialogic questioner. Troseth and colleagues asked the producers to remove irrelevant hotspots and other distracting features (e.g., having a dog bark every time his image is touched) to help children focus on the story (Takacs et al., 2015). However, simple multimedia (light animation highlighting the narrative) was retained to foster story engagement.

Two versions of the experimental, enhanced eBook were created. The first included "Ramone" (the dialogic character) on every page, modeling simple dialogic prompts that began immediately after the narration on each page. In the second version, Ramone asked more difficult questions but only appeared on 7 out of 12 pages. This was done to see if parents would begin to use dialogic methods autonomously on those pages, after a limited amount of modeling of the methods. Parents in the enhanced condition listened to the two versions of "*The Big Dog Problem*" twice with their child in a single lab visit (the simpler version first and the more difficult version second). The control group families listened to the non-enhanced, narrated version of the eBook twice. In comparison to parents and children in the control group, parents and children exposed to Ramone talked over 3 times more. Parents and children also produced more content-related utterances, as well as talk at a higher level of cognitive demand (Price, Van Kleeck, & Huberty, 2009). Parents spontaneously used more P-E-E-R based conversational tactics (e.g., prompting their child more), even though these strategies were not explicitly modeled. Finally, parents produced significantly more C-R-O-W-D prompts on the pages where Ramone did not appear, as compared parents in the control condition on the same pages of the story book (Troseth et al., 2019).

In a follow up study, the researchers looked at this new technology with children and parents from a broader range of socioeconomic backgrounds (middle and high income households) and added two other reading conditions: use of a control eBook with the audio turned off, as well as a print version of the eBook. Early in data collection with the enhanced and control eBooks, some parents provided feedback stating that they would interact more with their child while reading a print book, an attitude supported by previous research (Rainie, Zickuhr, Purcell, Madden, & Brenner, 2012; Strouse & Ganea, 2017). The new conditions were included to see whether reading a print book, or removing the audio narration from the electronic book and having the parent read the story, would change how parents and children interact compared to when the reading was supplied by the device. It could be that merely having the book on a tablet changes how parents think about the reading situation and potentially, their behavior.

Nevertheless, parents and children using the experimental eBook with Ramone talked three times more than those in all three other groups, had more content-related discussion, and used more talk with higher levels of cognitive demand. Without being explicitly trained, parents in this condition autonomously used more dialogic strategies to structure their conversations with their child. Of note, the parents and children in the print book group talked significantly less than their enhanced eBook counterparts, with observational data showing most of their interaction to involve text reading, or low level of cognitive demand talk around perceptually salient features such as the color or location of story characters (Strouse, Troseth, Stuckelman, Flores, & Russo-Johnson., *in prep*). This finding goes directly against parents' perceptions of how they interact with their children when they read together. Therefore, incorporating enhanced eBook technology into the home reading environment may serve to both increase conversation and promote higher quality parent-child interaction.

The Current Study

One limitation of the prior studies was that the two readings of the book were within a single lab session, rather than over a longer period of time and in a more natural setting. The research reported here is part of a study in which families received prolonged exposure to the experimental, dialogic eBook or the control eBook over two weeks at home. The research team included new tasks to measure parents' transfer of dialogic tactics to new books and formats. The team also added a condition in which families had a choice on each reading whether to use one of the two experimental versions with Ramone (with easier or harder prompts) or to use the control version without Ramone. This condition was added: 1) to see whether families would choose to use the versions with the dialogic questioner or prefer the standard eBook, when given the choice, and 2) to see whether any amount of exposure to Ramone over the two weeks would promote parent-child interaction and parent use of dialogic strategies.

The main focus of the research with the dialogic questioner has been on the quantity and quality of talk produced by the parent and child while using this intervention, and on parents' adoption of dialogic reading methods. The results certainly are promising, and the notion of transfer of the dialogic method to new formats is definitely a point of interest in the two-week study. Another important area of inquiry is whether other aspects of parenting during reading might be affected by exposure to an eBook enhanced with a character modeling dialogic questioning. According to the research reviewed above, it is not solely what the parent says during reading that can impact the child's language and literacy outcomes. Rather, the way the parent behaves toward, responds to, and interacts with the child can impact the shared reading experience just as much. Because many parents may not accurately report or perceive how much they interact with their children as they typically read together (at least, according to our

previous results), my prediction was that this enhanced, dialogic eBook would give parents a new tool that not only promotes parent-child dialogue around story books, but also provokes more positive and responsive parenting during these crucial interactions.

As part of this study with 3-to-5-year old children and their parents, I incorporated measures and analyses to see if use of this dialogic eBook at home over two weeks would lead to changes in parenting behaviors, and subsequent child behaviors, during shared reading interactions. To do so, I evaluated parents' and children's behaviors on the first lab visit during a baseline shared reading task, before families took a tablet home and read the eBook 10 times over two weeks. Then during the final lab visit, I evaluated families' reading behaviors while they used a new eBook and a new print book.

I expected no parenting differences based on condition assignment during the initial lab visit reading. However, I predicted that upon returning to the lab for the second visit, both parents and children exposed to the experimental eBook in any capacity (i.e., either reading the two experimental eBook versions with Ramone, or receiving all three versions in the choice condition) would exhibit more positive affect, behaviors and responsiveness while reading compared to those exposed solely to the control eBook (without Ramone's example) over the two weeks. In addition, I predicted that families would remain on task more often while reading during the second lab visit, compared to those who only received the control eBook exposure. I also expected to find significant gains in the level of reciprocity between the parent and child, an important measure of parenting quality in prior research, as well as their cooperation throughout the readings (Christenson & Sheridan, 2001; Leseman & de Jong, 1998). Finally, I expected that parents and children exposed to Ramone would exhibit considerable growth in these behaviors when compared to their initial baseline reading during the first lab visit.

I also predicted condition differences in negative parenting behaviors, as well as child behaviors, such as negative affect, noncompliance and conflict, particularly as families were asked to read two books in succession on the final lab visit of a long study. I hypothesized that after exposure to Ramone, no significant increases would be found in these negative behaviors during the shared reading interaction on the final lab visit. In contrast, I predicted increases in negative behaviors and no significant changes in positive behaviors for families who used the control eBook. In previous research, much of the parent-child talk that occurred when reading the control, audio narrated eBook centered around directing the child's attention and behavior, if the families even talked at all (Strouse et al., *in prep*; Troseth et al., 2019). This kind of control-focused talk might be accompanied by more critical or harsh parenting behaviors, as well as subsequence negative reactions from the child. For this Master's thesis, I present data from 42 parent-child dyads (of 75 families participating in the full study) for which parenting behaviors have been coded.

Methods

Participants

Participants were forty-two children between the ages of 3.02 and 4.88 years old (M = 3.91 years, SD = .50) with their parents from the southern US (23 families) and from the US Midwest (19 families). Families were recruited from state birth records and from local events in the community. The majority of children were typically developing and learning English as their primary language. One child was identified by their parent as being diagnosed with cystic fibrosis, one had a minor speech articulation delay, and one child was identified by their parent as having pressure-equalizing (PE) hearing tubes. Because these children did not have severe developmental delays or disorders, they met the inclusion criteria to participate in the study.

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On a parent questionnaire, parents identified their participating children as European American (93%), African American (2%), or Hispanic (2%). One parent (2%) declined to respond to the child ethnicity question. Thirty-nine (93%) of the parents were female. Over 60% of the families that participated had a household income of $75,000 or more per year. All participating parents had attended some college, with the majority (79%) having a bachelor's degree or higher. Table 1 shows all relevant demographic information within each of the three conditions. The research was permitted by the IRBs of the two contributing universities and carried out with written parental consent and verbal child assent.

Materials

Parents and children were exposed to a narrated English storybook on an Amazon Fire HD Kids Edition tablet at home. The eBook (*Peg + Cat's The Big Dog Problem*, Oxley & Aaronson, 2016) was part of a collection intended to educate children about early math concepts and was used in two prior studies (Strouse et al., *in prep*; Troseth et al., 2019). This specific eBook was chosen due to its inclusion of an age-appropriate, engaging story with some suitably difficult vocabulary (i.e. "drooling", "mailbox", etc.). The publicly available version of the eBook (on the PBS Kids website) does not contain any distracting embedded games, making it a suitable eBook to adapt for the purposes of the research. For this study, parent-child dyads in the control group were exposed to a version of the eBook that was minimally modified from the original version. The research team requested that the producers remove some story-irrelevant hotspots to keep children from being distracted from the story (Bus et al., 2015).

Table 1
Demographic Details by Condition Group

	Control M (SD)	Experimental M (SD)	Choice M (SD)
Age in years			
Parent	34.15 (5.49)	34.00 (4.45)	33.21 (4.47)
Child	3.90 (0.47)	3.97 (0.52)	3.87 (0.54)
Parent-child dyads	N (%)	N (%)	N (%)
	14	14	14
Gender (Male/Female)			
Parent	1/13	0/14	2/12
Child	7/7	8/6	8/6
Recruitment location			
Southern US	9 (21.4%)	9 (21.4%)	5 (11.9%)
Midwestern US	5 (11.9%)	5 (11.9%)	9 (21.4%)
Parent Education Level			
Some College	1 (7.1%)	2 (14.3%)	1 (7.1%)
Associates/Technical Degree	3 (21.4%)	0 (0.0%)	1 (7.1%)
4-year College	6 (42.9%)	5 (35.7%)	6 (42.9%)
Professional or Graduate Degree	3 (21.4%)	7 (50.0%)	6 (42.9%)
Did not report	1 (7.1%)	0 (0.0%)	0 (0.0%)
Child Racial/Ethnic Identity			
Caucasian	8 (78.6%)	14 (100.0%)	14 (100.0%)
African American	1 (7.1%)	0 (0.0%)	0 (0.0%)
Hispanic/Latino	1 (7.1%)	0 (0.0%)	0 (0.0%)
Did not report	1 (7.1%)	0 (0.0%)	0 (0.0%)
Household Income			
Under $15,000	0 (0.0%)	0 (0.0%)	1 (7.1%)
$15,000-$30,000	1 (7.1%)	0 (0.0%)	0 (0.0%)
$30,000-$45,000	1 (7.1%)	2 (14.3%)	1 (7.1%)
$45,000-$60,000	2 (14.3%)	1 (7.1%)	1 (7.1%)
$60,000-$75,000	1 (7.1%)	2 (14.3%)	0 (0.0%)
$75,000-$90,000	2 (14.3%)	3 (21.5%)	1 (7.1%)
$90,000-$105,000	2 (14.3%)	1 (7.1%)	2 (14.3%)
$105,000-$120,000	4 (28.6%)	1 (7.1%)	3 (21.4%)
$120,000-$135,000	0 (0.0%)	1 (7.1%)	2 (14.3%)
$135,000-$150,000	0 (0.0%)	3 (21.4%)	1 (7.1%)
Above $150,000	0 (0.0%)	0 (0.0%)	2 (14.3%)
Did not report	1 (7.1%)	0 (0.0%)	0 (0.0%)

Parents and children in the experimental and choice conditions listened to this eBook with an additional digital overlay that contained our embedded, dialogic character. In partnership with The Fred Rogers Company, we altered *The Big Dog Problem* eBook by adding an

interactive character named Ramone. Although Ramone is a character in the PBS Kids *Peg + Cat* television program, he was not a character in The Big Dog Problem.

Ramone appeared on the title page to briefly describe the importance of parents interacting and talking with their children while reading together. Of note, he did not overtly teach dialogic reading methods in any way during this supportive introduction. Ramone was programmed to appear in the corner of the page at the end of the audio story narration to provide a model of dialogic reading prompts that parents could use to increase interaction around the story content with their child, as well as to serve as "springboard" for further content-related conversation on the page.

As in the previous studies on this eBook, two experimental versions were used. In the first version, Ramone appeared automatically on every single page once the audio narration was finished. In this version of the eBook, Ramone modeled easier dialogic-based C-R-O-W-D prompts, such as Wh- questions that have perceptually accessible answers (e.g., "Who is wearing the coat?") as well as some simple open-ended questions (e.g., "Do you think the dog is scary? Why?"). In the second experimental eBook, Ramone demonstrated a variety of more challenging prompts to parents to encourage more diverse child responses, as well as more thoughtful parent-child conversation. Recall-based questions (e.g., "How do you think Peg got the red letter back?") as well as open-ended prompts that required complex reasoning (e.g., "I wonder how Peg is feeling. What do you think?") were modeled. Challenging Wh- questions required children make predictions about a character's state of mind (e.g., "Why is Peg excited?"). Finally, Ramone modeled ways that parents could make connections between the story content and their child's own life using distancing prompts (e.g., "You could talk about what it is like to ride on someone's shoulders.").

Ramone only appeared on 7 out of the 12 total pages of the second experimental eBook version, to see if parents would use the dialogic interaction style independently on the remaining pages. On the title page, Ramone made parents' role clear by telling them, "It's your turn to do the talking on those pages." A coffee cup icon showed parents where to find a hint from Ramone on the 5 pages if they chose. However, in previous research, parents most frequently asked independent questions and did not use the icon to access Ramone's hint (Strouse et al., *in prep*; Troseth et al., 2019).

During their initial lab visit, families read a print version of *The Big Dog Problem*. For the second lab visit, they first read *The Election Problem*, another *Peg + Cat* eBook (Oxley & Aaronson, 2016) that contained similar content and vocabulary as *The Big Dog Problem* and was not modified in any way. Then parents and children read a print book entitled *The Bear Snores On* (Wilson, 2002), a rhyming book that had age-appropriate story content and language but had no relation to the *Peg + Cat* series.

Finally, video cameras and an audio recorder (as backup and for better audio quality) were used to record parent-child interactions in the lab for later analysis. Parents were given an audio recorder to use at home when reading their given eBook. Parents were instructed on how to use the audio recorder, and were told any unrelated audio would be immediately deleted for confidentiality. The home audio recordings will be transcribed and reported on in later research.

Design

Families were randomly assigned to one of three conditions, with the caveat that we tried to balance children's age, gender, and the site of testing across conditions. One-third of the families, including 8 boys and 6 girls ($M = 3.97$ years, $SD = 0.52$; 9 southern and 5 midwestern

children), were assigned to the experimental group. Another third of the families, including 7 boys and 7 girls ($M = 3.90$ years, $SD = 0.47$; 9 southern and 5 midwestern children) were assigned to the control group. The final third of families, including 8 boys and 6 girls ($M = 3.87$, $SD = 0.54$; 5 southern and 9 midwestern children) were assigned to a choice group.

The experimental group was asked to listen to the two enhanced versions of the narrated eBook with Ramone on the tablet over two weeks, for ten total readings. For the first week of five readings, families listened to the version of the story with easier Ramone prompts. For the second week, families listened to the version where Ramone used more challenging prompts and only appeared on 7 out of 12 pages. Families in the control group listened to the narrated eBook without Ramone over the two weeks, for ten total readings. The remaining group of families received both eBook versions with Ramone, as well as the control version without Ramone, on their tablet and had the choice of which version they wanted to read for each of their ten readings. The researchers were curious which version parents and children would chose to read each time, how much they were willing to tolerate Ramone over the two weeks, and if this ability to choose whether to have Ramone would have an impact on their reading behavior during shared reading. An additional research question in the larger study was how much exposure to Ramone was necessary to see differences in conversational quality and interaction style during shared reading.

Procedures

In-lab visits lasted approximately one hour and took place in a quiet room at a campus research lab. During the first visit, an assistant asked parents to fill out a consent form, as well as a demographic survey about their family and their beliefs about and use of digital media. At the

same time, the experimenter received verbal assent to participate from the child, and then completed expressive and receptive vocabulary assessments with them to measure their baseline knowledge of the target words. Then, the experimenter had the child complete the Quick Interactive Language Screener (QUILS™) on an iPad to measure their standardized receptive vocabulary skills (Golinkoff, de Villiers, Hirsh-Pasek, Iglesias, & Wilson, 2017). These data will not be reported here but are part of the larger study.

Next, parents in all three conditions were given a print version of *The Big Dog Problem* and asked to read the story to their child as they would at home. This provided an opportunity to get a baseline for the parent-child dyad's reading behaviors and amounts of talk. When they were finished reading, the parent was given a tablet loaded with the version(s) of the eBook for their assigned condition, a portable audio recorder to record each home reading, and a reading diary with further instructions and troubleshooting tips. The experimenter ended the session by instructing the parents, based on their condition, what they should be doing at home. A requirement was that the parent who attended the first lab visit was to be the primary reader of the eBook with their child, and that any reading done with the co-parent, sibling, or other party would be counted as an extra reading outside of the required ten. No specific instructions were given on how to interact with the eBook itself, or how the parents should behave toward their child around it. Parents were then given the opportunity to ask questions while their child picked out a prize, and then were scheduled for their follow-up lab visit.

During the two weeks, a member of the research team checked in with the family at scheduled intervals to ensure adherence to the study procedure. An initial call, two days after the first lab visit, was done in order to ensure that the eBook was functioning properly. If it was malfunctioning, the research assistant offered assistance over the phone or offered to bring a

functioning tablet to the family's home. One week after the initial lab visit, a research assistant

again contacted the family to check in. Families in the experimental condition were instructed at

this point to switch to the second, challenging version of the Ramone eBook. Families in the

other two conditions were merely asked if they had any technical issues and were given

assistance if needed. Finally, one day prior to the second lab visit, a lab member did a final

check-in to ensure that the procedure had been followed and to remind the families of their

appointment the next day.

On arriving for the second lab visit, parents were given a condition-specific exit survey to

give feedback about the family's experience with their eBook and with Ramone (for families

exposed to him). Children were given post-test assessments of the same receptive and expressive

vocabulary items as on during their initial lab visit; they also completed story comprehension

measures. These data will be reported as part of the larger study.

After the parent and child completed their independent activities, they were given a new

narrated eBook (*The Election Problem*) and were asked to read the story as they would at home.

Again, the researchers left the room after starting the video camera and audio recorder.

Following the eBook reading, the experimenter gave the dyad the print book (*The Bear Snores

On*) to read as they normally would. At the end of the session, the parent was given a gift card as

compensation in appreciation for their time, while the child was allowed to pick out a prize.

Measures

Parent and child reading interaction behaviors were coded from videos of the three in-lab

reading sessions using an adaptation of the Parent-Child Interaction System (PARCHISY;

Deater-Deckard, Pylas, & Petril, 1997). The PARCHISY coding scheme measures aspects of the

parent-child interaction based on different critical factors. Parents and children each received a score based on a 7-point Likert-type rating scale (ranging from 1 = no sign of the behavior to 7 = constantly engaging in the behavior). Parent items included *positive control* (i.e. use of explanation, open-ended prompting, praise, etc.), *negative control* (i.e. use of criticism, physical control, negative feedback, etc.), *positive affect* (i.e. laughing, physical affection, smiling, etc.), *negative affect* (i.e. frowning, rejection, harsh tone, etc.), *responsiveness* to the child's questions, comments, and behaviors (i.e. engagement with the child, verbal responses to child, behavioral responses to child, etc.), keeping *on task* (i.e. taking initiative, keeping attention on the task, etc.), and number of *verbalizations*. Child-based codes were *positive affect* (i.e. laughing, physical affection, smiling, etc.), *negative affect* (i.e. frowning, rejection, harsh tone, etc.), *responsiveness* to the parent's questions, comments, and behaviors (i.e. engagement with the parent, verbal responses to parent, behavioral responses to parent, etc.), keeping *on task* (i.e. attentive, taking initiative, etc.), *noncompliance* (i.e. not following instructions, direct insubordination, saying "no" often, etc.), and number of *verbalizations*. Finally, joint dyad codes were used to evaluate the overall quality of the interaction and included the items *reciprocity* (i.e. joint positive affect, turn-taking conversation, etc.), *conflict* (i.e. disagreement, shared negative affect towards each other, open argument, etc.), and *cooperation* (i.e. explicit agreement, joint decision making, etc.). The system has been used and validated in a variety of different research-based contexts, such as in assessing parent-child interaction behaviors during free play activities and puzzle tasks (Atzaba-Poria, Deater-Deckard, & Bell, 2017; Hughes, & Devine, 2019).

Two undergraduate research assistants, blind to the study hypothesis, served as coders of the video data. Coders were trained to give global evaluations on a total of 16 items from the PARCHISY coding scheme, adapted to suit the main interaction type for this study. They first

coded practice videos of 8 families who participated in a different reading study using the dialogic and control eBooks, but who were not included in this study. The videos from 11 participating parent-child dyads (25% of participants) were double-coded to establish reliability, and the remaining 31 participant videos were coded by one of the two coders. The single-measures ICC was computed using a two-way mixed model to examine the consistency of the raters. For parent codes, Intraclass correlations were: positive control, r = .97; negative control, r = .89; positive affect, r = .85; negative affect, r = .85; responsiveness, r = .88; on task, r = .93; and verbalization, r = .85. For child codes, intraclass correlations were: positive affect, r = .85, negative affect, r = .94, responsiveness, r = .78, on task, r = .82, noncompliance, r= .84, and verbalization, r = .89. Finally, for dyadic codes intraclass correlations were: reciprocity, r = .92, conflict, r = .86, and cooperation, r = .80.

Results

Day 1 Behavior During Reading

Parent Behaviors. A one-way MANOVA was conducted to determine if any significant pre-intervention differences were detected between the three condition groups (experimental, control, and choice) in positive parenting behaviors (positive control, positive affect, responsiveness, and on-task) during the initial lab visit reading. No additional factors were controlled for in this analysis, as no significant group differences were expected due to randomization. No significant effects of condition were found in positive parenting behaviors, Wilk's $\Lambda = 0.83$, $F(8, 72) = 0.90$, $p = .524$, $\eta^2 = .091$. Parents also did not differ by condition in negative parenting behaviors (negative control and negative affect), Wilk's $\Lambda = 0.96$, $F(4, 76) =$

0.39, $p = .814$, $\eta^2 = .020$. Finally, a one-way univariate Analysis of Variance revealed no condition effects on parents' use of verbalizations, $F(2, 39) = 0.10$, $p = .902$, $\eta^2 = .005$.

Child Behaviors. A MANOVA examining the corresponding pre-intervention positive child behaviors (positive affect, responsiveness, and on-task) also revealed no significant differences between conditions, Wilk's $\Lambda = 0.92$, $F(6, 72) = 0.49$, $p = .817$, $\eta^2 = .039$. Parent responsiveness was controlled for in this analysis, due to its potential role in influencing child behaviors. An additional MANOVA, controlling for parental responsiveness, revealed no significant condition effects in negative child behaviors (negative affect and noncompliance), Wilk's $\Lambda = 0.90$, $F(4, 74) = 1.00$, $p = .415$, $\eta^2 = .051$. A one-way ANOVA was run for child verbalizations; this time, parental responsiveness was added as a covariate, as it might contribute to how willing children are to talk while reading. No effect of condition was found, $F(2, 38) = 0.17$, $p = .841$, $\eta^2 = .009$, although parental responsiveness did, in fact, have a significant effect, $F(3, 38) = 13.45$, $p < .001$, $\eta^2 = .515$.

Dyadic Behaviors. For the remaining positive outcomes relating to dyadic interactions (reciprocity and cooperation), a one-way MANOVA was run to see if there were pre-intervention differences between the three conditions. No differences were expected. I controlled for parental responsiveness due to its direct impact on how reciprocal and cooperative a shared parent-child interaction might be. No differences between conditions were found on these outcomes, Wilk's $\Lambda = 0.93$, $F(4, 74) = 0.69$, $p = .601$, $\eta^2 = .036$. The negative dyadic behavior of conflict was examined with a one-way ANOVA, once again controlling for parental responsiveness. No significant differences emerged from this analysis, $F(3, 38) = 0.99$, $p = .409$, $\eta^2 = .072$.

Therefore, parents and children did not systematically differ by condition on positive, negative, or dyadic behaviors during their first lab reading. All parent, child and dyadic behavioral means by group are found in Table 2.

Table 2
Day 1 Paper Book Behavioral Means by Condition Group

	Control M (SD)	Experimental M (SD)	Choice M (SD)
Parent			
Positive Control [a]	2.57 (0.76)	2.64 (0.63)	3.14 (1.29)
Negative Control [a]	2.43 (1.45)	2.14 (1.17)	2.00 (1.11)
Positive Affect [a]	2.57 (1.09)	2.64 (1.01)	2.93 (1.14)
Negative Affect	2.21 (1.25)	1.93 (1.14)	2.00 (1.41)
Responsiveness to Child [a]	2.79 (1.31)	2.57 (1.31)	3.07 (1.27)
On-Task	3.50 (0.94)	3.93 (0.62)	4.14 (0.86)
Verbalizations[a]	3.79 (0.89)	3.64 (1.01)	3.79 (0.97)
Child			
Positive Affect [a]	2.93 (1.91)	2.79 (0.80)	3.14 (1.17)
Negative Affect [a]	2.07 (1.59)	1.29 (0.83)	1.64 (1.08)
Responsiveness to Parent [a]	3.00 (0.88)	3.00 (0.88	3.07 (1.14)
On-Task [b]	3.29 (0.99)	3.36 (0.93	3.79 (1.19)
Non-Compliance [a]	1.71 (1.38)	1.50 (0.85)	1.50 (0.94
Verbalizations[a]	2.64 (0.93)	2.57 (0.94)	3.00 (1.36)
Dyad			
Reciprocity [a]	2.71 (1.14)	2.64 (0.84)	3.07 (1.07)
Conflict [a]	2.50 (1.45)	2.21 (1.31)	2.00 (1.30)
Cooperation [a]	2.00 (0.96)	1.57 (0.65)	1.79 (0.84)

Notes. [a]1(none at all) – 7(constant) [b]1(not engaged at all) - 7(Extremely engaged).

Day 2 Behavior During eBook Reading

Parent Behaviors. To examine post-intervention condition differences in positive parenting outcomes during the second day eBook reading, a one-way MANOVA was run controlling for parental responsiveness on Day 1. There were significant differences in positive parenting behaviors between condition, Wilk's $\Lambda = .42$, $F(8, 70) = 4.79$, $p < .001$. The multivariate η^2 based on Wilk's Λ showed a strong effect size, .35. Follow-up ANOVAs

revealed specific condition-based differences for the positive outcome variables. Using the Bonferroni adjustment, each ANOVA was tested at the $\alpha = .025$ significance level. There was a significant effect of condition on positive control, $F(2, 38) = 18.21$, $p < .001$, $\eta^2 = .489$, responsiveness toward the child, $F(2, 38) = 9.36$, $p < .001$, $\eta^2 = .330$, and remaining on task, $F(2, 38) = 19.06$, $p < .001$, $\eta^2 = .501$. A condition difference in parents' positive affect approached significance, $F(2, 38) = 2.94$, $p = .065$, $\eta^2 = .134$.

Post hoc analyses for the positive control, responsiveness, and on-task outcomes examined which conditions differed on these dimensions. Adjusting for multiple comparisons, each pairwise comparison was tested at the $\alpha = .025$ significance level divided by 3, or $\alpha = .008$. Parents in the experimental and choice conditions showed higher levels of positive control and on-task behaviors compared to parents in the control group. No significant differences between parents in the experimental and choice conditions were found on these outcomes in the post-hoc tests (see Figure 1). Interestingly, only those in the experimental group showed significantly higher levels of responsiveness than the control group during the eBook reading.

Another one-way MANOVA was run for negative outcomes displayed by parents, controlling for parents' day 1 responsiveness. No significant effect of condition was found on negative parent behaviors, Wilk's $\Lambda = .94$, $F(4, 74) = 0.57$, $p = .686$, $\eta^2 = .030$.

Finally, a univariate analysis of variance on parent verbalizations during this reading showed a significant effect of condition when controlling for parents' day 1 responsiveness, $F(3, 38) = 9.34$, $p < .001$, $\eta^2 = .425$. Post-hoc tests with $\alpha = .008$ revealed significant differences between the experimental and control conditions, as well as the choice and control conditions, in the number of parent verbalizations (see Figure 1).
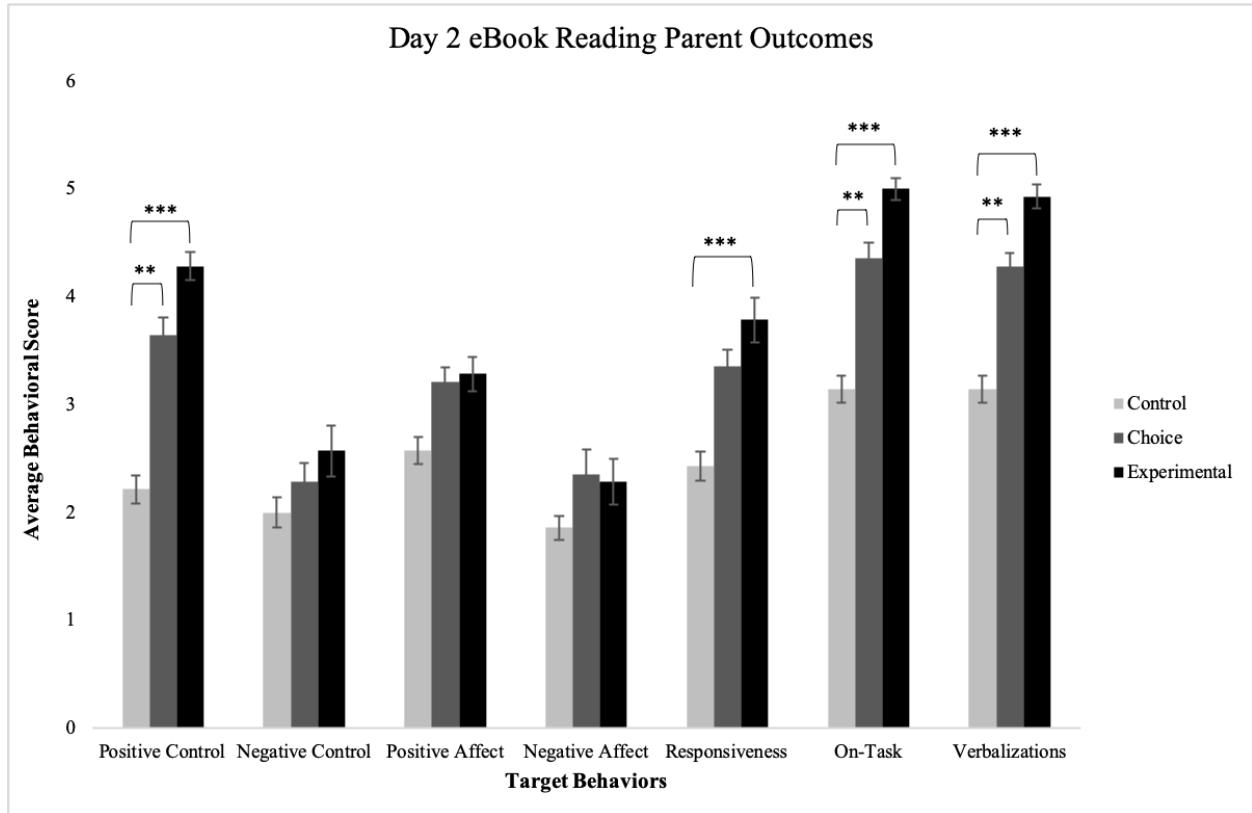
Figure 1. Parent's second day eBook reading behavioral outcomes. **p<.01, ***p<.001. Error bars reflect standard error.

Child Behaviors. For the corresponding post-intervention positive child behavioral outcomes (positive affect, responsiveness, on-task), the same type of MANOVA was run with parental responsiveness from day 1 controlled for. No significant effect of condition was found, Wilk's Λ = .79, $F(6, 72)$ = 1.46, p = .203, η^2 = .109. Controlling again for day 1 parental responsiveness, child negative behavioral outcomes (negative affect, non-compliance) were evaluated using a MANOVA. Although a significant effect of parental responsiveness was found, Wilk's Λ = .84, $F(2, 37)$ = 3.51, p = .040, η^2 = .160, no condition differences emerged between the three groups, Wilk's Λ = .82, $F(4, 74)$ = 1.92, p = .116, η^2 = .094.

Finally, in a one-way ANOVA controlling for day 1 parental responsiveness, a significant effect of condition emerged in child verbalizations during this reading, $F(3, 38)$ = 7.93, p < .001,

$\eta^2 = .385$. In post-hoc tests, there were no condition differences at the $\alpha = .008$ significance level, but significant differences were found at $\alpha = .05$ between child verbalization in the experimental and control conditions, as well as in the choice and control conditions (see Figure 2). All results will be re-examined after data from all 75 participating families has been coded.
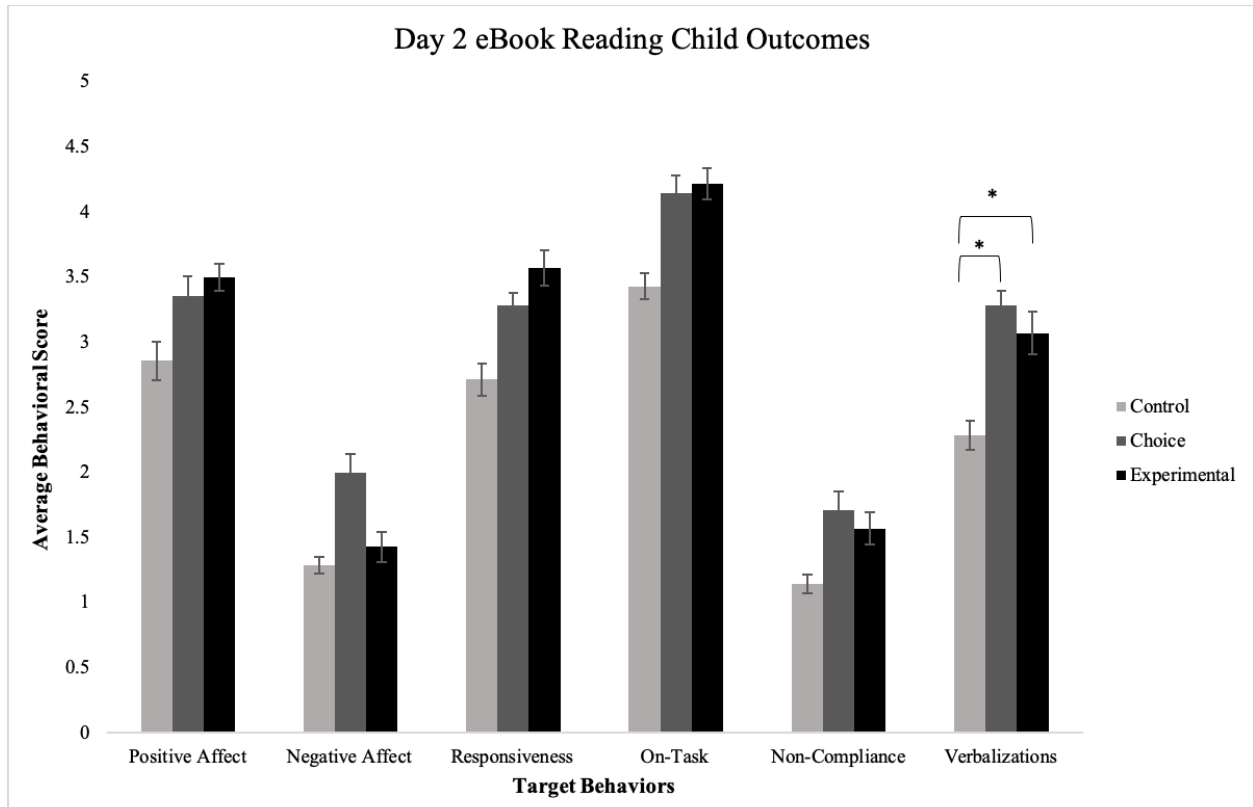

Figure 2. Children's second day eBook reading behavioral outcomes. *$p<$.05. Error bars reflect standard error.

Dyadic Behaviors. A MANOVA on data from the two positive dyadic codes (reciprocity, cooperation), controlling for parental responsiveness on day 1, was significant, Wilk's $\Lambda = .71$, $F(4, 74) = 3.48$, $p = .012$, $\eta^2 = .158$. . Follow-up ANOVAs using the Bonferroni adjustment, tested at the $\alpha = .025$ significance level, revealed a significant effect of condition on reciprocity, $F(2, 38) = 7.44$, $p = .002$, $\eta^2 = .281$, but not on cooperation, $F(2, 38) = 1.34$, $p = .275$, $\eta^2 = .066$.

Post hoc pairwise analyses for reciprocity ($\alpha = .008$) tested which conditions differed. The experimental group showed higher levels of reciprocity than the control group, but the choice group was not different from the other two groups (see Figure 3). For the conflict outcome, a one-way ANOVA yielded no significant effects of condition, $F(3, 38) = 1.05$, $p = .380$, $\eta^2 = .077$.
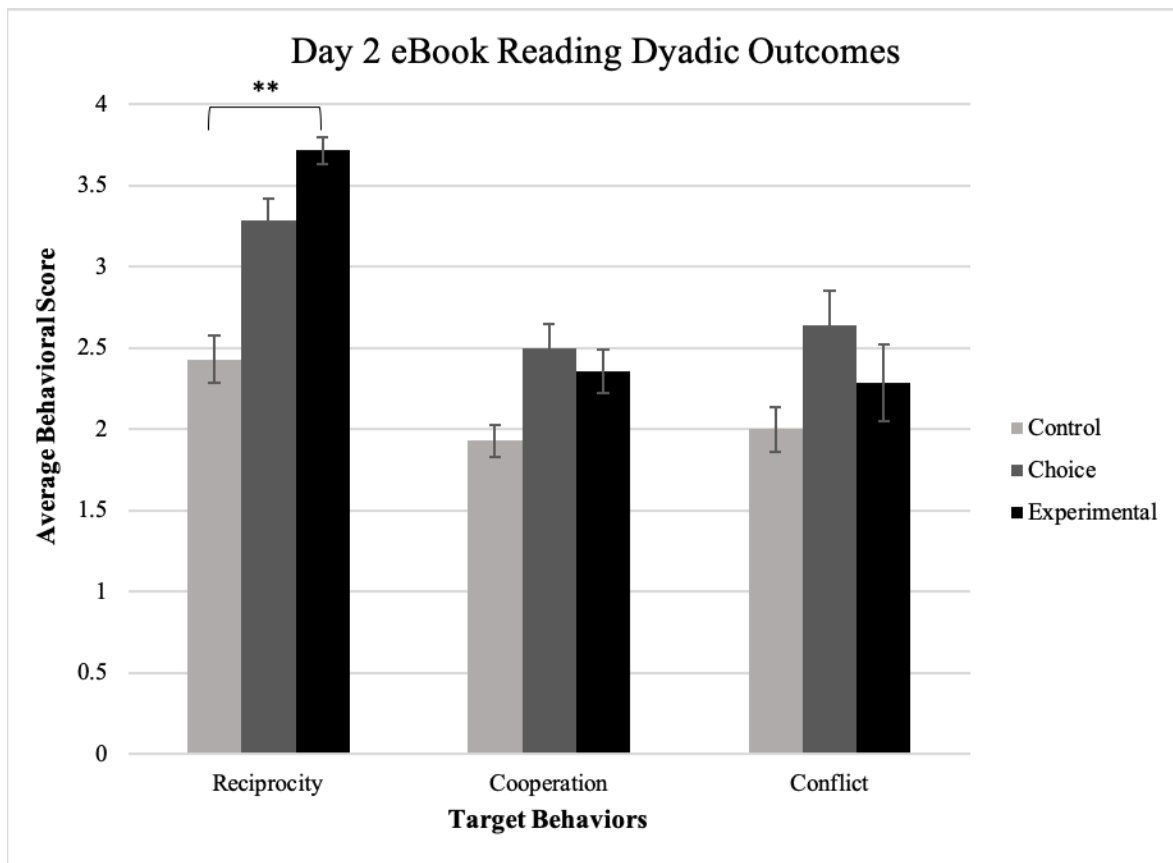
Figure 3 .Dyadic second day eBook reading behavioral outcomes. **$p<.01$. Error bars reflect standard error.

Day 2 Behavior During Paper Book Reading

Parent Behaviors. The paper book reading followed the reading of the eBook. A one-way MANOVA, controlling for day 1 parental responsiveness, revealed a significant condition effect in positive parenting outcomes during this final reading, Wilk's $\Lambda = .43$, $F(8, 70) = 4.58$, p < .001, $\eta^2 = .344$. In follow-up ANOVAs (Bonferroni correction, $\alpha = .025$), there was a significant

effect of condition on all outcomes: positive control, $F(2, 38) = 17.38$, p < .001, $\eta^2 = .478$;

positive affect, $F(2, 38) = 6.76$, $p = .003$, $\eta^2 = .262$; responsiveness to the child, $F(2, 38) = 5.67$,

$p = .007$, $\eta^2 = .230$; and remaining on task, $F(2, 38) = 15.90$, p < .001, $\eta^2 = .456$. Results of the

post hoc pairwise comparisons ($\alpha = .025$ significance level divided by 3, or $\alpha = .008$) echoed

those found in the second day eBook outcomes: parents in both the experimental and choice

condition groups had higher positive control and on-task behaviors compared to those in the

control group. At the $\alpha = .05$ significance level, parent behaviors in the experimental and choice

condition were significantly different than those of the control group in responsiveness and

positive affect. No differences between the experimental and choice conditions emerged for the

outcomes in the post-hoc tests (see Figure 4).

For parent verbalizations during this reading, a univariate analysis of variance,

controlling for parent responsiveness on day 1, was significant, $F(3, 38) = 4.38$, $p = .010$, $\eta^2 =$

.257. Post-hoc tests with $\alpha = .008$ significance level showed no differences between the

experimental and control conditions, or the choice and control conditions, in the number of

parent verbalizations. However, the differences between parent verbalizations in the

experimental and control groups were significant at the $\alpha = .01$ level, and for the choice and

control groups at the $\alpha = .05$ significance level (see Figure 4). The more stringent significance

level may be found with the full data set (all 75 families) once all data is coded.

Child Behaviors. A one-way MANOVA controlling for parental responsiveness from day

1 showed significant condition differences in children's positive affect, responsiveness, and on-

task behaviors, Wilk's $\Lambda = .64$, $F(6, 72) = 2.98$, $p = .012$, $\eta^2 = .199$. Follow-up ANOVAs using

the Bonferroni adjustment ($\alpha = .025$ significance level) showed significant effects of condition

on child responsiveness, $F(2, 38) = 8.22$, $p = .001$, $\eta^2 = .302$, and child on-task behavior, $F(2, 38)$

$= 5.21$, $p = .010$, $\eta^2 = .215$. No significant differences were found for positive affect, $F(2, 38) = 2.72$, $p = .079$, $\eta^2 = .125$.

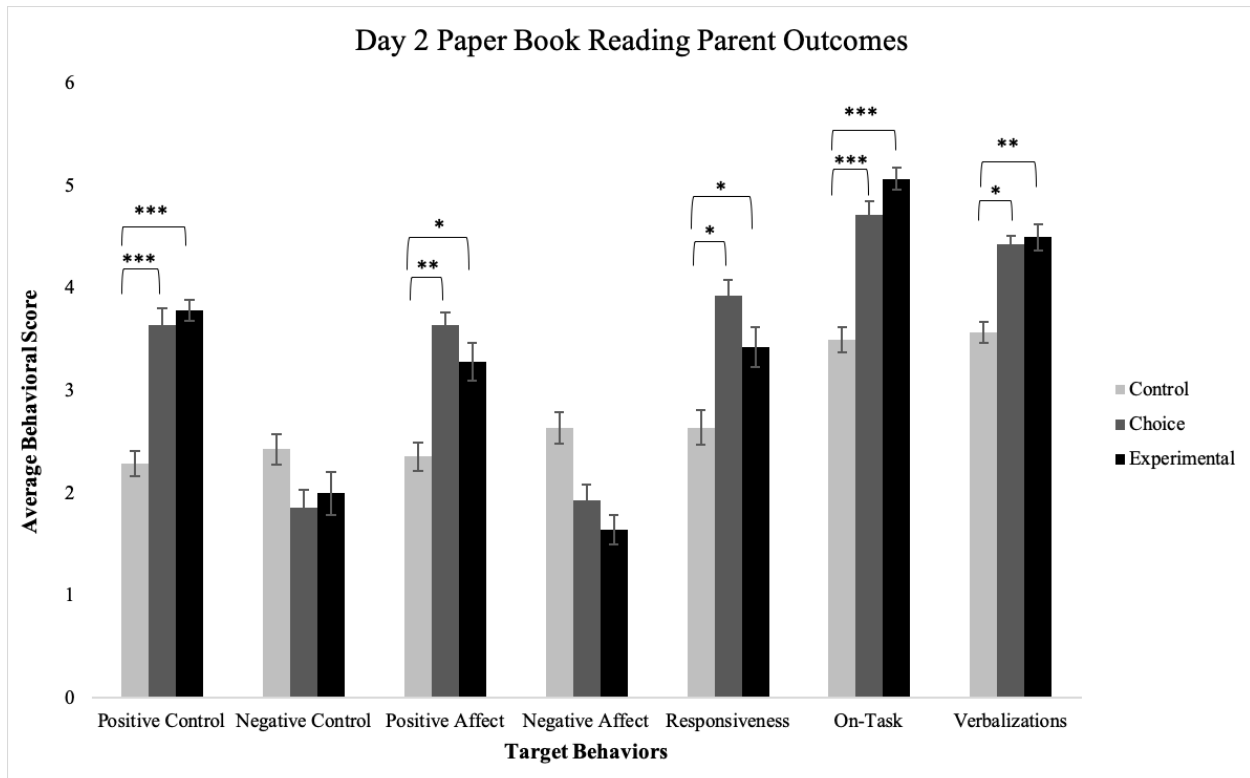*Figure 4*. Parent's second day paper book reading behavioral outcomes. *$p<.05$, **$p<.01$, ***$p<.001$. Error bars reflect standard error.

Post-hoc tests at the $\alpha = .008$ significance level indicated that children in the experimental group were significantly different from those in the control group on responsiveness and on-task behaviors. Those children in the choice condition were significantly different than those in the control group in responsiveness at the $\alpha = .05$ significance level. No differences were found between the experimental and control groups in these positive outcomes (see Figure 5).

In a MANOVA for children's negative affect and non-compliance outcomes, controlling for day 1 parental responsiveness, no significant effects emerged, Wilk's $\Lambda = .80$, $F(4, 74) = 2.18$, $p = .080$, $\eta^2 = .105$. A one-way ANOVA on children's verbalizations during this reading,

controlling for parental responsiveness on day 1, was significant, $F(3, 38) = 12.22$, p < .001, $\eta^2 =$ .491. In follow-up post-hoc analyses, no condition differences were found at the $\alpha = .008$ level, but the experimental and control, as well as choice and control, groups differed in child vocalizations during the paper book reading at the $\alpha = .05$ level (see Figure 5).
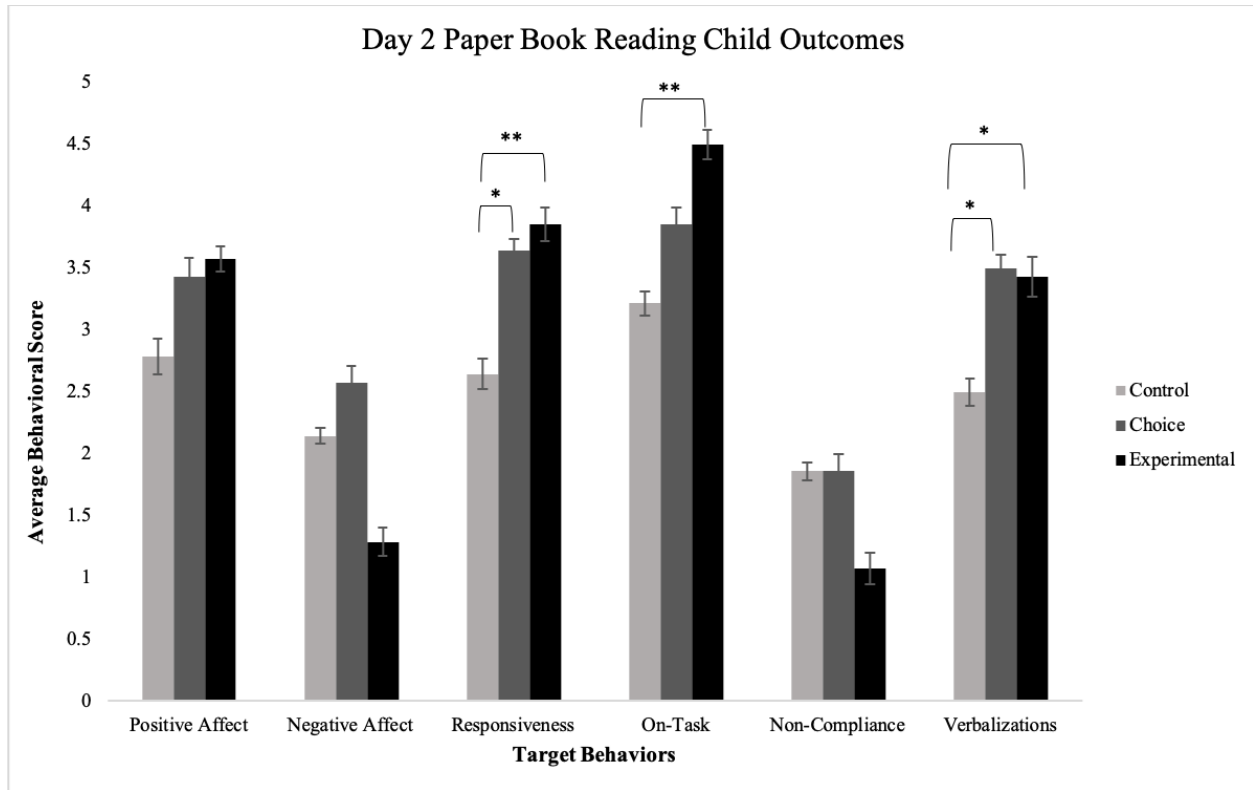
Figure 5. Children's second day paper book behavioral outcomes. *p<.05, **p<.01. Error bars reflect standard error.

Dyadic Behaviors. A significant effect of condition was found for positive dyadic codes during this reading in a MANOVA controlling for parental responsiveness on day 1, Wilk's $\Lambda =$ .61, $F(4, 74) = 5.22$, $p = .001$, $\eta^2 = .220$. Follow-up ANOVAs with a Bonferroni adjustment revealed a significant effect of condition on reciprocity, $F(2, 38) = 9.04$, $p = .001$, $\eta^2 = .322$. An effect of condition was not found for cooperation at the $\alpha = .025$ significance level, but was found at the .05 level, $F(2, 38) = 3.26$, $p = .049$, $\eta^2 = .147$. In post hoc pairwise analyses of

reciprocity ($\alpha = .008$), dyads in both the experimental and choice groups showed higher levels of reciprocity compared to those in the control group (see Figure 6), and there were no differences between reciprocity in the experimental and choice groups. Finally, when controlling for parental responsiveness on day 1, a univariate ANOVA on conflict approached significance, $F(3, 38) = 1.57$, $p = .212$, $\eta^2 = .110$.
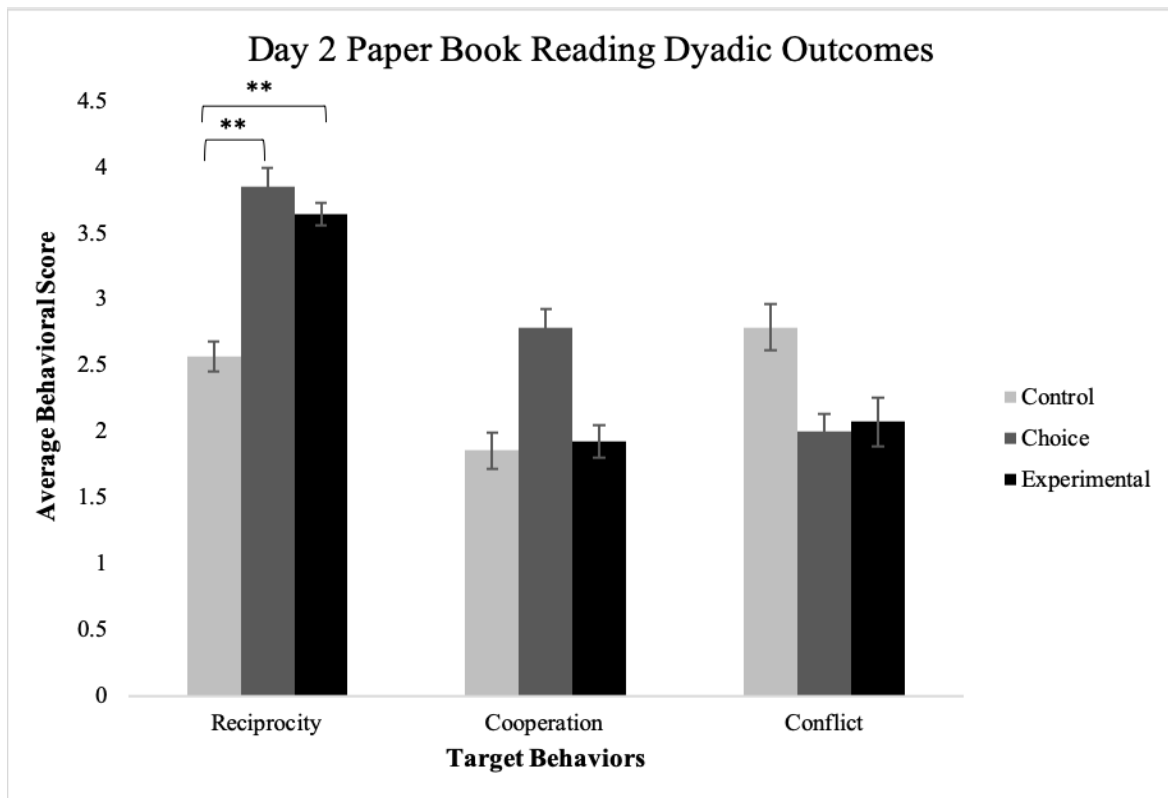
Figure 6. Dyadic second day paper book reading behavioral outcomes. **$p<.01$. Error bars reflect standard error.

Change Across the Three Readings within Condition

Three between-subjects multiple analyses of variance for the three conditions with reading (day 1 print book, day 2 eBook, day 2 print book) as the between groups factor were conducted to see if particular behaviors increased for the parent, child, and dyad across readings.

Experimental Parents. A one-way MANOVA was run for experimental group parents on the positive behavioral outcomes, controlling for day 1 parental responsiveness, across the three readings. The results showed a significant effect of reading, Wilk's $\Lambda = .42$, $F(8, 70) = 4.68$, p < .001, $\eta^2 = .349$. Subsequent follow-up ANOVAs were conducted to see if differences emerged between readings. Using the Bonferroni adjustment, each ANOVA was tested at the $\alpha = .025$ significance level. Results showed a significant effect of reading on positive control, $F(2, 38) = 19.01$, p < .001, $\eta^2 = .500$, responsiveness toward the child, $F(2, 38) = 7.42$, $p = .002$, $\eta^2 = .281$, and remaining on-task, $F(2, 38) = 11.25$, p < .001, $\eta^2 = .372$. Positive affect, however, did not see an effect of reading emerge, $F(2, 38) = 2.36$, $p = .108$, $\eta^2 = .110$. Post hoc pairwise comparisons (tested at $\alpha = .008$) revealed significant differences in positive control and on-task behaviors during both second day readings compared to the first day reading. The second day eBook reading was significantly different from x at this alpha level in responsiveness. At the $\alpha = .05$ significance level, the second day paper book reading did show differences in responsiveness, as well. No differences between the two second day readings were found for these outcomes (see Figure 7).

In a MANOVA controlling for day 1 parental responsiveness, no significant effect of reading was found for negative parenting outcomes, Wilk's $\Lambda = .94$, $F(4, 74) = 0.55$, $p = .700$, $\eta^2 = .029$. For parent verbalizations during these readings, a univariate analysis of variance found a significant effect of reading, $F(3, 38) = 4.55$, $p = .008$, $\eta^2 = .264$. Post-hoc tests were run at the $\alpha = .008$ significance level. Differences were shown in the number of parent verbalizations only between the second day eBook reading and the first day paper book reading. No differences were found between the day 2 paper book reading and the other two readings (see Figure 7).
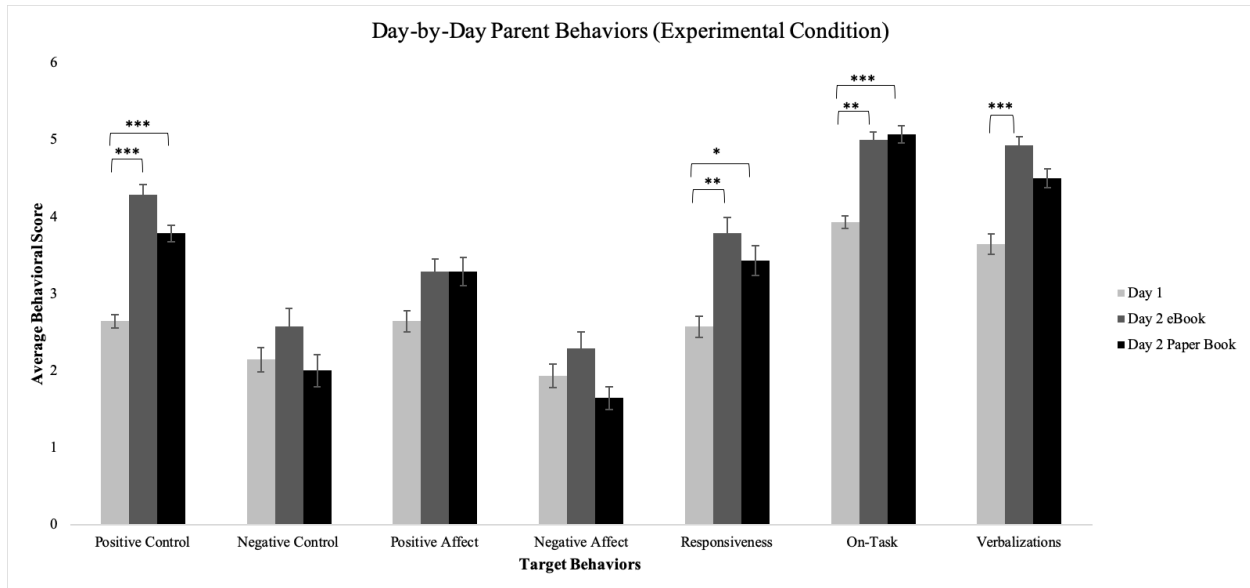
Figure 7. Experimental condition parent behavioral outcomes by reading. *p<.05, **p<.01, ***p<.001. Error bars reflect standard error.

Experimental Children. A MANOVA was run, across the three readings, for the experimental children's positive affect, responsiveness, and on-task behavior, with parental day 1 responsiveness controlled for. The results showed a significant effect of reading, Wilk's Λ = .64, $F(6, 72)$ = 2.96, p = .012, η^2 = .198. Additional analyses were run to see differences between readings. Using the Bonferroni method, the ANOVAs were tested at the α = .025 significance level. Positive affect showed significant differences, $F(2, 38)$ = 4.74, p = .015, η^2 = .199, as did on-task behaviors, $F(2, 38)$ = 6.09, p = .005, η^2 = .243. Post-hoc tests at α = .008 revealed that there was a significant difference between the day 1 reading and day 2 paper book reading for on-task behavior. At α = .05, differences emerged between the second day paper reading and the initial reading on positive affect, as well differences between the second day eBook reading and the initial reading on the two aforementioned behaviors (see Figure 10).

An additional MANOVA was run for children's negative behavioral outcomes. Controlling for the chosen covariate, no effect of reading was found, Wilk's Λ = .85, $F(4, 74)$ =

1.52, $p = .206$, $\eta^2 = .076$. Finally, for child verbalizations during these readings, a univariate analysis of variance found a significant effect of reading, $F(2, 38) = 4.416$, $p = .023$, $\eta^2 = .180$. Follow-up tests at the at $\alpha = .008$ found no significant differences between the three readings. However, at the at the $\alpha = .05$ significance level, the day 2 paper book reading saw more child verbalizations than the day 1 paper book reading (see Figure 8).
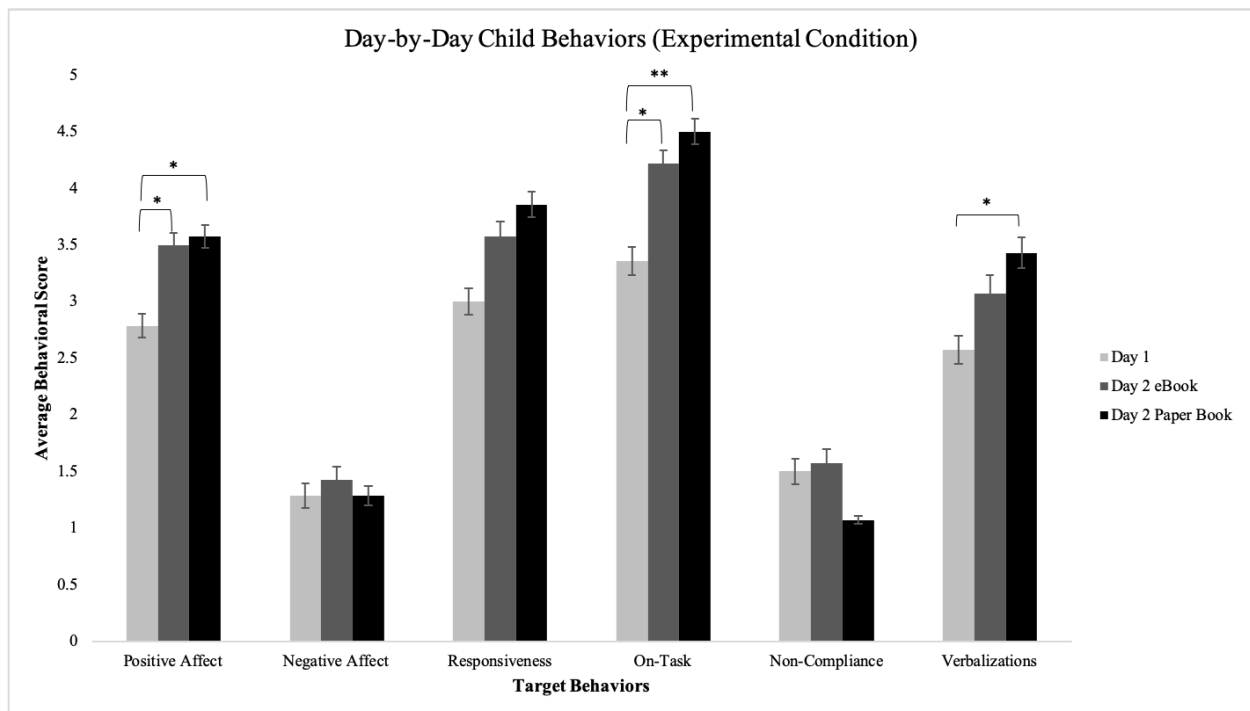
Figure 8. Experimental condition child behavioral outcomes by reading. *$p<.05$, **$p<.01$. Error bars reflect standard error.

Experimental Dyads. Experimental group reciprocity and cooperation were analyzed with a MANOVA, controlling for the day 1 parental responsiveness. Significant effect of reading were found on these behaviors, Wilk's $\Lambda = .61$, $F(4, 74) = 5.16$, $p = .001$, $\eta^2 = .218$. Follow-up analyses at $\alpha = .025$ were performed, showing a significant difference between readings for reciprocity $F(2, 38) = 10.57$, $p < .001$, $\eta^2 = .357$. Cooperation approached significance, $F(2, 38) = 3.11$, $p = .056$, $\eta^2 = .141$. A post-hoc test for reciprocity at $\alpha = .008$ showed significant

differences between the second day eBook reading and the initial lab reading, as well as the second day paper book reading and the initial lab reading. Lastly, a univariate ANOVA was performed on the negative dyadic outcome of conflict, controlling for parental responsiveness on day 1. No effect of reading was found, $F(2, 38) = 0.10$, $p = .909$, $\eta^2 = .005$ (see Figure 9).
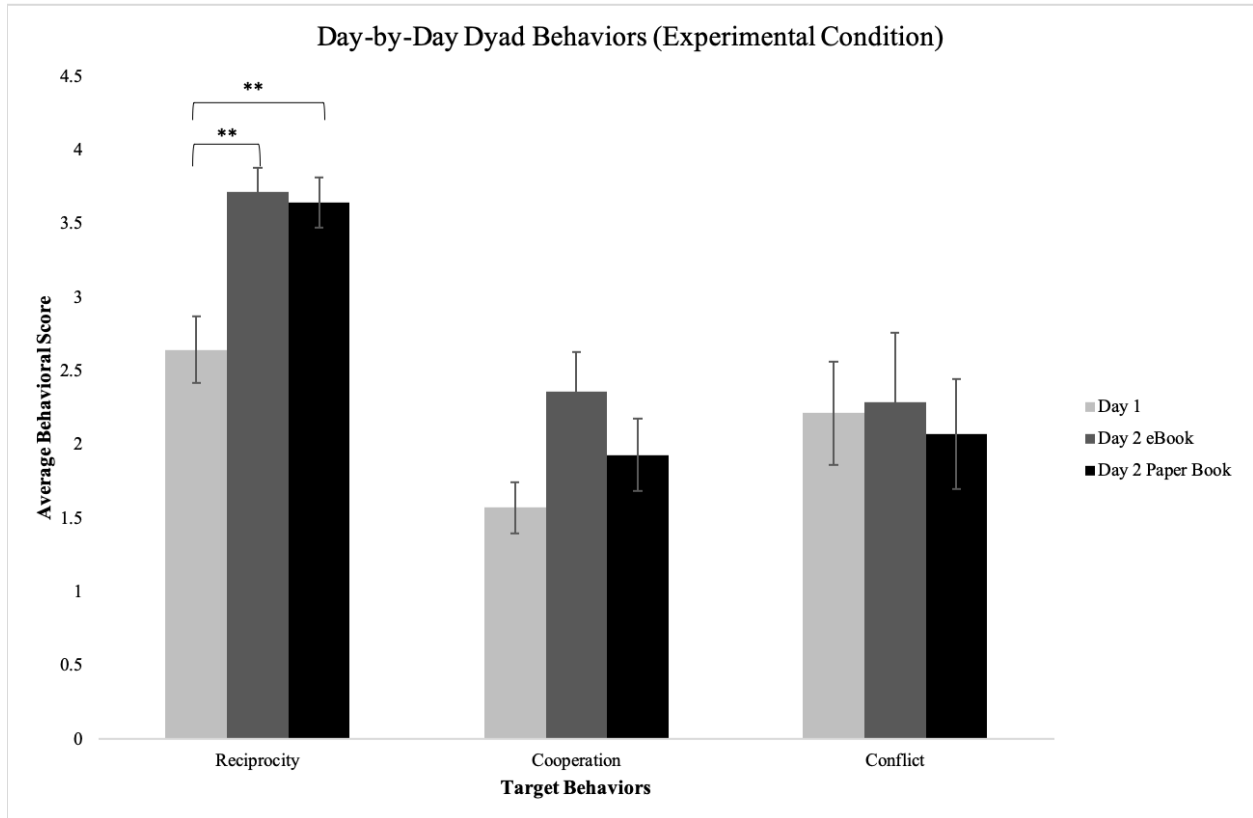
Figure 9. Experimental condition dyadic behavioral outcomes by reading. **$p<.01$. Error bars reflect standard error.

Choice. Using the same method as experimental families, results showed there was a significant effect of reading for parent behaviors, Wilk's $\Lambda = .63$, $F(8, 70) = 2.25$, $p = .034$, $\eta^2 = .204$. Follow-up ANOVAs with Bonferroni correction ($\alpha = .025$) revealed a significant effect of reading only on responsiveness, $F(2, 38) = 8.04$, $p = .001$, $\eta^2 = .297$. In a post hoc analysis for parent responsiveness ($\alpha = .008$), only the day 2 paper book reading was significantly different from the initial lab visit reading, and no differences were found between the second day readings. No significant effect emerged in a one-way MANOVA for negative control or affect, once again controlling for day 1 parental responsiveness, Wilk's $\Lambda = .97$, $F(4, 74) = 0.25$, $p = .909$, $\eta^2 = .013$. Also, in a univariate ANOVA, parents did not differ in their verbalizations between readings, $F(2, 38) = 2.40$, $p = .105$, $\eta^2 = .112$ (see Figure 10).
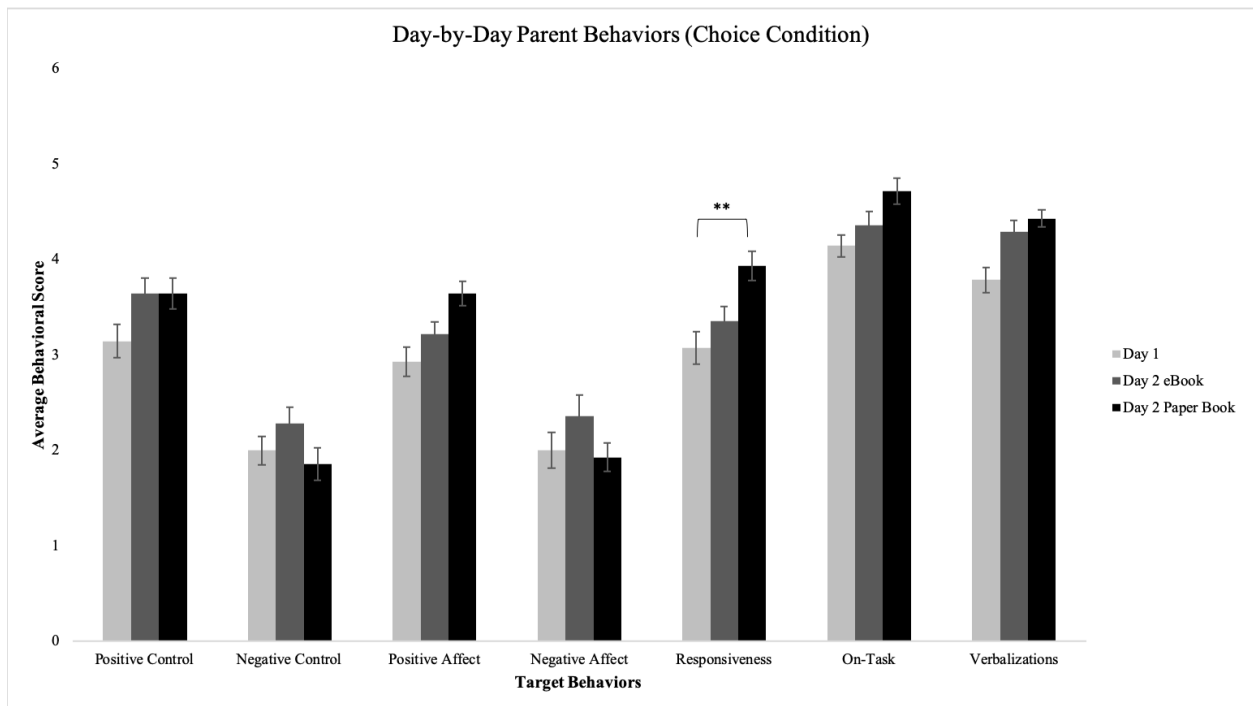

Figure 10. Choice condition parent behavioral outcomes by reading. **p<.01. Error bars reflect standard error.

However, using the same analyses as above, no significant difference was found in child or dyadic behavioral outcomes across readings, controlling for day 1 parent responsiveness (see Table 3).

Table 3
Choice Child and Dyad One-Way MANOVA Results by Reading

	Wilk's Λ	*F*	*p*	η^2
Child				
Positive Behaviors[a]	.82	1.27	.283	.096
Negative Behaviors[b]	.88	1.24	.302	.063
Verbalizations		1.12	.336	.056
Dyad				
Positive Behaviors[c]	.80	2.15	.083	.104
Conflict		1.00	.404	.073

Notes. [a]Positive Affect, Responsiveness, & On Task, [b]Negative Affect & Non-Compliance, [c]Reciprocity & Cooperation.

Control. Finally, using the same analyses as above, no effect of reading was found for any behavioral outcomes for the parent, child or dyad. All control parent, child and dyadic behavioral means by reading are found in Table 4.

Table 4
Control Group One-Way MANOVA Results by Reading

	Wilk's Λ	*F*	*p*	η^2
Parent				
Positive Behaviors[a]	.87	0.62	.755	.067
Negative Behaviors[b]	.85	1.52	.204	.076
Verbalizations		1.33	.278	.257
Child				
Positive Behaviors[c]	.92	0.53	.782	.043
Negative Behaviors[d]	.88	1.18	.327	.060
Verbalizations		0.79	.459	.040
Dyad				
Positive Behaviors[e]	.98	0.17	.952	.009
Conflict		0.88	.459	.065

Notes. [a]Positive Control, Positive Affect, Responsiveness, & On Task, [b]Negative Control & Negative Affect, [c]Positive Affect, Responsiveness, & On Task, [d]Negative Affect & Non-Compliance, [e]Reciprocity & Cooperation.

Discussion

The experimental eBook was created to help promote shared conversation when parents and children read together. Previous research has shown that the eBook achieves this result (Strouse et al., *in prep*; Troseth et al., 2019). I predicted that being exposed to a model of dialogic reading might positively influence other behaviors of the parent and child. The current study demonstrated increases in parent, child, and dyadic positive behavior as an additional benefit of this new eBook, without the need to explicitly teach beneficial parenting behaviors. Families who had any amount of exposure to the dialogic questioner, Ramone, over the two weeks of the study engaged in higher levels of some crucial behaviors that have been shown to improve child developmental outcomes. Furthermore, significant differences in positive behaviors emerged between those dyads who had used Ramone in any capacity (either throughout the two weeks in the experimental condition, or for part of the weeks in the choice condition) and those who used the control version of the eBook and, therefore were not exposed to Ramone's example of prompting conversation with children.

Initial Family Behaviors

During the initial visit, parents exhibited no differences across condition in any of the parenting behaviors while reading a print book. Parents were told to read and interact around this paper book as if they were at home. Most parent behaviors were evaluated as being relatively neutral on the rating scale during this initial reading: families did not strongly exhibit any of the target behaviors and progressed through the book with little to no interaction or strong affect, (positive or otherwise). Although the participating parents may have viewed shared reading experiences as important learning opportunities, they initially did not frequently interact with

their child in ways that have been shown to produce positive learning and literacy outcomes. Thus, the parents in the current research were similar to those surveyed previously, who often overestimated the time they spent reading with their child and entertained self-beliefs that they were interacting in quality ways during shared reading (DeBaryshe, 1995; Mol & Bus, 2011).

As expected, no major condition effects were found in the initial reading for children's positive behavior or for dyadic behaviors. However, an important finding worthy of future consideration is that parental responsiveness had a significant effect on child verbalizations from the start of the study. In future research, I will examine the impact of parental responsiveness on child language and literacy outcomes.

Evaluating Condition Differences in Parent Behaviors Two Weeks Later

Following exposure to the eBook with or without Ramone, major condition differences emerged in parenting behaviors. As hypothesized, parents who were exposed to Ramone's example of dialogic reading in both the choice and experimental condition used significantly more positive control when reading with their child on their final lab visit, compared to parents in the control group, and this was particularly true for parents in the experimental condition. The pattern of more positive parenting behaviors was found when families read another *Peg + Cat* eBook, and when they went on to read a paper book on a completely different topic.

After experiencing Ramone's example, parents used important dialogic techniques such as asking open-ended questions and offering explanations and praise The current results extended previous research that showed increases in similar types of talking when using *The Big Dog Problem* experimental eBook with Ramone (Troseth et al., 2019), as well as research on

video that incorporated a dialogic questioner (Strouse et al, 2013). Of note, parents generalized using these dialogic skills with new story content and book formats.

Further, experience with the helpful Ramone character's example appeared to change the way parents used an electronic book, compared to the typical parent reaction: in earlier research, parents were not nearly as interactive or enthusiastic when using electronic books with their children compared to print book, nor excited about using media in general (Krcmar & Cingel, 2014; Lavigne, Hanson, & Anderson, 2015). Despite parents' preconceived notions and attitudes around eBook reading and media use, exposure to this enhanced eBook in any capacity led to more of these language-promoting parenting behaviors during new reading sessions.

Parents differed in positive affect based on condition. In the follow-up analyses, this finding only reached significance during the second day paper book reading, but not while reading the novel Election Problem eBook. This eBook was not altered from the original appearing on the PBS Kids website, and it contained some hotpots and other distracting features. As shown in previous literature, this could have impacted how much parents enjoyed the experience and showed positive affect toward their child (Richter & Courage, 2017; Takacs et al., 2015). Additionally, the eBook dealt with a relatively complex theme and vocabulary for this age group (the concept of voting, counting totals, and comparison). For this reason, parents may have engaged in more positive affect behaviors for *The Bear Snores On* (Wilson, 2002), a simple rhyming book appearing in paper format.

Parents who were exposed to Ramone over the two weeks tended to be on task significantly more during the day 2 readings, regardless of the format of the new book they were given to read. Often parents worry about children's attentiveness and behavior when they are interacting with media and technology (Strouse, Newland, & Mourlam, 2019). The parents who

were far less engaged and engaging with their child while reading the new books were those who had used the control eBook over the two week period, compared to parents who had used the eBook with Ramone. Without any form of assistance, parents continued their relatively uninvolved method of reading and interaction when reading eBooks with their child (Korat & Or, 2011). In contrast, and as previous research has shown, having a character who suggested ways to interact fostered a more engaging experience for the parent and child. It is encouraging that there was significantly more talk during both second day readings from the families who were exposed to the enhanced eBook in comparison to those who were not (Bus & Neuman, 2009; Higgins & Cocks, 1999; Troseth et al, 2019).

One intriguing difference between the two condition groups exposed to Ramone (the experimental and choice groups) was in parental responsiveness. During the day 2 eBook reading, only the parents who were consistently exposed to Ramone for the two weeks (in the experimental condition) were significantly more responsive than the control group. Both groups were more responsive than the control group parents during the second day paper book reading. It is possible that parents who read the eBook with Ramone for over two weeks were given more training in the crucial behavior of responsiveness, compared to those parents in the choice condition who could switch between the versions with and without Ramone. The amount parents and children chose to use Ramone is an important factor to evaluate in future research, as dosage of exposure may influence parenting outcomes. However, it is very promising that parents in the experimental group exhibited more of the important parenting behavior of responsiveness across both of the second day readings.

No condition differences were found in parents' use of negative control or expression of negative affect when reading with their child. This goes against my initial prediction of increases

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in negative behaviors during the second lab visit readings. Parents in the control group did use slightly more of these tactics during the second day paper book reading. In previous research, children chose and enjoyed digital media more often than print (Strouse, Newland, & Mourlam, 2019; Vaala & Takeuichi, 2012). In the current research, children in the control condition may have been relatively more attentive to the day 2 eBook compared to the print book, requiring less negative parental control. Furthermore, as the print book was read immediately after the novel eBook, it is possible that these behaviors were needed to maintain children's focus as they became tired. Future research will be needed to see if this prediction can be supported. However, parents who had learned the style of interactive reading fostered by Ramone's example appeared to remain positive and keep children's attention throughout the session.

Children's Behavior on Day 2

Children in the choice and experimental conditions were higher than the control group across all of the outcomes during the second eBook reading, but only the number of verbalizations was significantly higher. Increased verbalizations (compared to the control group) also occurred in the second day paper book reading. The changes in parents' behavior in the experimental and choice conditions, in comparison to the control group, very likely promoted the increased amount of talk from the children. Condition differences in amount of talk while reading the eBook with Ramone's example has been seen in previous research (Strouse et al., *in prep*; Troseth et al., 2019). In the current research, the fact that differences were found in children's verbalizations while reading a new story with parents that did not include Ramone's example, as well as while reading in a new (print) format, indicates that modeling dialogic reading for parents has the effect of increasing children's talk beyond use of the training book.

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While reading the new print book with their parent on the second day, children whose parents were exposed to Ramone were more responsive than children in the control group. Research has shown that when parents are responsive to their child while reading, the child responds in kind (Fletcher & Reese, 2005; Landry et al., 2011). Children in the experimental condition were also more on task and engaged during the paper book reading compared to children in the control group. Children in the choice condition also showed more on-task behaviors, as well.

One puzzling aspect of the data was that children in the choice condition showed somewhat (although not significantly) higher levels of negative affect and non-compliance than those in the experimental group--levels that were comparable to those in the control group. Possibly, giving children in the choice condition more agency over the two weeks to pick which version of the story on the tablet they wanted to read (with or without Ramone, and with simpler or harder prompts) might have raised an expectation of continuing to get a choice when reading a new eBook on a tablet. When given new materials, children in the choice condition may have been disappointed that they did not get to read the tablet-based story they were so used to. In future research, aspects of the choice condition that might lead to this kind of difference could be tested.

Dyadic Behaviors after Prolonged eBook Use

Families who used the eBook with Ramone across the two weeks showed higher levels of reciprocity during the second lab visit readings. Specifically, the experimental families were much more reciprocal in their interaction during the second day eBook reading compared to families in the control group. Families in the choice condition were higher in reciprocity than

those in the control group during the eBook reading, but the difference was not significant. However, both experimental and choice families were significantly more reciprocal during the second day paper book reading, compared to those in the control group. Given the increases in individual positive behaviors for children and parents who experienced Ramone's example, it is likely that these increases led to more shared positive behaviors, as well (Moilanen, Rasmussen, & Padilla-Walker, 2015; Spera, 2005).

Interestingly, there were no significant condition differences in the dimension of cooperativeness. Thus, while the overall interaction during the second day readings may have been more reciprocal for experimental and choice families, parents and children did not necessarily work together to figure out problems in the book and come to a mutual agreement more often. This is likely due to Ramone mostly trying to help parents engage their children in conversation, rather than get them to cooperate with one another in order to come to mutual agreement during this task (Troseth et al., 2019). This child-centered approach is common in dialogic reading and, thus, might not have been called for when using this method and this eBook (Opel, Ameer, & Aboud, 2009; Whitehurst et al., 1988).

Children in the choice condition did show somewhat higher levels of cooperativeness in both second day readings when compared to the control group families, despite a lack of significant condition differences. The cooperative nature inherent in families choosing which book to read could have led to some small effects when parents and children in this condition read together. Finally, no effects were found in levels of conflict while reading. Based on the child outcomes during the second day eBook reading, we were not surprised, however, to see more conflict in the choice condition when compared to the other two groups. Once again, future research should look at the influence of the child's level of agency or autonomy to determine

whether the choice condition may lead to more rebellious behaviors towards the parent (Mol & Bus, 2011; Wasik, Hindman, & Snell, 2016)

Did the eBook Help Families Change?

Looking at the within group analyses, families did grow in certain dimensions over the two weeks. Most impressively, the experimental families grew in multiple dimensions, most of which were as hypothesized at the beginning of the study. Parents ended up using significantly more positive control in their behaviors towards their child in both the new eBook and new print book readings, as compared to their initial visit. Additionally, parents grew in their showing of responsiveness and keeping on task, during both of the readings. Parent verbalizations were only significantly different between the second day eBook readings and their initial day 1 reading. Their second day paper book reading was still more than their first, albeit not significantly. It is clear that, even without being explicitly taught to engage in these behaviors, parents were taking in the interaction style that they picked up from their time with the enhanced eBook, and transferred it to some new content and a new format. This has major implications for learning outcomes: if parents realize they can make the shared reading interaction more positive by using this kind of eBook, many of the positive outcomes that come from warm, responsive parenting could be gained using this kind of technology (Leigh, Nievar, & Nathans, 2011; Landry et al., 2011).

Child and dyadic behaviors also saw increases in the experimental condition, though on less dimensions than parents. Children significantly increased in their use of positive affect, as well as their on-task behaviors during the second day readings as compared to the initial lab reading. As parent and children's relationships are bidirectional, it is difficult to tell whether one caused the other, or if both contributed an equal part to these outcomes (Lengua & Kovacs, 2005;

Holden, 2015). Finally, the experimental group showed overall growth in reciprocity when comparing the two second day readings to the initial lab visit reading. By the nature of dialogic reading, this result was the most expected, as the method primarily consists of trying to promote a back-and-forth, or reciprocal, experience around reading (Whitehurst, Epstein, et al., 1994). Neither cooperation nor decrease in conflict significantly changed across the three readings for the experimental families. This goes against the initial hypothesis around cooperation, and leads to more questions about ways in which an enhanced eBook like the one used in this study may be adapted to suit this behavioral outcome. However, in the current study, this eBook may not have been wholly appropriate for the dialogic reading situation.

The choice condition families did show some minor changes, though the majority of the outcomes were not significantly different across readings. While child and dyad-based behavior, such as positive affect and reciprocity, did increase between day 1 and day 2, the differences did not end up significant. Significant differences may emerge in analysis of data from the full number of participants. However, there was some growth for parents in the choice condition. Parents showed increases in most positive outcomes, though the majority of changes were nonsignificant. Responsiveness, however, did increase between the first print book reading and the second print book reading. After having been exposed to Ramone in some capacity, parents were able to improve their responsiveness when reading a new print book. Parental responsiveness with the eBook may have been less due to the fact that the choice condition allowed families to choose how much exposure to Ramone they wanted. If parents found Ramone annoying or unnecessary, they may not have gotten the amount of experience with an example of responsiveness to transfer this practice to reading a new eBook story.

As expected, no change occurred for any of the outcomes in the control families. Furthermore, on some dimensions, control families even decreased in their scores. It seems as though, based on this sample, parents and children may not interact as much as they think without any form of assistance. If families do not engage in some of the positive target outcomes evaluated in this study while reading as they normally would, many of the developmental benefits of shared reading could not emerge (Landry et al., 2001; Tamis-LeMonda et al., 2009; Troseth et al., 2019). Unsurprisingly, the outcomes were most similar in the control condition for the first visit and second visit print book readings. It is possible that, without any assistance, families will continue to engage in low-levels of behavioral interaction when reading paper books, and less so when reading eBooks.

Limitations

Uniformity of the sample. This study used a relatively uniform sample, which may impact the ability to replicate the results with different families. The sample primarily identified their child as Caucasian (95%), and the majority of families (79%) target parent reported they received a 4-year degree or higher. While this certainly allowed for the groups to be comparable at a demographic level, it likely impacts the generalizability of the results found in the current study. While previous research on this eBook has demonstrated that families from a more diverse socioeconomic and racial background saw just as much success in terms of parent-child conversational quality outcomes as their higher income counterparts, no similar kinds of parent and child behavior coding were done with this other sample (Strouse et al., *in prep*; Troseth et al., 2019). Thus, it is difficult to say whether families who come from a more diverse background would see similar behavioral changes when using this experimental eBook.

Furthermore, there is more uncertainty as to whether more warm and responsive parenting behaviors are always necessary to produce positive developmental outcomes. In samples of Chinese and Chinese-American families, parents who had high demands and expectations,, specifically with regard to academic performance, did not produce the same negative outcomes in their children, in comparison to Caucasian families (Chao, 1994). In a similar study, while warm and sensitive parenting has been shown to be significantly linked with academic achievement for Caucasian families, no strong relationship was found for Asian, Black, or Hispanic families (Dornbusch et al., 1987). In addition, these results have been confirmed in other studies with other age groups, as well (Pinquart & Kauser, 2018; Roche, Ensminger, & Cherlin, 2007). Thus, the effect of this experimental, dialogic eBook may have differed had the study included a more diverse sample of families. Future research should include a more diverse population of participants, to clarify whether this eBook could change families' behaviors during shared reading. Furthermore, it would give insight into whether these kinds of changes are necessary to produce a more productive and engaging shared reading interaction for both the parent and child.

Theory of Mind and Emotion Recognition. No coding was done on some crucial socioemotional skills that are important in development. Specifically, no data was collected around children's ability to put themselves into the mentality of characters in the stories they read. The parent's behavior encouraging this type conversation and understanding was not looked at either. Ramone did touch on some small emotion recognition-type prompts, but no specific codes looking at the behaviors that parents can use to promote this kind of thinking were evaluated. As these kinds of behaviors only become more important as children progress through development, it would be important in future research to look into these more complex

socioemotional behaviors to see if enhanced eBook technology with a helpful character could lead to increases in these dimensions.

Study duration. This study, while certainly longer than previous research using this enhanced eBook, only occurred over the course of two weeks, and no follow-ups were done. The researcher is unable to conclude whether or not the outcomes extended beyond two weeks. Even more prolonged use of the enhanced eBook should certainly be evaluated, as well as additional follow-up appointments after initial exposure to see if families continue to exhibit positive behavioral outcomes.

Future Directions

More work can be done in this intersection of research on parent and child behaviors and the impact of digital media. One area that has yet to be explored with this new technology is the level of interaction with a dialogic model, that is needed to produce increases in positive behaviors, such as responsiveness and positive affect. In the current study, there was no way to adjust how much Ramone popped up throughout the story. For families in the experimental condition, he appeared on every page for the first week, and on a majority of pages for the second week. Families in the choice condition had more freedom, but they still only had the enhanced book options of Ramone on every page, Ramone on 7 out of 12 pages, or no Ramone at all . An important future question is how much of the dialogic model is needed on every reading to most helpfully promote rich parent-child interaction. In future research, an eBook programed with multiple levels of dialogic character incorporation should be evaluated for its effect on behavioral and conversational outcomes.

Additionally, future research should look into whether incorporating more socioemotional based prompts could lead to even more increases in positive parent, child, and dyadic behaviors. Ramone's questions were based on the dialogic reading method, and incorporated a variety of different kinds of prompts. Therefore, incorporating more specific kinds of prompts around target outcomes, such as positive parenting or child behaviors, may lead to new kinds of effects around this technology. Future research should consider incorporating different themes in the eBooks prompts.

Conclusion

After prolonged exposure to an enhanced, dialogic-based eBook, families showed increases in integral positive behavioral outcomes for both the parent and child. (i.e. reciprocity, positive control, responsiveness, etc.) Variations were found based on how much families were exposed to this new technology, which should inspire future research. Furthermore, families were not explicitly told to try and be warmer and more responsive while reading. While many parents may believe that use of digital media and technology does not foster more intimate and positive interactions, the current research shows that this new kind of technology can influence how parents and children read and interact together in critical ways. Thus, this eBook may serve as an integral tool in bringing families closer together while reading.

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Appendix A
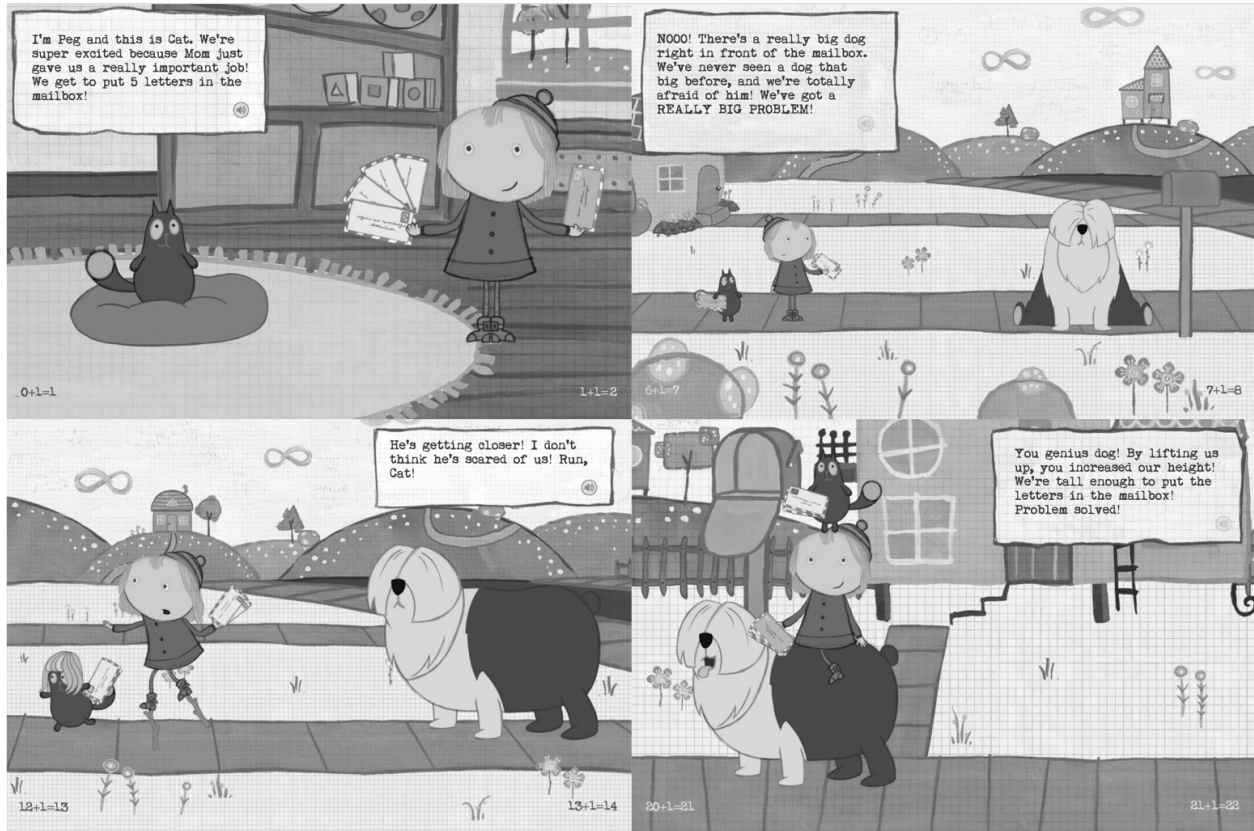
Example Pages from Control eBook

Figure A. Example pages from *The Big Dog Problem* eBook.
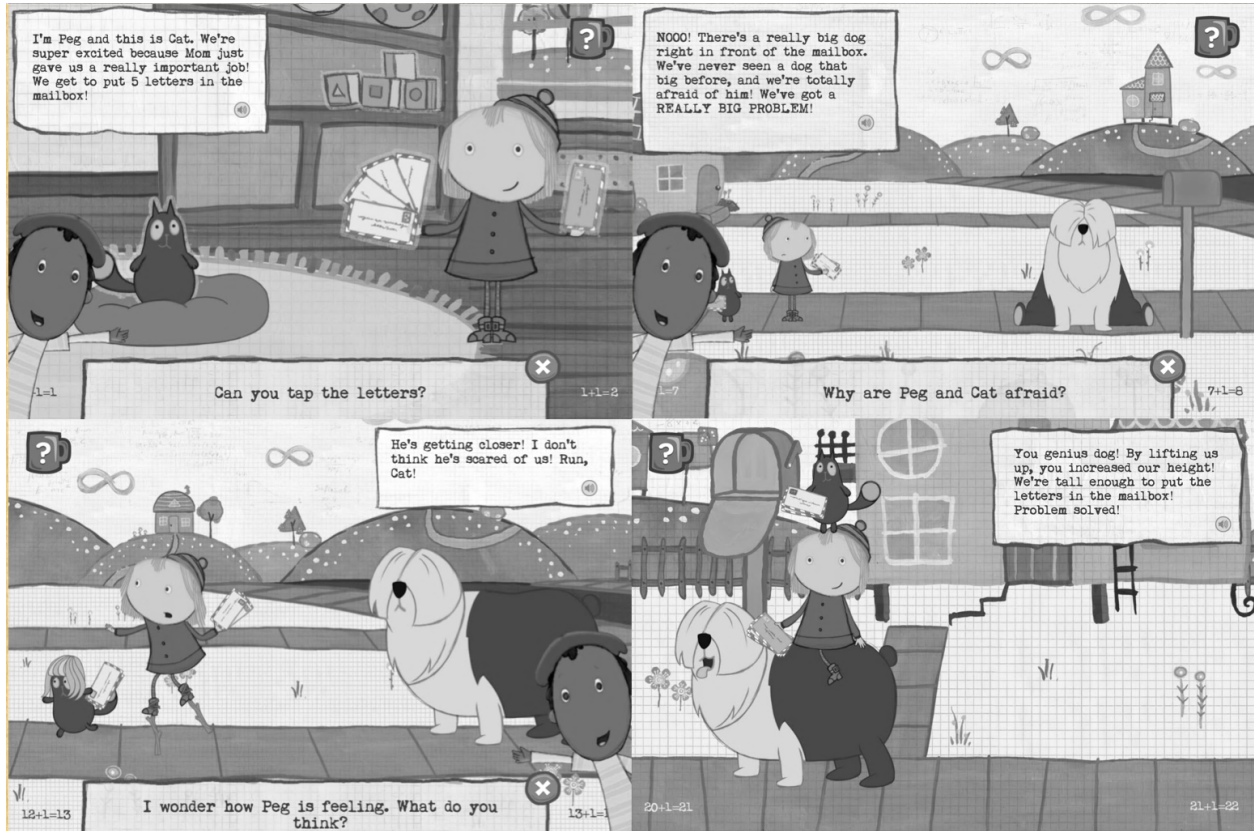
Example Pages from Experimental eBook

Figure B. Example pages from *The Big Dog Problem* experimental eBook with Ramone. The bottom right quadrant page is an example from the second version of the experimental eBook where Ramone does not appear automatically.