Value Added: Digital Modeling of Dialogic Questioning Promotes Positive Parenting During Shared Reading

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Abstract

American parents describe bonding with their child as a primary reason for engaging in shared picture book reading. One prominent reading intervention (dialogic reading) reliably increases language outcomes, but until recently, has not been evaluated for how well it promotes warm parent-child interactions. In this study, a digital application designed to promote parent-child conversation by modeling dialogic questioning also increased mutuality, positivity, and on-task behaviors. Three- and four-year-old American children (n = 73) and their parents were randomly assigned to read 10 times at home either: 1) an eBook with a character who modeled dialogic questioning (experimental); 2) a version of the same eBook without modeling (control); or 3) to choose between versions for each reading (choice). An adaption of the PARCHISY coding scheme was used to evaluate parent, child, and dyadic behaviors during in-lab readings at the beginning and end of the two-week home reading period. At the final visit, experimental group families showed significant growth in mutuality (i.e., responsiveness, reciprocity, and cooperation), on-task behaviors, and parent and child positivity, and displayed more of these behaviors than families not exposed to modeling. Some increases in mutuality and positivity also emerged in families in the choice condition, but fewer than in families who only read the eBook with modeling. Parents and children exhibited no significant changes in negativity in any condition. This study suggests that carefully designed digital technology has the potential to foster positive shared reading interactions between parents and young children.

Key words: dialogic reading, parent-child interaction, eBooks, digital media, parenting

Value Added: Digital Modeling of Dialogic Questioning Promotes

Positive Parenting During Shared Reading

Parent-child mutuality (shared responsiveness, reciprocity, and cooperation; Deater-Deckard & O'Connor, 2000) and positivity often play a crucial role in both socioemotional and cognitive development (Calkins et al., 1998; Mathis & Bierman, 2015; Pastorelli et al., 2016). For example, reciprocal mother-child relationships promote prosocial values and behaviors (Barry et al., 2008) and responsive, positive parenting in the early years is related to children's later use of emotion regulation and attention control (Calkins et al., 1998) and to language and literacy development (Landry et al., 2001; Leigh et al. 2011). Thus, activities that promote parent-child mutuality and parental positivity have the potential to positively impact children in multiple ways (Lengua & Kovacs, 2005).

For many American families, reading bedtime stories is a regular shared activity. One prominent reading intervention (*dialogic reading*) might increase parent-child mutuality, positivity, and on-task behavior by promoting discussion and focus on a shared goal, with both parties contributing and having a voice (Zevenbergen & Whitehurst, 2003). Dialogic reading reliably increases language outcomes, but only recently has been evaluated for its effect on the quality of parent-child interactions. The current study explores whether exposing parents and children to models of dialogic questioning by means of an electronic book (eBook) promotes positive, mutual, parent-child interactions.

Parenting Behaviors and Development

Many different constructs have been included in studies of positive parent-child interactions. Across cultures, mutuality, positivity, and responsiveness are associated with positive developmental outcomes in childhood and adolescence, such as increased prosocial

behavior (Ensor et al., 2011), lower levels of peer aggression (Kawabata et al., 2011), greater pre-academic skills (Wade et al., 2018), and better self-regulation (Grolnick, 2009). In contrast, the use of constant control, expecting high levels of obedience, and high parental frustration often have a detrimental impact (Ganiban et al., 2011; Grolnick, 2009). Parents who use more harsh directives tend not to provide rationales or use reasoning with their children, behaviors that increase closeness and emotion regulation (Calkins et al., 1998). In addition, a lack of needed parental responsiveness can impair children's future willingness to cooperate and interact with their parent (Landry et al., 2001).

Parenting and Shared Reading

Many parents describe bonding with children as an important goal of shared reading (Audet et al., 2008; Nowak & Evans, 2013; Preece & Levy, 2018; Swain et al., 2017). In one survey, parents viewed shared reading as an opportunity to promote enjoyment of reading, soothe an upset child, and increase parent-child closeness (Audet et al., 2008). Parents described fun back-and-forth interactions promoting bonding (Preece & Levy, 2018) and reported reading with their children because they enjoyed it, wanted to reproduce positive experiences they had reading with their own parents, and because it helped them build a more intimate relationship with their child (Swain et al., 2017).

Although all the potential "positive collateral effects" of shared reading (Canfield et al., 2020, p. 1305) are still to be discovered, evidence of the relation between shared reading and more general parenting quality has recently emerged. In a secondary analysis of data from the Fragile Families and Child Wellbeing Study (large cities; births to unmarried mothers oversampled), shared reading in infancy predicted better child behavior at age 3 and less harsh parenting when children were 5 (Jimenez et al., 2019). In another sample of low-income

families, shared book reading at 6 months was associated with increases in parental warmth and sensitivity at 18 months (Canfield et al., 2020). Therefore, promoting positive parent-child interactions during shared reading, characterized by mutuality, may have long-term benefits for the parent-child relationship.

For instance, dialogic reading interventions teach parents to use conversation prompts to get children expressing themselves (Zevenbergen & Whitehurst, 2003). Across repeated readings, adults are instructed to ask more challenging questions tailored to children's development and experience. Parents are also encouraged to provide responsive feedback to children and to model answers themselves, exposing children to advanced language. In essence, the aim of dialogic reading is to encourage families to have richer, higher quality mutual conversations while sharing focus on the story.

When parents engage in dialogic reading, children show gains on multiple language and literacy outcomes (Mol et al., 2008). These benefits are consistent across populations including English language learners (Brannon & Dauksas, 2014), children at risk for reading impairment (Hargrave & Sénéchal, 2000), and in Western and non-Western societies (Opel et al., 2009; Zevenbergen & Whitehurst, 2003). Parent training in dialogic reading can have a long-lasting impact on children's early literacy, as families still engage in the techniques up to two years later (Huebner & Payne, 2010).

The features that make dialogic reading effective in supporting literacy development may also enrich parent-child interactions. Responsive behavior while reading makes parents aware of their child's cognitive and linguistic abilities (and limitations), allowing them to optimize the reading experience (Bergman Deitcher & Johnson, 2015). Asking open-ended questions shows a parent's interest in their child. Engaging in reciprocal conversations might build cooperation as

parents consider their child's points of view and follow up on their comments. In turn, positive and responsive parents may have children who are more on task during reading and engage in more cooperative *mutuality-based* behaviors (e.g., Landry et al., 2011).

Initial evidence that dialogic reading training impacts some parenting outcomes has been reported. After an 8-week dialogic reading intervention, South African parents of 14- to 16-month-old infants improved in sensitivity, elaborations, and reciprocity while reading, compared to a control group (Murray, et al., 2016). In a study conducted in China, parents of 3- to 12-year-old children (identified as having relational problems with their parents) reported an improved parent-child relationship (parenting satisfaction; awareness of how to communicate with their child) following a 12-week dialogic reading intervention (Ganotice et al., 2017). However, effective in-person interventions such as this are labor-intensive and expensive, engendering calls to find alternative methods to promote the benefits of parent-child reading interactions (Cates et al., 2016; Hindman et al., 2016).

Potential Solution: Digital Media

The development of eBooks on tablets offers a portable, flexible platform for *modeling* dialogic reading prompts in context instead of explicitly teaching parents the strategies. However, parents often do not interact with their children with digital books in some of the positive ways they do with print books (Strouse & Ganea, 2017; Strouse et al., 2019). Rather than an opportunity to actively engage with their children, parents may view children's media use as solitary play time (Barkin et al., 2006) while parents catch up on other tasks (Nabi & Krcmar, 2016). When parents and children do use digital books together, the presence of hotspots and touch-based activities may create problems around who controls the eBook and hinder shared discussion of story content, especially when compared with non-interactive print

books (Munzer et al., 2019). Parents may not see the untapped potential in shared eBook reading to produce warm and productive interactions with their child.

To overcome these barriers, it is important that digital books are designed to foster positive parent-child interactions. Discussion prompts in an eBook offer the opportunity for parents and children to personalize the way they interact with the story (Kucirkova, 2018). Distracting eBook elements (hotspots and intrusive games) can be avoided (Krcmar & Cingel, 2014). Using an eBook could become a situation that fosters engagement, learning, and warm parent-child interaction.

Troseth and colleagues (2020) developed an eBook with an embedded character who modeled dialogic questioning. Parents and their 3-to-5-year old children talked more than 3 times as much as families who read the same eBook without the dialogic modeling, focused more of their conversation on the story, and asked their own questions using the modeled techniques. An open question is whether dialogic reading training also promotes parent-child mutuality and positive, on-task interactions that would generalize to reading interactions with other digital and print books.

The research reported here is part of a study in which families received prolonged exposure to the dialogic eBook originally used by Troseth and colleagues (2020) or a control version without modeling over two weeks at home. An additional group of families had a choice on each reading whether to use the eBook with or without modeling. This condition was included to examine whether families would choose to use the modeler and whether variable exposure to the modeler would impact their interactions. We predicted that exposure to the dialogic eBook would provoke more positive, mutual, story-focused (on-task) parent and child behaviors during subsequent shared reading interactions, and that families who consistently used the eBook with

the modeler would have larger increases than families who had a choice to use (or were assigned to use) the eBook without modeling.

Methods

Participants

Participants were 75 children 3.02 to 4.99 years old (M = 3.91 years, SD = .50), 40 from a southern US city and 34 from small towns in the US Midwest, each with a parent (68 female). Families were recruited from state birth records, child care centers, preschools, flyers posted in the community and online, and from local community events. Children did not have significant developmental delays and were learning English as their primary language. Parents identified children as European American (85%), African American (1%), Hispanic (1%), or belonging to multiple racial categories (11%). Over 70% of families had an annual household income of $75,000 or more. All parents had attended some college; the majority (84%) had a bachelor's degree or higher. Supplemental Table A shows demographic information by condition.

The analyses reported here address secondary hypotheses planned prior to data collection. The study was not preregistered. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. Our target sample size of 25 families per condition was calculated to power a primary hypothesis about parent language (based on Troseth and colleagues, 2020; Power .86 for ANOVA, η^2 = .4). We collected data from 5 participants beyond the planned 75 to account for the need to drop several children from the language study. However, those children were considered for analysis here so long as we had codable videos of at least one reading. Of the 80 families, 6 were dropped due to incorrect video angles for all 3 recordings. The research was approved by the IRBs of the two contributing universities, and carried out with written parental consent.

Materials

Home Reading Materials. Families in the control group were given a narrated English storybook on an Amazon Fire HD Kids tablet to use at home. The eBook (*Peg + Cat's The Big Dog Problem*, Oxley & Aaronson, 2016a) included no embedded games and was minimally modified from the PBSKids website version by removing some story-irrelevant hotspots.

Families in the experimental condition received the same eBook with an added embedded character, Ramone (who appeared in the *Peg + Cat* series but was not a story character in *The Big Dog Problem)*. On the title page, Ramone briefly described the importance of parents talking with their children while reading but did not overtly teach dialogic reading or offer parenting tips. On subsequent pages, Ramone provided a model of dialogic reading prompts after the automated story narration, including questions (e.g., "Who's the tallest in your family?) and conversational prompts (e.g., "You could talk about what it's like to ride on someone's shoulders"). No other shared reading behaviors (e.g., following up on children's comments, giving positive feedback, etc.) were explicitly described.

There were two versions of the embedded character supports. In an easy version, Ramone modeled a simple question or suggested a simple discussion topic on each page. In the other version, he offered more complex, cognitively demanding questions and prompts (see Troseth et al., 2020) on 7 of the 12 pages, with the idea that parents might independently discuss their own topics on the other 5 pages.

In-Lab Reading Materials. To provide a baseline measure of parent-child interaction, families read a print version of *The Big Dog Problem* at their first lab visit. At the second visit they read another *Peg + Cat* eBook from the PBS Kids website, *The Election Problem* (Oxley & Aaronson, 2016b). It contained similar content and vocabulary and was not modified; thus, it

included a small number of hotspots children could tap to trigger sound effects and animations. Parents and children then read a print picture book (*The Bear Snores On;* Wilson, 2002) with no relation to *Peg + Cat*. These two readings on the second day enabled testing for generalization of behaviors across new story content and across reading formats.

Design

Families were randomly assigned to one of three conditions (control, experimental, choice) with the caveat that the last 10 participants were assigned to balance children's age, gender, and the site of testing across conditions. For the home reading activities, families in the control group were asked to listen to the narrated eBook (without Ramone) ten times over the two weeks. Those in the experimental group were asked to listen to the easy Ramone eBook for five readings, and the more challenging version for the next five readings. Choice condition families received all three versions and could choose which to use for each of their ten readings.

Procedures

The two (video-recorded) lab visits took place in a quiet room on campus, child care, or school. During the first visit, parents completed a consent form and a demographic survey. Concurrently, the child completed several vocabulary measures (not reported here).

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. The researchers left the room or turned away and busied themselves with paperwork. When families finished reading, the parent was given a tablet loaded with the eBook(s) for their assigned condition, a portable audio recorder to record each home reading, and a reading diary with troubleshooting tips (see online Supplemental Material A). The parent was asked to read the eBook ten times with their child at home, and told that any child reading of the eBook done solo or with another party would be

counted as additional beyond the required ten. No specific instructions were given on how to interact with the eBook or behave toward their child.

During the two weeks that families read at home, a researcher checked in at scheduled intervals to ensure adherence to the study procedure and offer assistance. If families had not completed ten readings or could not keep their second appointment, they were asked to reschedule within four days.

During the second lab visit, parents completed a feedback survey about their experience with the eBook. Children were given post-test vocabulary assessments and a story comprehension measure (not reported here). Parents and children were then asked to read *The Election Problem* eBook followed by a print copy of *The Bear Snores On.*

Measures

Parents' and children's reading interactions were coded from videos of the in-lab readings using an adaptation of the Parent-Child Interaction System (PARCHISY; Deater-Deckard et al., 1997), which has been validated for assessing parent-child behaviors in contexts such as free play, puzzle tasks, and shared reading (Atzaba-Poria et al., 2017; Mullineaux et al., 2009; Wade et al., 2018). Parents and children each received a score for 13 different behavioral aspects based on a 7-point Likert-type rating scale (1 = no sign of the behavior to 7 = constantly engaging in the behavior). We adapted the scale by providing coders more detail for how to weigh both intensity and frequency of behavior. We removed codes that were irrelevant to the shared-reading context (child autonomy-independence and activity). The remaining codes were organized into six composites based on prior literature.

Two dyadic composites reflected how each partner responded to the other. A parent-child *mutuality* score (Ensor et al., 2011; Iacono, 2019) was created by averaging individual *parent*

and *child responsiveness* to the other person's questions, comments, and behaviors (i.e.

engagement with, verbal responses to, and behavioral responses to the other party, etc.), the

dyad's *reciprocity* (i.e. joint positive affect, turn-taking conversation, etc.), and their *cooperation*

(i.e. explicit agreement, joint decision making, etc.).

We created a composite for overall *on-task* behaviors by combining the *on-task* codes for

the parent and the child (i.e. taking initiative, keeping attention on the task, etc.). We did not find

this composite in the literature, but the two scores were significantly correlated across the three

readings (r_{Visit1} = .674, $r_{Visit2eBook}$ = .640, $r_{Visit2Print}$ = .695) and conceptually related.

Individual positivity (Atzaba-Poria et al., 2014; Mullineaux et al., 2009) and negativity

composites (Atzaba-Poria et al., 2014; Oliver & Pike, 2019) were created for parents and

children. Parent positivity consisted of *positive control* (i.e. use of explanation, open-ended

prompting, praise, etc.), *positive affect* (i.e. laughing, physical affection, smiling, etc.), and

responsiveness (i.e. engagement with, verbal responses to, and behavioral responses to the child,

etc.). The child composite consisted of the parallel child components, *positive affect* and

responsiveness to the parent.

Individual *negativity* composites included *negative control* (i.e. use of criticism, physical

control, negative feedback, etc.) and *negative affect* (i.e. frowning, rejection, harsh tone, etc.)for

the parent composite, and *noncompliance* (i.e. not following instructions, direct insubordination,

saying "no" often, etc.) and *negative affect* for the child composite.

Two research assistants, blind to the study hypothesis, were trained to give global

evaluations of each reading and practiced by coding 8 videos from another study. They then

coded 20% of participating dyads' videos to establish reliability (single-measures ICC; two-way

mixed model; $r_{mutuality}$ = .77; r_{ontask} = .80; $r_{parentpositivity}$ = .88; $r_{parentnegativity}$ = .88; $r_{childpositivity}$ = .75; $r_{childnegativity}$ = .85). The

remaining 55 participant videos were coded by one of the two coders. The dataset and syntax are

provided as Supplemental Material B and C and can be accessed through the online resources.

Results

Fidelity of Implementation

Families reported reading approximately the same number of times across conditions

(experimental $M = 10.72$ reads, $SD = 1.70$; choice $M = 11.09$, $SD = 2.35$; control $M = 11.33$, SD

$= 2.46$; Range 7 to 18). Families in the experimental condition reported reading the two versions

of the eBook with Ramone with similar frequencies (easy: $M = 5.52$ reads, $SD = 1.19$; more

complex: $M = 5.16$, $SD = 1.14$). Families in the choice condition split reading across their three

eBooks (easy Ramone: $M = 3.59$ reads, $SD = 2.73$; complex Ramone: $M = 3.18$, $SD = 1.84$, no

Ramone: $M = 4.32$, $SD = 3.32$). However, exploratory analyses demonstrated no association

between the number of times the choice condition families read with Ramone during the two

weeks and any of the target outcomes.

Parent-Child Interaction Behaviors

Descriptive information is presented in Supplmental Table B. To assess whether there

were condition differences or pre- to post-intervention changes in our parent-child behavior

outcome variables, we used linear mixed models due to their strength in modeling repeated-

measures data and robustness in the face of missing data points for individual participants. For

these models, we included reading (visit 1 print, visit 2 eBook, visit 2 print) as a repeated effect,

and a fixed effect for condition. Because of concerns that parent and child negativity, which were

heavily skewed, did not meet the assumptions of the linear models, we used a GEE with a

gamma distribution and log link for these outcomes. We included reading as a within-subjects

effect and a fixed effect for condition. Significant main effects of condition or reading were not

part of our hypotheses, so post hoc follow-ups of these effects are not reported in the text but are

included in the supporting information. Significant interactions between condition and reading

were followed up with simple effects analyses and post hoc tests as needed to address our

hypotheses (Figure 1, Tables 1 and 2).

Dyadic Behaviors

Mutuality. The linear mixed model for mutuality indicated a significant main effect of

condition ($F(2, 72.72) = 3.93$, $p = .024$), main effect of reading ($F(2, 70.69) = 11.25$, $p < .001$),

and interaction of condition and reading ($F(4, 70.64) = 5.59$, $p = .001$). Simple effects analyses

revealed a significant effect of reading in the choice and experimental but not control conditions

(Table 2). Families in the experimental group increased in mutuality from the first visit to both

second-visit readings (eBook $d = 0.99$; print $d = 0.89$). At the second visit, their mutuality was

significantly higher than that of the control group (Table 3; eBook, $d = 0.84$; print, $d = 0.89$). The

choice group increased in mutuality for the print book only ($d = 0.78$), and their mutuality score

for this reading was also significantly higher than that of the control group ($d = 1.12$).

On Task Behaviors. The linear mixed model for on-task behaviors indicated a significant

main effect of condition ($F(2, 72.37) = 5.31$, $p = .007$), main effect of reading ($F(2, 71.46) =$

11.34, $p < .001$), and interaction of condition and reading ($F(4, 71.45) = 5.95$, $p < .001$). Simple

effects analyses revealed a significant effect of reading in the experimental but not choice or

control conditions (Table 2). Families in the experimental group increased in on-task behaviors

from the first visit to both second-visit readings (eBook $d = 1.00$; print $d = 1.11$). On-task

behaviors at their second visit were significantly higher than the control group (Table 3; eBook,

$d = 1.16$; print $d = 1.13$). Families in the choice group did not show significant increases, and

their second-visit on-task behaviors were only significantly higher than the control group for the eBook reading ($d = 0.76$).

Parent Behaviors

Positivity. The linear mixed model for parent positivity indicated a significant main effect of reading ($F(2, 70.57) = 14.34, p < .001$) and interaction of condition and reading ($F(4, 70.56) = 4.81, p = .002$). Simple effects analyses revealed a significant effect of reading in the choice and experimental but not control conditions (Table 2). Parents in the experimental condition increased in positivity from the first visit to both second visit readings (eBook $d = 1.33$; print $d = 0.91$). Their positivity was significantly higher than the control group (eBook, $d = 0.74$; print, $d = 0.68$; Table 3). Parents in the choice group significantly increased in positivity for the print book only ($d = 0.79$), and their second-visit positivity for the print book was significantly higher than the control group ($d = 0.85$).

Negativity. There was no significant main effect of condition or reading, nor interaction between the two. Negativity remained quite low for all groups.

Child Behaviors

Positivity. The linear mixed model for child positivity indicated a significant main effect of condition ($F(2, 72.76) = 3.28, p = .043$), main effect of reading ($F(2, 70.45) = 5.53, p = .006$), and interaction of condition and reading ($F(4, 70.39) = 2.83, p = .031$). Simple effects analyses revealed a significant effect of reading in the experimental but not choice or control conditions (Table 2). Children in the experimental condition increased in positivity from the first to the second visit while reading both books (eBook $d = 0.66$; print $d = 0.74$), but their positivity was only significantly higher than the control group for the print reading ($d = 0.96$; see Table 3).

Children in the choice group did not significantly increase in positivity, but did display positivity during the print book that was significantly higher than the control group ($p = .013$, $d = 0.82$).

Negativity. As with parent negativity, there was no significant main effect of condition or reading, nor interaction between the two. Child negativity remained quite low for all groups.

Discussion

The current study demonstrates increases in parent and child positive behavior as a result of exposure to an eBook with an embedded character designed to promote dialogic reading. Families who had consistent exposure to modeling of open-ended questions and conversation prompts for two weeks showed significant growth in mutuality, on-task behavior, and parent and child positivity, regardless of which type of book they were reading post-intervention. They also had higher scores on these variables than families who read without the modeler. Furthermore, families who were allowed to choose between eBook versions chose to read with Ramone 60% of the time, on average, and showed significantly more mutuality and parent and child positivity than those in the control group when reading the print book, and on-task behavior when reading the eBook, post-intervention. Both parent and child negativity remained low for all groups.

Shared Family Behaviors after eBook Use Over Two Weeks

No condition differences were found in any measured variable during the initial lab visit reading. During the second in-lab visit, parent-child dyads who experienced dialogic modeling at home displayed more mutuality and on-task behaviors while reading together. Improvement occurred without specific instructions from Ramone to engage in these behaviors.

Increased mutuality was the most expected outcome, as the dialogic reading method primarily consists of creating back-and-forth (or mutual) conversational exchanges (Zevenbergen & Whitehurst, 2003). A parent showing interest in their child's comments and point of view may

build closeness and connection, fostering children's cooperation (Hindman & Morrison, 2012;

Landry et al., 2001). Ramone provided parents with examples for how to carry out these

conversations.

Parent-child dyads' increased mutuality may have been due to learning and adopting

Ramone's conversation strategies. Additionally, Ramone's scaffolded interactions may have

offered an environment in which families could acquire their own strategies for interacting in a

cooperative way during reading, along with positive attitudes and shared goals for future

interactions. On-task behaviors reflected an increased focus on the shared reading activity rather

than child distraction and parent behavior management.

Parent Behaviors

During the initial visit, families progressed through the book with little to no strong

affect, positive or otherwise. Although participating parents may have viewed shared reading as

an important bonding opportunity (Audet et al., 2008; Nowak & Evans, 2013; Swain et al.,

2017), they initially did not interact with their child with strong displays of positivity.

Following exposure to the eBook, the hypothesized condition differences in parent

positivity emerged between the experimental and control groups when reading both electronic

and print books. No change or condition differences in negativity were found. Our results are

similar to improvements in parental sensitivity and reciprocity during reading found by Murray

et al. (2016), but without the extensive direct training in dialogic reading used in that study.

The increase in parent positivity is especially striking in the case of the eBook reading on

the second visit. In earlier research, parents were less interactive and enthusiastic when using

eBooks than print books with their children (Krcmar & Cingel, 2014; Strouse et al., 2019).

Nevertheless, families in the experimental condition navigated the presence of some distracting

hotspots in the eBook (such as a chicken clucking whenever a child touched it) while still exhibiting positivity.

Child Behaviors

Like parents**,** children exposed to Ramone in the experimental condition demonstrated increased positivity on the second visit, although the condition difference was only significant for the print book. They had low levels of negativity across all readings. Conversing about a story takes time and mental effort, yet in the face of these cognitive and executive control demands, children maintained positive interactions while reading an eBook that contained hotspots, followed by a print book, without any increase in negative affect or noncompliance. Persistent negative affect in children leads parents to increase their use of unilateral decision making and strict socialization strategies (Ganiban et al., 2011), so children's ability to maintain low levels of negativity may be a key to continued mutuality and parent positivity.

Choice Condition

We included the choice condition to learn how parent-child interaction might change when dyads were given the option to use the dialogic modeling eBooks or the non-Ramone version at home. Dyads might have avoided the Ramone versions, which took longer to read, or perceived the added content as interfering with the flow of the story. However, most families in this condition opted to use Ramone at least sometimes, on average choosing one of the experimental versions the majority of the time. In exploratory analyses, the number of times the families read the eBook versions with Ramone was not related to the outcome variables.

These families displayed a general trend of increasing mutuality and parent positivity from the first to the second visit readings, with medium to large effect sizes, but these were only significant when reading the print book. During this reading, families in the choice condition

displayed significantly more mutuality and parent and child positivity than families in the control condition did. The stronger effects in the print context could be associated with parents' traditionally more positive views about print books compared to eBooks (Strouse & Ganea, 2017; Strouse et al., 2019). Parents' beliefs are important because in prior studies, positive attitudes and goals around reading were associated with higher frequency and quality of literacy-based behaviors and interactions (Audet et al., 2008; Newland et al., 2011). Choice condition parents had fewer experiences with the dialogic modeler during the intervention, possibly resulting in fewer opportunities for reciprocal, positive eBook experiences, and/or less practice adopting the style of dialogic reading. Thus, parents may have retained more of their traditional views about electronic and print formats. Only on-task behaviors were significantly higher in the choice than the control group during eBook reading; there was a (non-significant) medium effect size for on-task behaviors during the print book reading. Ramone's story-focused prompts may have modeled for these parents how to keep their child on task, allowing them to deal with some distracting hotspots in the new eBook.

Implications

Interconnectedness. Reading interventions that elicit more positive child behaviors can, as a result, lead to more positive parent behaviors (Bowlin Terlitsky & Wilkins, 2015). Parents-child conversations around shared activities, when they work well, are mutual, cooperative, responsive, and positive. These positive experiences may lead dyads to develop the strategies and motivation to engage in more mutual conversations. Similarly, benefits to literacy and bonding may be intertwined, as warm interactions provide optimal contexts for literacy-building conversations, and these warm conversations increase parent-child closeness (Cates et al., 2016; Murray et al., 2016).

In areas such as social or emotional development, children's behavior strongly influences parenting (Kuczynski & De Mol, 2015). Children who exhibit more positivity-based behaviors (e.g., physical affection, smiling, responsiveness) elicit more caring responses from parents and more reciprocal engagement (Lengua & Kovacs, 2005). Therefore, child positivity may support both parent-child mutuality and parent positivity during shared readings. This blend of positive experiences promoted by our intervention could support children's future engagement in reading, as positive shared reading experiences have previously been associated with children's future literacy engagement (Roberts et al., 2005).

In comparison to results from other more labor-intensive parenting intervention studies (Bakermans-Kranenburg et al., 2003), our intervention produced relatively large effect sizes for growth in positive parent-child behaviors after reading the dialogic eBook for two weeks. Changing parenting behaviors matters because it has a substantial impact on children's language and literacy outcomes (Murray, et al., 2016; Landry & Smith, 2007; Roberts et al., 2005), which suggests that this kind of tool could have a wide-reaching impact on parent-child reading behaviors and other literacy-based activities.

Shared reading with eBooks. Although valuing shared reading (DeBaryshe, 1995), parents may not naturally engage in rich, positive, and mutual discussions with their children while reading, especially with eBooks (Krcmar & Cingel, 2014; Strouse & Ganea, 2017; Troseth et al., 2020). In line with other studies (Revelle et al., 2019; Troseth et al., 2020), having a character model and suggest ways to interact while reading an eBook appeared to foster a more engaging experience for parents and children. Parents who have these positive interactions may be more interested in future co-use of digital content, and have the motivation and strategies for supporting positive, reciprocal interactions in these contexts. Overall, increases in parent

positivity could have major implications for how parents view learning from eBooks: if parents

realize they can make the shared reading interaction more of a mutual, cooperative conversation,

many of the beneficial outcomes of positive parenting (Leigh et al., 2011; Landry et al., 2001)

and shared reading (Wood, 2002) could be gained using this versatile technology. A recent

survey of low-income American parents highlighted the value of eBooks: many parents reported

having difficulty accessing print books during the COVID-19 pandemic, and said that their

children now read eBooks more than they did prior to the pandemic (Katz & Rideout, 2021).

Other advantages of eBooks are portability, accessibility, and the wide selection available

(Rainie et al., 2012). Families can bring a whole library anywhere, including while travelling.

Cultural Relevance

Our intervention promotes mutuality and parent positivity, which is aligned with the

warm, constructive parent feedback and parent-child discussion around decision-making that

define an authoritative parenting style (Baumrind, 1991). Researchers who study parenting

emphasize that associations between child outcomes and parenting style are culturally and

contextually dependent (Coatsworth et al., 2018). Authoritative parenting tends to be associated

with positive outcomes across cultures, and authoritarian parenting with negative outcomes, but

the strength of this association varies (Dearing, 2004). For example, high parental demands and

expectations did not produce the same negative child outcomes in Asian and Asian American

families as in European American families (Chao, 1994), and no strong association was found

between warm and sensitive parenting and academic achievement for Asian, Black, and Hispanic

American adolescents (Dornbusch et al., 1987). Additionally, parental use of strict limits and

unilateral decision making can be protective for African American adolescents and promote

academic achievement (Dearing, 2004). Thus, increasing parent-child mutuality (e.g., joint

decision making) and reducing certain types of parental control may not be a priority in all contexts and cultures. However, regardless of cultural background, research has shown that positivity- and mutuality-based behaviors can benefit child outcomes (Pinquart & Kauser, 2018). Our intervention models discussion prompts but does not prescribe for parents exactly how to interact during reading. This gives families the ability to customize their discussions in a way that best fits their culture and their child.

Limitations and Future Directions

Our sample was primarily white, middle-income, and well-educated, and therefore we are not able to accurately consider the effect of this intervention by cultural background. Future research is needed with families from diverse backgrounds to determine the potential of this kind of intervention to have a positive impact on parent-child interactions while reading, including information about the kind of parent-child interaction around stories and reading that would lead to benefits desired in that culture.

When possible, we made design choices that offered external validity: families read eBooks at home and some were given a choice between reading the Ramone-enhanced and non-Ramone versions. However, we assigned families to condition and provided some specific instructions about what and how frequently to read to be able to evaluate whether changes in behavior resulted from exposure to the eBook. In the absence of direction from researchers, parents and children may not have chosen to read eBooks at all, to read together, or to read in a consistent dyad. Additionally, because Ramone explicitly conveyed the importance of talking with children during reading, it is possible that parents who were exposed to Ramone initiated more conversations during post-test because they knew the researchers valued it. Thus, in the real world, families may not use the eBooks in the same way they did in the study.

Long-term follow-up would be needed to determine if the increased mutuality and positivity that families displayed would continue outside the lab context. In previous research, parents who were trained in dialogic reading strategies still engaged in the techniques up to two years after initial exposure (Huebner & Payne, 2010), suggesting that long-term positive behavioral outcomes are possible. In future studies, more prolonged use of character-enhanced dialogic eBooks might lead to additional or more enduring benefits.

Conclusion

The current research shows that co-using an eBook that promotes dialogic reading can influence how parents and children interact together while reading in ways that promote positive parenting and mutual engagement, as measured by a broader range of outcomes and collected directly through observation of parents and children. These effects generalized not only across books with different content but also different formats and were obtained without explicit instruction or training. Families who engaged with the enhanced eBook for two weeks grew in mutuality and parent and child positivity. Families given an option of reading the eBook with or without the modeler frequently used the version with the modeler; they increased in mutuality and positivity, although not as much as those consistently exposed to the modeler. There were no changes or condition differences in parent or child negativity across readings. Thus, incorporating supportive characters into eBooks may serve as a tool for bringing families closer together while reading.

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Figure 1

Behavioral Outcomes for Each Condition Across Readings
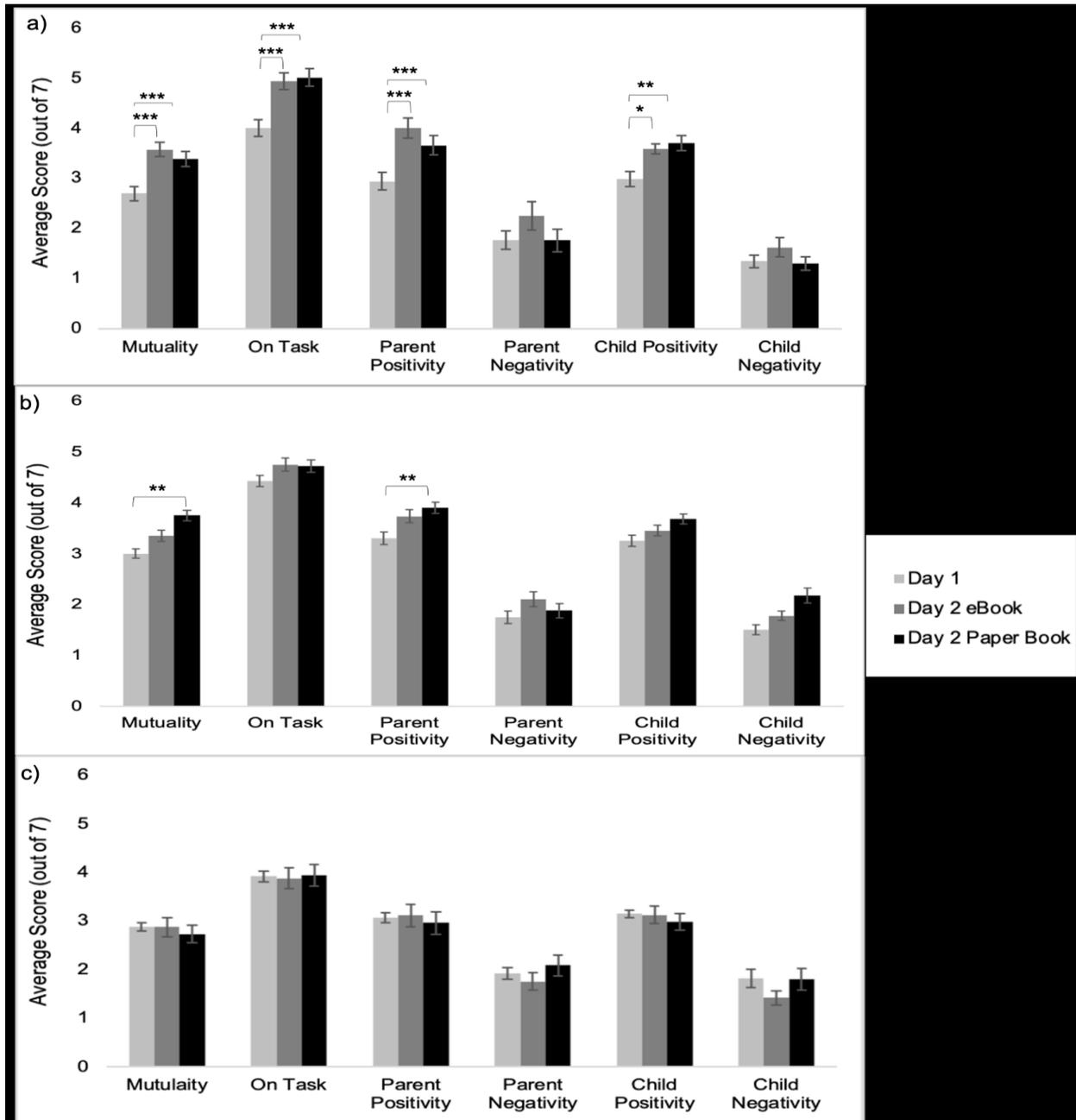
Note. a) Experimental, b) Choice, c) * p < .05, ** p < .01, *** p < .001.

Table 1

Simple Effects Tests of Changes in Behaviors From the First to the Second Visit

Behavior and condition	Test of reading differences	Visit 2 eBook vs. visit 1		Visit 2 print book vs. visit 1	
		p	d	p	d
Dyad					
Mutuality					
Experimental	$F(2, 23.91) = 12.19, p < .001$	< .001	0.99	< .001	0.89
Choice	$F(2, 21.60) = 6.65, p = .006$	n.s.	0.32	.005	0.78
Control	n.s.	n.s.	-0.01	n.s.	-0.20
On-Task Behaviors					
Experimental	$F(2, 23.91) = 18.54, p < .001$	< .001	1.00	<.001	1.11
Choice	n.s.	n.s.	0.34	n.s.	0.35
Control	n.s.	n.s.	-0.05	n.s.	0.03
Parent					
Positivity				< .001	
Experimental	$F(2, 23.68) = 22.39, p < .001$	< .001	1.33	.005	0.91
Choice	$F(2, 21.42) = 6.57, p = .006$	n.s.	0.42	n.s.	0.79
Control	n.s.	n.s.	0.05		-0.15
Negativity					
Experimental	n.s.	n.s.	0.49	n.s.	0.00
Choice	n.s.	n.s.	0.34	n.s.	0.10
Control	n.s.	n.s.	-0.18	n.s.	0.18
Child					
Positivity					
Experimental	$F(2, 22.89) = 6.74, p = .005$	.032	0.66	.004	0.74
Choice	n.s.	n.s.	0.17	n.s.	0.40
Control	n.s.	n.s.	-0.03	n.s.	-0.25
Negativity					
Experimental	n.s.	n.s.	0.27	n.s.	-0.04
Choice	n.s.	n.s.	0.30	n.s.	0.46
Control	n.s.	n.s.	-0.31	n.s.	-0.02

Table 2

Simple Effects Tests of Condition Differences for Each Reading

	Test of condition differences	Experimental vs. control		Choice vs. control		Experimental vs. choice	
		p	d	p	d	p	d
Visit 1							
Dyad							
Mutuality	n.s.	n.s.	-0.17	n.s.	0.16	n.s.	-0.34
On Task	n.s.	n.s.	0.04	n.s.	0.44	n.s.	-0.45
Parent							
Positivity	n.s.	n.s.	-0.10	n.s.	0.27	n.s.	-0.38
Negativity	n.s.	n.s.	-0.10	n.s.	-0.16	n.s.	0.07
Child							
Positivity	n.s.	n.s.	-0.12	n.s.	0.20	n.s.	-0.32
Negativity	n.s.	n.s.	-0.39	n.s.	-0.26	n.s.	-0.13
Visit 2 eBook							
Dyad							
Mutuality	$F(2, 70) = 4.31, p = .017$	.016	0.84	n.s.	0.50	n.s.	0.26
On Task	$F(2, 70) = 8.42, p = .001$	<.001	1.16	.019	0.76	n.s.	0.28
Parent							
Positivity	$F(2, 70) = 3.62, p = .032$	.031	0.74	n.s.	0.47	n.s.	0.24
Negativity	n.s.	n.s.	0.34	n.s.	0.24	n.s.	0.11
Child							
Positivity	n.s.	n.s.	0.58	n.s.	0.40	n.s.	0.09
Negativity	n.s.	n.s.	0.12	n.s.	0.36	n.s.	-0.20
Visit 2 print							
Dyad							
Mutuality	$F(2, 70) = 8.95, p < .001$	.01	0.89	<.001	1.12	n.s.	-0.32
On Task	$F(2, 70) = 7.81, p = .001$	<.001	1.13	n.s.	0.62	n.s.	0.45
Parent							
Positivity	$F(2, 70) = 5.15, p = .008$	.05	0.68	.012	0.85	n.s.	-0.19
Negativity	n.s.	n.s.	-0.22	n.s.	-0.16	n.s.	-0.05
Child							
Positivity	$F(2, 70) = 6.77, p = .002$	.004	0.96	.013	0.82	n.s.	0.08
Negativity	n.s.	n.s.	-0.48	n.s.	0.33	n.s.	-0.84