Use of Electronic Storybooks to Promote Print Awareness in Preschoolers who are Living in Poverty

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Abstract

The present study examined the extent to which teachers who provided print referencing strategies using electronic storybook (e-book) readings had students with greater emergent literacy skills compared to students who only had access to traditional storybook reading sessions. Letter knowledge, early decoding and print concepts knowledge were examined in 20, four- year- old children living in poverty. In the control condition, ten children completed 15 minutes a day of traditional storybook reading instruction, using a direct instruction curriculum Children in the intervention group (n=10) completed an additional e-book reading paired with adult directed print referencing strategies twice a week over the course of six weeks. Children exposed to e-books paired with adult directed print referencing strategies scored significantly higher on a measure of print concepts knowledge than those in the control group, although gains in letter knowledge and early decoding were equivalent across the two groups. Results suggested that the pairing of traditional instructional methods such as print referencing strategies with current technological tools that enhance engagement, such as e-books, may offer benefits to young children who are developing their awareness of print concepts.

Current efforts are underway to provide young children who are at risk for later academic difficulties with evidence-based early literacy instruction through school-based activities that promote socio-emotional and academic growth opportunities (Barnett, Bell, & Carey, 2002; Justice & Kaderavek, 2004). These opportunities are important for children even before they enter into kindergarten, as those who experience developmental risk in preschool are more likely to struggle with academic achievement throughout early childhood than children without any known risk factors (Skibbe, Grimm, Stanton-Chapman, Justice, Pence, & Bowles, 2008; Brizius, & Foster, 1993). In particular, children whose developmental risk is associated with poverty often exhibit underdeveloped print skills, which has led some professionals to advocate for interventions targeting this area of literacy explicitly (Justice & Ezell, 2001).

One effective means by which to boost literacy achievements for children at risk for reading difficulties is through the use of storybook reading interventions (e.g., Bus, Belsky, van IJzendoorn, & Crnic, 1997; Kaderavek & Justice, 2005; van Kleeck, Vander Woude, & Hammett, 2006; Wasik, Bond, & Hindman, 2006; Scarborough & Dobrich, 1994). These types of interventions can be effective for children exhibiting typical development (Justice & Ezell, 2004; Van Kleek, 1994) as well as those with developmental risk factors (Hargrave & Sénéchal, 2000; Justice & Ezell, 2002; van Kleeck et al., 2006; Wasik et al., 2006). Although studied less often than traditional paper formats, the digital version of a storybook, often referred to as electronic storybooks or e-books, can also be used to embed explicit targets into a storybook reading session (McKenna & Zucker, 2009). E-books offer children the opportunity to experience

storybook content in a technology-based format and are being used more commonly in schools across the United States.

The number of e-book sales in the United States has increased by 223% in the last year (IDPF, 2012). Although there is a definite push for the integration of technology in schools (USDOE, 2000), a recent technology survey observed that, on average, elementary schools had far fewer e-books in their schools (29%) than high schools (64%). However, it is likely that the prevalence of e-books in early childhood settings will increase, making it critical for us to examine how e-books relate to children's learning within the classroom. Although e-books accounted for only 2.8% of the estimated $8 million textbook market in the U.S. in 2010, the U. S. Department of Education recently released their "open source multimedia production tool for creating accessible e-books" for all children in efforts to ensure children from all income levels have access to e-books (U.S. Department of Education, 2012). Thus, it is important to understand how to tailor these technological tools in order to maximize possible benefits for children living in poverty, as these children are more likely to struggle when learning to read that their more affluent peers (West, Denton, & Germino-Hausken, 2000).

Children living in poverty often have limited access to reading materials, be it electronic or a traditional paper format. For example, low-income schools often have limited libraries (Duke, 2000), poor access to books at home (Feitelson Rita, & Goldstein, 1986), and fewer community reading resources (Neuman & Celano, 2001). Research suggests that this lack of resources can be detrimental to children's reading achievement (McQuillan, 1998; Lance, Hamilton-Pennell, Rodney, Petersen, & Sitter, 1999). Although limited research is available on poverty and e-books, preliminary evidence suggests that

children at-risk for reading difficulties can benefit from some of the supports provided by electronic storybooks (e.g., Shamir & Schlafer, 2011; Zucker, Moody, & McKenna, 2009).

E-books can incorporate many features that benefit young children's reading development. As one example, e-books often incorporate a read aloud function which offers greater independence for struggling readers (Parham, 1993; Trushell, Burrell, & Maitland, 2001), without requiring direct adult intervention. When used as a tool to promote early literacy development, e-books can track print to enhance the development of print, offer dictionary options to build vocabulary, provide decoding supports using text-to-speech software (McKenna, Labbo, Reinking, & Zucker, (2007), and offer increased exposure to text (Trushell, Burrell & Maitland, 2003; de Jong & Bus, 2003).

The options incorporated within e-books have proven to be beneficial for young children. E-books have been shown to promote child engagement (de Jong & Bus, 2002, 2003; Fisch et al., 2002; Talley et al., 1997; Moody et al., 2010), boost vocabulary (McKenna, Cowart, & Watkins, 1997; Korat, 2010), facilitate communication (Fisch et al., 2002; Moody et al, 2010; Verhallen, Bus, & de Jong, 2006), and improve comprehension skills (Doty, Popplewell, & Byers, 2001; Greenlee-Moore & Smith, 1996; Korat, 2010; Matthew 1996; 1997).

One of the most important ways that e-books can benefit young children is through the inclusion of print referencing strategies (Shamir & Schlafer, 2011). Print referencing strategies refer to the techniques that can be used during storybook reading to draw children's attention to the meaning and function of print using either nonverbal or verbal

cues (Justice & Ezell, 2004; Storch & Whitehurst, 2002). For instance, children can follow print as it is highlighted and track it from left to right on the screen, which teaches children print directionality (Parham, 1993). In sum, e-books provide additional opportunities for children to be exposed to print in ways that can enhance their emergent literacy skills.

In addition to the beneficial features noted above, many e-books offer digital features that can actually hinder learning, such as entertaining games and animations. Some of these features, such as 'hot spots,' direct children to focus on the storybook without attention to print. For example, when reading an e-book, the child receives visual and auditory feedback when clicking on a word or character and, as a result, can navigate through an entire story while receiving only minimal exposure to print. Features such as these serve to distract children from the text and emergent literacy supports that are usually provided when reading a book (Kamil et al., 2000; Labbo & Kuhn, 2000; Trushell et al., 2001; Zucker et al., 2009).

Some groups of children may be particularly susceptible to distractions within e-books that take children's attention away from print. Specifically, children living in low-income environments are often uninterested in reading (MacGillivray, Monzó, & Arzubiaga, 2001). They are also more likely to exhibit attention and engagement problems (Novotney, 2010) as well as low self-regulation (Blair & Diamond, 2008; Buckner, Mezzacappa, & Beardslee, 2009). These behavioral characteristics may make children living in low-income environments even more susceptible to distractions when working with electronic books independently.

One possible way to counteract the potential drawbacks of e-books is through the use of adult-directed storybook reading. At least in traditional storybooks, adults can help promote emergent literacy skills by modeling appropriate vocabulary and discussing the key concepts in the storybook (van Kleeck et al., 2006; Wasik et al., 2006; Whitehurst et al., 1988). For example, adult readers can point out letters, discuss print, and ask and answer questions about the storybook to keep children engaged in the storybook (Whitehurst & Lonigan, 1998). As young children gain increased exposure to e-books, it is important to also consider whether adults can be as effective in enhancing emergent literacy skills using this technology. A few studies examining the use of adult mediated e-book experiences are emerging (Moody et al., 2009; Verhallen et al., 2006) and findings from these studies suggest that the presence of an adult during e-book reading activities can enhance emergent literacy skills more readily than readings without an adult.

Unanswered questions remain about how effective e-book use is when paired with quality emergent literacy instructional techniques. The current intervention study examines whether the addition of shared e-book readings that incorporate explicit print-referencing techniques increases children's print-related knowledge. We examined children's print-related knowledge using three measures: letter naming, print concepts knowledge, and early decoding skills. The children involved in this study were participating in federally-funded center-based programs, and exhibited eligibility for these programs because of environmental disadvantage.

Methods

Participants

Participants were 20 4- to 5-year-old children (7 boys, 13 girls) enrolled in four

public preschool classrooms for children at-risk for academic difficulties due to poverty.

All 20 children were reported to be typically developing by their classroom teachers;

specifically, no child had diagnosed hearing loss, cognitive impairment, speech/language

impairment, or attentional difficulties. Children ranged in age from 54 to 64 months at

study entry (M = 59.8 months, SD = .49 months). The majority of children were

Caucasian (n = 13), although African Americans (n = 5), and Hispanics/Latinos (n = 2)

were also represented. Families reported that all children spoke English as their primary

language. The children's parents reported a mean average yearly household income of

approximately $28,000. Maternal education in this sample varied greatly. Two mothers

reported some high school education, four held high diplomas, seven earned associate's

degrees, three had some college, two held a bachelor's degree plus some additional

credits, and two held master's degrees.

General Procedures

Children were randomly assigned to either the control group or the intervention

group. Children in the intervention group (M = 58.4; SD = 2.72) were significantly

younger than those in the control group (M = 61.2; SD = 2.66) (t (20) = 2.30, p = .03). For

both groups, this study utilized a pre-post design in which each child participant (n = 20)

completed 10 e-storybook readings in a randomized order of presentation including *Living

Books* titles, "The Tortoise and the Hare" (Aesop, 1993), "Arthur's Birthday" (Marc

Brown, 1994), "Arthur's Teacher Troubles" (Marc Brown, 1994), "Grandma and Me"

(Mayer, 1992), and "Little Monster at School" (Mayer, 1994). Books were created for children three- to six-years of age and titles averaged 725 words over 23-40 pages.

All children received traditional storybook reading instruction using a direct instruction storybook reading program for 15 minutes per day by a teacher. In addition, the intervention group received approximately two e-book readings a week for six weeks in addition to the traditional curriculum provided by the teacher. Sessions ranged from 15 to 20 minutes, depending on the length of the book (*Range* = 23 - 40 pages). Over the course of the program, children in the intervention received a total of 180 minutes, or 3 hours, for the intervention. Books were presented in a randomized order. During each intervention session, adults and children read one e-book, which had two print references embedded within it. E-books were read in the play mode and researchers followed scripted print referencing targets and provided reflective feedback (e.g., "point to a letter", "This is a capital letter"). All sessions were completed in a quiet classroom in the school with one- to- one instruction from trained researchers.

All reading sessions were videotaped to document procedural reliability in the field; 15% of the reading sessions for each researcher who read to children were randomly selected and scored using a researcher developed fidelity observation tool created by the authors (see Appendix A). Results yielded an overall fidelity of 96% to the scripted procedures.

Measures

Children's print-related skills were measured one week before the beginning of the intervention and within one week following the intervention using the following measures: letter-word identification, letter knowledge, and print concepts knowledge. All

were administered in English in a quiet setting within the preschool program setting by

trained examiners.

To measure print-related skills, the upper-case alphabet ability knowledge task of

the Phonological Awareness Literacy Screening: PreK (PALS; Invernizzi, Meier, &

Sullivan, 2004) was administered along with the letter-word identification subtest from

the Woodcock Johnson© III Tests of Achievement (WJ-III; Woodcock & Mather, 2001).

As part of the PALS-PreK: upper-case task, children are asked to name each of the 26

individual, upper-case letters of the alphabet, which were presented in random order on a

single printed sheet. One point was awarded for every letter correctly identified, for a total

of 26 points. Interrater reliability of this measure is reported as .99 (Invernizzi et al.,

2004). The letter-word Identification scale of the WJ-III requires children to name letters

on a page, followed by reading words aloud. This subscale of the WJ-III demonstrates a

reliability of .94 in the norming population. According to the manual, this task

demonstrated excellent reliability (alpha = .91) and fall scores were positively and

significantly correlated with spring scores (r = .82). In the present study, children's

performance is reported using *W* scores, the Rasch-based scores included in the testing

manual.

To measure print concept skills, the Preschool Word and Print Awareness measure

was administered (PWPA; Justice & Ezell, 2001; Justice, Bowles, & Skibbe, 2006). The

PWPA examined children's knowledge of 14 print and word concepts as a child reads

Nine Ducks Nine (Hayes, 1990) with an adult while asking a targeted series of questions

(e.g., show one letter on the page). Scores on this task could range from 0 to 16. See Table

1 for descriptive information about this sample's early literacy performance prior to the

onset of the intervention.

Table 1.

Pre-test and Post-test Means (Standards Deviations) by Gender, Age, Print, and Name

Writing

| Treatment	Gender (m/f)	Age (month)	Print Concepts Knowledge		Letter Knowledge		Early Decoding	
			Pre	Post	Pre	Post	Pre	Post
Control	4/6	58.4	7.50	13.70	15.90	19.60	335.60	354.50
			(3.27)	(3.16)	(9.62)	(8.58)	(28.24)	(25.31)
Intervention	3/7	61.2	8.50	10.00	17.60	20.10	346.30	363.20
			(3.27)	(2.91)	(8.37)	(8.85)	(37.98)	(24.60)

Results

Results of the study suggest that the print concept knowledge of children in the

intervention group (M =7.50; SD = 3.27) did not differ significantly from those in the

control group (M = 8.50; SD = 3.27) before the onset of the intervention, (t (20) = -.68, p

= .50). Similarly, before the intervention, children's upper case letter knowledge did not

significantly differ between the intervention (M =15.90; SD =9.62), and control groups

(M =17.60; SD = 8.37), (t (20) = -.42, p = .68). Finally, W scores from the pre-test of the

Woodcock Johnson III for the intervention ($M =335.60$; $SD =28.24$) and control groups

($M = 346.30$; $SD = 37.98$) indicated no significant differences (t (20) = -.72, $p = .48$).

Table 1 includes descriptive information regarding children's performance on the

literacy measures for both time points tested. For each of the three outcome variables, an

ANOVA was calculated with group (intervention or control) included as a fixed factor and

pre-test scores included as a covariate. Children receiving the intervention made

significantly greater gains on the measure of print concepts knowledge (F (2, 17) = 16.02,

$p < .01$). See Figure 1.

Figure 1. Pre- and Post- Scores for Print Concepts Knowledge
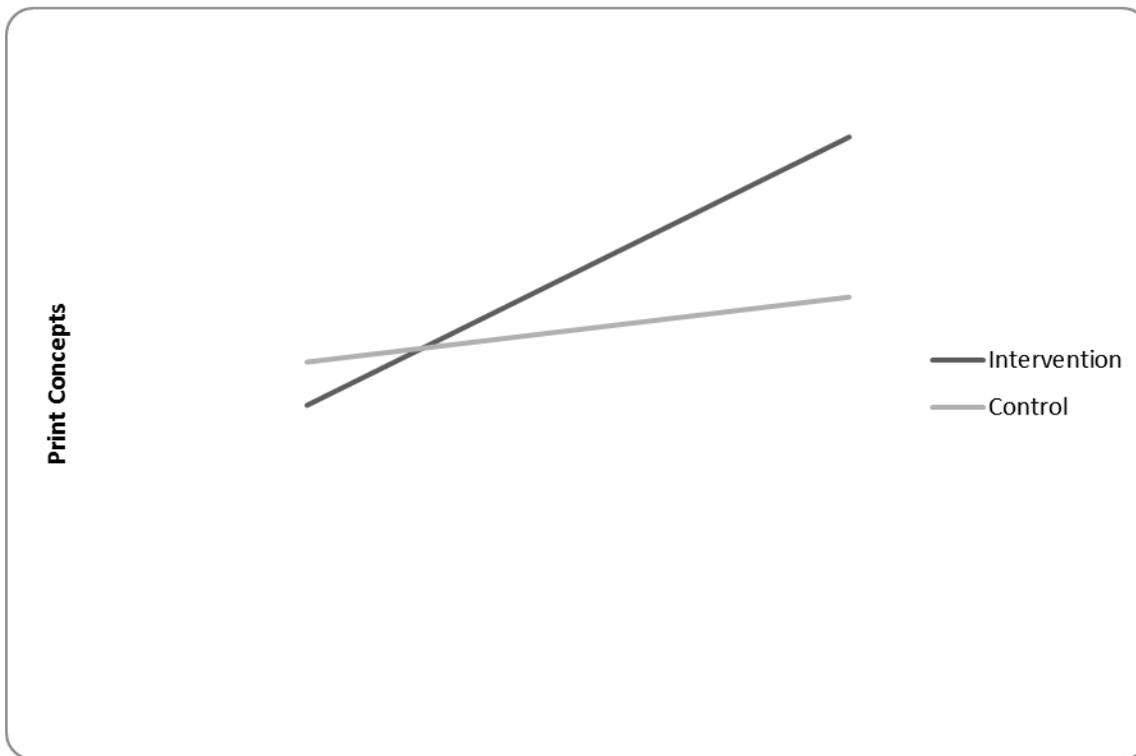
receiving the intervention did not make greater gains in the area of letter knowledge (F (2,

17) = .78, $p = .39$) or early decoding (F (2, 17) = .11, $p = .74$). See Figures 2 and 3.

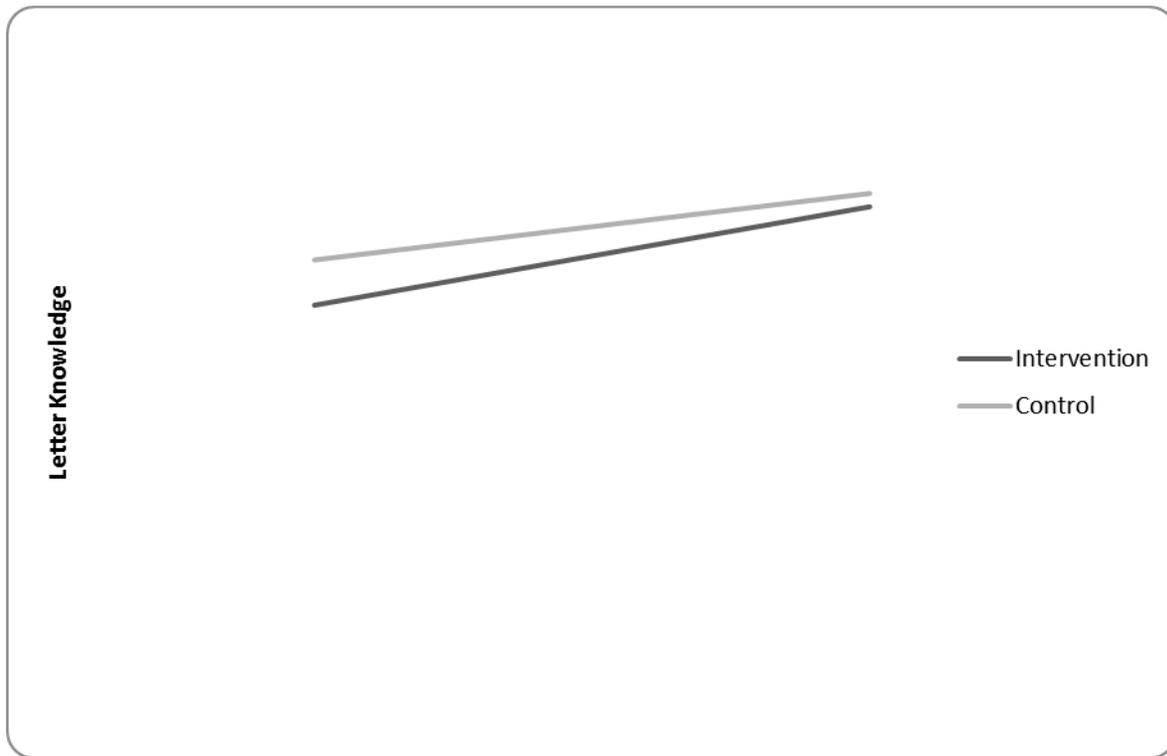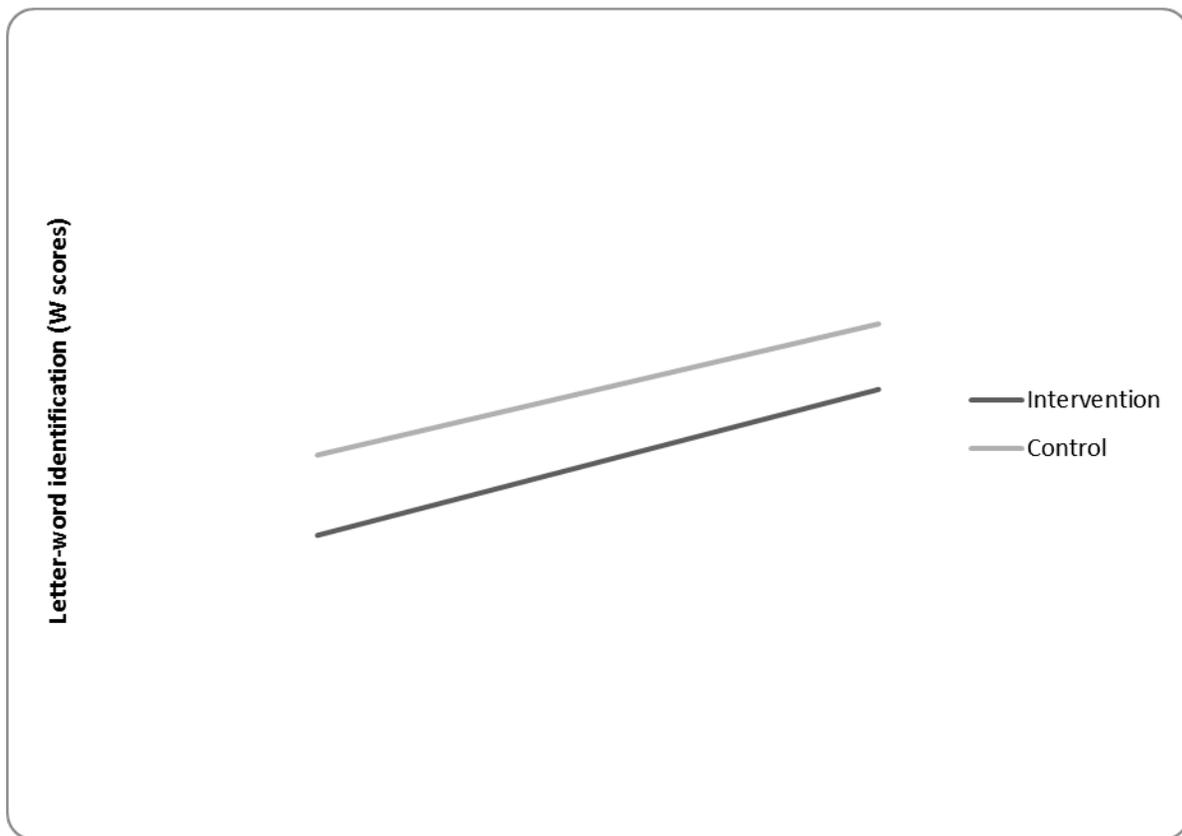Figure 2. Pre- and Post- Scores for Letter Knowledge

Figure 3. Pre- and Post- Scores for Early Decoding

Discussion

This study investigated the ways in which teachers can influence children's understanding of print using e-books. Findings indicated that children exposed to e-books paired with adult directed print referencing strategies scored significantly higher on a measure of print concepts knowledge than those in the control group. Results suggested that the pairing of traditional instructional methods, such as print referencing strategies, with current technological tools, such as e-books, may offer benefits to young children who are developing their awareness of print concepts. These benefits, which did not extend to letter knowledge or early decoding, were found using a low-intensity intervention program, which lasted a total of 3 hours spread over six weeks.

E-books provide children with opportunities to listen to the storybook while interacting with text, animated features, and exploring characters and illustrations (de Jong & Bus, 2003). Participants were attending federally funded preK programs designed to reduce disparities in early development for children reared in economically-disadvantaged homes. Establishing the ways in which children can gain emergent literacy experiences using 21st century technology tools in schools is currently an important goal in educational policy and practice. Possible benefits may include: 1) The use of adult mediation to ensure e-book tools are paired with evidence-based instructional strategies; 2) The use e-books to further support emergent literacy skills when paired with traditional instruction. In the next sections, we briefly discuss the major findings related to the impact of using e-book reading to enhance print concepts knowledge.

Results suggest that low exposure to adult-directed e-book readings may offer significant benefits for increasing print concepts knowledge in preschool children at-risk due to poverty. Current evidence suggests that e-books can increase reading engagement in young children (see de Jong & Bus, 2002, 2003; Fisch et al., 2002; Moody et al., 2009; Talley et al., 1997). Our research suggests that, similar to traditional storybook reading activities (Justice et al,. 2009; Lonigan & Whitehurst, 1998; McGinty, et al.,2012), e-books can also increase children's opportunities to gain some critical emergent literacy skills, including print concept knowledge.

Similar to previous work (e.g., Justice & Ezell, 2001, 2004), adults provided explicit print referencing strategies during the storybook reading sessions analyzed as part of the current intervention program. Research examining the use of print referencing strategies during storybook readings indicates greater gains than traditional storybook

reading without explicit instruction (Zucker, Justice & Piasta, 2009; Piasta et al., 2012).

Our findings indicate that e-books can also be used to foster gains in print concept

knowledge, which is important, as educational researchers suggest that using technology

as a tool to enhance instruction and learning is critical (Means & Olson, 1995; Owston,

1997; Valdez et al., 1999).

While there may be some benefits to supplementing traditional storybook reading

activities with the use of e-books, educators need to pay particular attention to ensure that

they are targeting specific skills during those activities. Note that our intervention utilized

print referencing skills explicitly and benefits for children did not extend to their letter

knowledge or early decoding skills. To achieve gains across more literacy skills, it is

likely that more intensive and broadly focused techniques would need to be utilized. For

example, in the beginning stage of reading, children are often unable to link letter sounds

with letter symbols (Ehri, 1994) and activities that build phonological awareness such as

rhyming, blending and segmenting, recognizing odd sounds, and adding and deleting

syllables may be needed to assist in the development of early decoding skills (Torgesen,

Wagner & Rashotte, 1997). For letter knowledge, tasks such as alphabetic matching and

naming may prove beneficial (Moats, 2005). In sum, it is likely that our intervention was

not sufficiently broad to support gains in areas outside of print concept knowledge.

Limitations

Several limitations are of note in the present study. Children lived in low-income

environments and were fairly homogenous with respect to race/ethnicity, disability status,

and socioeconomic status; thus, results may not generalize to other populations of children

(e.g., Anderson, 1995). In addition, the size of our sample likely limited our ability to

detect effects on the literacy measures studied. It is possible that we would have

uncovered additional benefits of the program had we included more children in the

program. Finally, researchers delivering the intervention followed scripted instructions,

similar to a direct instruction curriculum. While similar scripted programs can be found in

preschool classrooms, such practices can negatively influence the level of socio-emotional

engagement in storybook reading activities and thus influence academic performance (see

Morrison, Rimm-Kaufman, & Pianta, 2002; Pianta & Harbers, 1996). Although observers

reported that children seemed engaged during the e-book sessions and they were

encouraged to actively participate in the book reading session, we did not measure

children's engagement explicitly, so we do not know how the program related to

children's behavior relative to a traditional format. Finally, our program was not tailored

for individual children, a practice that has been suggested for adult led interactive e-book

experiences (see La Paro, Pianta, & Stuhlman, 2004; Moody et al., 2009). Future

programs should consider how to incorporate individually targeted strategies when

reading books with children.

Conclusion

E-book technologies offer a low cost, technological tool that can be easily be

integrated into centers or daily reading programs to reinforce critical emergent literacy

skills. Results from the current study suggest that this technology, when used with adult

support, can promote print concepts knowledge for children at-risk for poor reading

outcomes using a low-intensity intervention in as little as six weeks. Educators and other

professionals are encouraged to consider this technology when working to promote the

early literacy skills of young children.

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Appendix A
Reader Observation Fidelity Checklist

Book Title	
Storybook	Arthur's Teacher Trouble____ Arthur's Birthday ___ The Tortoise and the Hare ____ Arthur's Teacher Troubles ____ Grandma and Me ____ Little Monster at School ____
Child Assent	
Reader obtains child assent	Yes ____ No ____
Reader follows script	
Reader followed the script	Yes ____ No ____
Reader uses correct number of prompts	
Reader uses correct number of prompts	Introduction _____ (1) Title Page _____ (2) Page 1_____(2) Page 2 _____ (1) Page 3 _____(1) Page 4 _____ (1) Page 5 _____ (2) Page 6 _____(2) Page 6 _____ (2) Page 7 _____(1) Page 8 _____ (1) Page 9 _____ (1) Page 10 _____ (1) Page 11 ____ (2) Page 12 ____ (1) Page 13 ____ (1) Total ____/____
Session Length	
Report the total reading time	_____ Minutes _____ Seconds