Article

Expanding the boundaries of shared book reading: E-books and printed books in parent–child reading as support for children's language

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Abstract

Early shared book reading activities are considered to be a promising context for supporting young children's language development. Ninety low socioeconomic status preschoolers and their mothers were randomly assigned to one of three groups: (1) e-book reading; (2) printed book reading; (3) regular kindergarten literacy program (control). Mothers of children in the intervention groups received guidance on how to read to their child, and had five sessions of reading within a period of two weeks. The final session was videotaped and transcribed. Children in both intervention groups showed significant progress in word comprehension and phonological awareness compared to the control group. Children's initial knowledge in each skill and both interventions contributed to language progress more than maternal education, frequency of shared book reading and computer use. The authors conclude that parents and children may expand their shared book reading experience to include e-books, which may serve as promising contexts for developing young children's language.

Keywords

The book market has undergone a dramatic change in recent years, and different forms of electronic books (e-books) have become widely available. In one survey, 20% of adult

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Americans reported that they had read an e-book during the past year (Pew Research Center Survey, 2012). This uptake of e-books is the case not only for adult readers but also for children, including young children. Many of today's young children appear to enjoy listening to or reading stories on the computer or other devices. According to parents' reports, 20% of 3- to 4-year-old American children use the computer for 45 minutes a day, and 36 of these minutes are dedicated to reading e-books. In response to these developments in children's reading experiences, a new body of research has emerged in the past decade, which examines the potential of the e-book format for supporting children's language and literacy (e.g., Bus, de Jong, & Verhallen, 2006; Chera & Wood, 2003; Korat & Shamir, 2012; Shamir, Korat, & Phella, 2012; Shamir, Korat, & Shlafer, 2011; Smeets & Bus, 2012).

E-books for children are usually programmed to be interactive and include multimedia effects such as written text, oral reading, oral discourse, music, sound effects and animation. They enable young children, even before school age, to engage in listening to and reading stories independently by visually following the stories using a digital system. Multimedia applications can provide the user with a lively picture of the story meaning, including linguistic as well as paralinguistic features such as body language, gestures, prosody, etc. (Brett, 1995; Fidelman, 1997; Gassin, 1992; Hurley, 1992). Activating e-books that incorporate highlighted text, a built-in dictionary and language hotspots may offer young children an opportunity to learn different aspects of language and literacy, including word comprehension and phonological awareness skills. Parents repeatedly reading the same printed book to their young children has been one of the most widely endorsed literacy experiences in the family context for years. Shared storybook reading, which most often takes place between mothers and their young children (Pellegrini, Galda, Shokley, & Stahl, 1994), is considered an important opportunity for enriching children's language, including vocabulary and phonological awareness, in different cultures and countries (for example, in the US, Hoff, 2010; in Australia, Farrant & Zubrick, 2011; in the Netherlands, Bus, Leseman, & Keultjes, 2000; in Japan, Toshiki, Dale, Ogura, Yamashita, & Mahieu, 2005). These two skills are considered to be key factors in reading and reading comprehension in school (Whitehurst & Lonigan, 2001). Interestingly, although this activity is considered to be a promising means for supporting children's vocabulary, a recent study shows that parents do not always take the opportunities presented in picture-book reading to explain new word meanings to their young children (Evans, Reynolds, Shaw, & Pursoo, 2011). This suggests that providing initial guidance to parents might be an important step in helping parents to support their children.

It is well established that middle socioeconomic status (MSES) mothers read more frequently to their children, and use higher levels of support during storybook reading that incorporate word comprehension and language support compared to low socioeconomic status (LSES) mothers (De Temple & Snow, 1996; Heath, 1983; Korat, Klein, & Segal-Drori, 2007; Ninio, 1980). The frequency of book reading and mothers' support level were found to be important vehicles for children's language development (Bus, van Ijzendoorn, & Pellegrini, 1995).

According to a study conducted with Hebrew-speaking children, MSES as well as LSES families reported having at least one computer at home and five software packages for children, including e-books (Landau, 2005). Parents reported working with their

children 1–3 hours a week on the computer and reading printed books with them twice a week. The time is ripe for investigating adult–child e-book reading activity. Our literature search showed that only a few studies have focused on this topic (Fisch, Shulman, Akerman, & Levin, 2002; Kim & Anderson, 2008; Labbo, 2008; Smith, 2001). All these important pioneering studies were naturalistic and focused on small samples. A previous study we conducted (Korat & Or, 2010) with a larger sample than former studies ($N =$ 90), examined MSES parent–child (children aged 5–6) interactions using printed books compared to e-books. The results indicated general as well as specific parental support behavior in each context.

The current research differs in that it is an intervention study, which was performed with LSES mothers and their 3- to 4-year-old children. Mothers and children were engaged in a mutual activity of reading an e-book compared to the same book in its printed version. The decision to include 3- to 4-year-olds was based on our previous studies that showed that not only children aged 5–6, but also younger children, can benefit from e-book reading (see Korat, 2009). We also found a tendency for a ceiling effect for children's phonological awareness, especially regarding the syllabic level. Our focus was on mothers' support of their children in the reading activity, as well as on children's improvement in vocabulary learning and phonological awareness following this intervention. It should be noted that previous studies that focused on observations of parent–child reading using e-books targeted the participants' behavior without relating to the effectiveness of this activity for children's literacy skills (e.g., Kim & Anderson, 2008; Korat & Or, 2010). This aspect was researched in the current study.

We anticipated that young children may need some augmentation via adult support in order to gain effective results in language and literacy skills, especially if we focus on young children and their LSES mothers. Previous studies with young children showed that adult support is a vital vehicle for promoting their skills in activities with the computer, and that they might go further in their development beyond their independent activity (Klein, Nir-Gal, & Darom, 2000; Tzuriel & Shamir, 2002). In this case, human support might provide qualitative teaching which is cognitively and emotionally adjusted to the child, support which is not given via the child's independent computer activity. Thus, the current study is based on the sociocultural school of Vygotsky (1978) and neo-Vygotskians such as Rogoff (1990) and Wertsch (1984), who propose that culture shapes the mind, especially in collaboration with more experienced others. We regard adults' support for children as a central factor in literacy development (Whitehurst & Lonigan, 1998). Learning that is intentionally supported by an adult can be maintained for a longer period of time than incidental learning, and may also serve as the basis for other new learning (Feuerstein, 1979; Klein, 1996; Vygotsky, 1978).

Taking all of these findings into account, it seems important to investigate whether reading an e-book with adult support will have a significant effect on young children's language similarly to printed book reading with adult support. The multimedia features of the e-book (e.g., dictionary support for the comprehension of new words, and words that are divided into their sounds – syllables and sub-syllables), including text which is highlighted congruently with the narrator's reading, can help not only the child, but also the adult, to focus on language skills during the reading and may promote children's language.

Evidence that LSES children have a lower level of language and literacy than high SES (HSES) children is well established in the literature (Hecht, Burgess, Torgesen, Wagner, & Rashotte, 2000; Lonigan, Burgess, Anthony, & Barker, 1998). According to national research in Israel (Hablin, Walters, Wolf, Saiegh-Haddad, & Kemersky, 2004; OECD, 2002), the gap between the literacy level of children from an LSES and those from an HSES family was among the most marked in international comparisons. This gap begins to emerge in kindergarten (Korat, 2005). Thus, supporting young LSES children's language in the context of shared book reading is an important mission.

The present study

In the present study we investigated the extent to which reading an educational e-book with adult support compared to reading a printed book with adult support can promote language skills (word comprehension and phonological awareness) of LSES pre-kindergarten children (aged 3–4 years). We hypothesized that children in both intervention groups will exhibit greater language knowledge (in word comprehension, syllabic and sub-syllabic skills) compared to the control group which did not receive the book reading intervention. Since the software of the e-book includes language activities, and based on our previous study on mother–child e-book reading, we assumed that mothers will use the e-book activities and give a higher level of support to their children in the e-book reading. We also asked whether there will be a difference in progress in children's language skills in the group that read the e-book compared to the progress of the group that read the printed book. No hypothesis was made regarding this question. We also assumed that, after controlling for the mothers' education level, children's initial level in the pretest, the mothers' support level, as well the interventions themselves, would contribute to the children's language progress, as measured post-intervention.

Participants

The sample consisted of 90 pre-kindergarten children (57% girls) and their mothers. The mean age of the children (in months) was 56.10, and the range was between 55.30 and 59.90. All children attended pre-kindergarten classes located in three LSES neighborhoods in three different cities in the center of Israel. Neighborhood SES levels were determined according to the Israeli Municipalities' Statistical Report (Central Bureau of Statistics, 2009), which includes data such as the parents' education level, income level, housing density, PC ownership, etc. Demographic data gathered from the mothers showed that the average education level of both of the children's parents was 3.00 ($SD = 0.68$) on a scale of 1–5. This means that they graduated from high school. The mean family income level was 2.30 ($SD = 0.90$), which is lower than the average income in Israel. Parents' professions were mainly in unskilled jobs and they worked, for example, as cleaners, hairdressers, office workers, etc. Parents reports showed that, on average, there is one computer at home in these communities. Reading a printed book to the target child was reported as twice a week, and parent–child engagement or work with a computer with the target child was reported as once a week.

The children and their mothers were randomly assigned to one of three groups (30 dyads in each): (1) reading the printed book *Yuval Hamebulbal*; (2) reading the e-book *Yuval Hamebulbal*; (3) receiving the regular kindergarten program (control). A nearly equal number of boys and girls were represented in each of the three groups.

Materials

Books

The printed book. The children's book used in this study is called *Yuval Hamebulbal* (*Confused Yuval*) (Roth, 2000). Four children's literacy experts selected this as a good book for work with children in the target age range. The story's structure and simple narrative elements – setting, characters, goal/initiating event, problem and solution/ending (Mandler & Johnson, 1977) – appear eminently suitable for preschoolers. The story's protagonist is Yuval, a young boy who tends to be confused and forgetful until his grandmother makes a special hat for him to help him remember. A large colored drawing covering more than half of the page appears on each of the book's 15 pages, as do three to five written sentences totaling about 40 words. The written text is printed in dotted letters (*nekudot* in Hebrew), so that the children can also relate to the printed text.

The e-book. The e-book used in the research is based on the printed book *Yuval Hamebulbal*. It was designed by the authors to capture principles that were found to be especially beneficial for developing literacy, while avoiding drawbacks identified in standard e-books (de Jong & Bus, 2003). We scanned the pages from the printed book for the e-book in order to maintain similarity between the versions. The narrator explains the different options for activating the story in the electronic version. The children are offered three channels or options: (1) read story only, (2) read story and play, (3) read story with dictionary. The children in this study worked only on the 'read story and play' and 'read story with dictionary' channels. All channels include an oral reading of the printed text by a narrator. The e-book incorporates automatic dynamic visuals that dramatize story details, fragments and the complete story scene as well as extra music and film effects that may 'bring the story content to life'. The e-book has a forward button (a colored arrow that points to the right) and a backward button (an arrow that points to the left) on each screen in order to stimulate the children's reading orientation and involvement, thereby allowing them to return to previous screens or continue to the next one. A function that allows the children to re-read/re-listen to the text is also available. The highlighting of written phrases as the text is declaimed is designed to focus the children's attention on the relationship between the text and the oral reading, thus supporting their exposure to the written text and perhaps word recognition (de Jong & Bus, 2002).

The 'read story and play' channel was designed to enhance the children's story understanding and phonological awareness. Its interactive functions enable the children to activate the story by clicking on hidden hotspots as they appear on (a) characters or objects and (b) words appearing in the text. However, the hotspots were programmed so that the children could activate them only after reading/listening to the text on each page,

since we did not want the hotspots to distract the children from listening to or reading the story. Activation of the characters or objects was designed to enrich story comprehension by means such as a discourse between the main characters, voice and sound effects. The inclusion of hotspots of words was also aimed at promoting the children's phonological awareness of syllabic and sub-syllabic levels. For example, when the word 'Yuval' (the hero's name in *Confused Yuval*) is shown, it is divided into syllables and sub-syllables, which the narrator reads out loud.

The 'read story with dictionary' channel offers explanations of difficult words that appear automatically on the screen after the entire page has been read by the narrator and the children can reactivate these words.

Measures

Children's language skills

Word comprehension. The children were asked the meaning of the 10 words from the story's text which appeared in the dictionary mode of the e-book. These words were judged to be relatively difficult for children of this age. The children were asked to choose the picture that best illustrates the word's meaning out of a set of four pictures. The total score for this task ranged from 0 to 10. The alpha score for this measure was .64

Phonological awareness. Phonological awareness was measured using 12 two-syllable words and 12 sub-syllabic words. In each set, six of the words appeared in the target book and the other six words were frequent Hebrew words. The words were presented to the children orally, one at a time, and the children were asked to repeat them in a syllabic and then in a sub-syllabic manner, breaking each word into three parts (e.g., the word *gadol* [big] should be divided into *ga-dol* for the syllabic and *ga-do-l* for the sub-syllabic). The sub-syllabic level is a conjunction of a phoneme (consonant) and a vowel which, according to Hebrew grammar, is sometimes considered a syllable and sometime as less than a syllable. This unit is between a syllable and phoneme. It is smaller than a syllable but bigger than a phoneme. We decided to ask the children to segment words only into sub-syllables (and not also into phonemic components), since in Hebrew, this super-phonemic level – the sub-syllable (e.g., *gadol* to *ga-do-l*) – is more accessible for segmentation than phonemes (e.g., *g-a-d-o-l*) (see Share & Blum, 2005). Before testing, the children practiced the task with two examples presented by the researchers. Each correctly repeated word received a score of 1. Incorrect answers were scored 0. Thus, the total range of scores for the 12 words was 0–12 for the syllabic and 0–12 for the sub-syllabic part. The inter-rater reliability across two raters using Cohen's kappa was .90 for the syllabic and .84 for the sub-syllabic part.

Mothers' support level. The interaction was segmented into verbal units. A verbal unit constitutes the smallest unit of meaning and is usually comprised of sentences. This method was previously used by Bus et al. (2000) and by Korat et al. (2007). Content was coded only when a new subject was added to the previous discourse. Topic units were classified into nine levels of content categories, from low (1) to high (9), as follows: relating to (1)

objects in illustrations, (2) action of characters or objects, (3) text to illustrations, (4) details in illustrations not in text, (5) text paraphrasing, (6) word meaning, (7) personal experience, (8) text comprehension via distancing and (9) language or print. The hierarchy of the levels was determined by 'moving from concrete immediately available information' (De Temple & Snow, 1996, p. 54) to higher cognitive or abstraction processes, called 'distancing' by Sigel (1982). Each unit was coded into only one of the nine categories. In a few cases in which a unit referred to more than one category, a decision was made by the two raters after a discussion on the category to which it seemed to fit better. This coding system, based Bus et al. (2000), was modified for the purposes of the current study. We added the category 'word meaning' and distinguished it from 'paraphrasing' in order to differentiate between these two behaviors. In the word meaning behavior the mothers gave more precise explanations (similar to a dictionary) to specific words, whereas paraphrasing was a more general explanation for part of the text. We also placed the category 'promoting text comprehension via distancing' at a higher level of cognitive support than 'promoting text comprehension via paraphrasing'. Table 1 presents examples of the mothers' support levels while book reading with their children

Each verbal unit that could be classified into the nine content categories was given a score ranging from 1 = low (naming characters and objects) to 9 = high (relating to language or the written system in the book). Inter-judge reliabilities based on two independent raters for sorting content units were computed based on a random selection of 10% of the dyads. Reliability for the overall scale measured by Cohen's kappa was $k = .86$, $p < .001$ (range $k = .81$, $p < .001$ to .90, $p < .001$).

Procedure. Data were collected in three sessions: pretest, intervention and posttest. Children were tested in pretest and posttest in word comprehension, syllabic awareness and sub-syllabic awareness tests.

Pretest. All children were pretested in their kindergarten individually for approximately 15–20 minutes.

Intervention. All mothers were visited in their home by the researcher. They were given the target book (electronic or printed book according to the group to which they were assigned) and were asked to read it to their children during the next 2 weeks in five different sessions. The mothers were asked to hold the sessions 2–3 days apart. They were also given recommendations on how to read the books with their children. Suggestions for support in book reading followed principles developed in previous research (Korat, Ron, & Klein, 2008), following Vygotsky's theory (1978). The reading instructions included raising questions about the story content (problems, solutions), learning new words, pointing to the written text while reading, playing with words (rhyming, dividing into syllables and sub-syllables) and reading important words that were repeated in the text. The e-book we used was programmed to support these activities, while stickers were placed in the printed book in order to remind the mothers to work on these activities with the children.

For example, it was suggested that mothers explain new words to the children, and they were given a list of the dictionary target words in the book. They were also given a

Table 1. Examples of mothers' instruction levels while book reading with their children.

Mediation level[a]	Example
1. Relating to objects in illustration	On the screen/page a picture of a chameleon. M: (points to the picture on the screen and says) Here you see. This is a chameleon. What color is the chameleon? C: Green.
2. Action description of characters or objects	On the screen/page a picture of the child Yuval carrying his toy rabbit. The child points to the rabbit. M: (pointing to the rabbit). Yes, he takes him to the kindergarten.
3. Relating text to illustrations	The text says: 'He enters the kindergarten very happy.' M: Look at the picture, how happy he is.
4. Relating to details in illustrations not in text	The narrator/text says: 'Everything is very confusing here.' M: (points to the picture on the screen/page showing a cup and a jar of Nescafé). Look at the nice cup of coffee.
5. Promoting text comprehension via paraphrasing	The narrator/text says: 'What funny pants. They became so small, after Yuval put both of his legs into one pant leg, and the other pant leg is empty …' M: He pushed both of his legs into one of the pant legs so it is jam-packed. C: Yes, he is so funny…
6. Word meaning	M: What is Tzara [trouble in Hebrew]? C: I don't know. Tzara is trouble. M: A problem.
7. Relating to personal experience	The narrator/text says: 'Yuval cannot find his hat.' M: He cannot find his hat. Does it remind you of somebody? C: Yes. Me. (Laugh). M: Yes … remember when were looking for your hat and it was on your head.
8. Promoting text comprehension via distancing	The narrator says: 'A cold wind was blowing in the street, and in his hat everything was good and warm.' M: Grandma knitted a warm hat made of wool for him. For winter, hats should be warm, not like in the summer.
9. Relating to language or print	M: Look, something is written here on the hat (pointing to the word hat). The child says 'ha … hat … hat'. M: Great, very nice.

[a]From level 1 = lowest to level 9 = highest.

list of words and it was suggested that they play with these words when they appear in the text by dividing them into group of sounds (syllables and sub-syllables). Three examples on how to implement the support were given to each mother, together with her child.

The mothers were given a printed chart which they were asked to fill for reporting on their reading to their children (date, hour, short description and remarks), in order to encourage the mothers and children during the reading sessions. The mothers were told that their fifth reading session would be videotaped by the researchers.

Reading the e-books included two channels, 'read and play' and 'read with dictionary'. The mothers were told that each session should last 20 minutes. In the first session they were asked to first read the 'read and play' channel to the child, followed by the 'read with dictionary' channel, allowing 10 minutes for each channel. In the second session they were asked to read only the 'read with dictionary' channel for 20 minutes. In the third session they were asked to first read the 'read with dictionary' channel with the child and afterwards the 'read and play' channel, again allowing 10 minutes for each channel. In the fourth session they were asked to read the 'read and play' channel for the entire 20 minutes. In the last and fifth session they were asked to first read the 'read and play' channel with the child, followed by 'read with dictionary', allowing 10 minutes for each channel. This design created four repeated readings for each channel.

Videotaping the mother–child reading session. The fifth mother–child story reading (printed/electronic) session was videotaped in the participants' homes.

The mother–child book reading interaction took place in the participants' chosen place at home (the living room, the child's room, or the kitchen). Almost all mothers preferred the living room, which they found as a convenient place for the activity. The researcher asked the mother to read the book with her child as she did in the previous sessions. A VHS camcorder placed at the far end of the room videotaped the session. For the e-book session, an additional VHS camcorder was used in order to videotape the computer screen. In most cases, mothers and children succeeded in ignoring noise which came from outside the home, and in a few cases when the noise came from inside the home, the mothers stopped it by request. The dyadic interactions were transcribed verbatim and the transcripts were used to code the interactions.

Posttests. All children were post-tested in their kindergarten individually in the same tests they received in the pretests.

Results

We examined three aspects of children's language performance: word comprehension, syllabic awareness and sub-syllabic awareness). Descriptive statistics (means, *SD*s) are presented in Table 2. Each dependent variable was submitted to a 3 (group: printed book, e-book, control) × 2 (time: pretest vs posttest) ANOVA, with repeated measures on the latter factor.

Word comprehension

Significant differences, $F(2,87) = 3.22$, $p = .04$, $\eta_p^2 = .07$, were found in the pretests between the children's scores in the three groups, indicating that the groups differed on the measured word comprehension. Pairwise comparisons showed that children who worked with the printed book ($M = 52.50$, $SD = 3.40$) had higher scores than children from the

Table 2. Means (and standard deviations) of children's pre and post scores (in percentages) by intervention group (N = 90).

	Pretest			Posttest		
	Electronic	Printed	Control	Electronic	Printed	Control
Word meaning	47.50	52.50	40.40	72.00	75.40	47.50
	(16.86)	(20.34)	(18.20)	(20.40)	(20.10)	(22.40)
Syllabic awareness	65.55	69.40	68.00	77.50	74.16	62.50
	(29.00)	18.20)	30.14)	20.10)	26.00)	(32.00)
Sub-syllabic awareness	17.50	20.55	11.40	28.90	26.70	6.40
	(24.80)	24.92)	(14.10)	(27.50)	(29.00)	(9.20)

control group ($M = 40.40$, $SD = 3.40$). The time × group interaction was significant, $F(2,87) = 5.19$, $p = .007$, $\eta_p^2 = .11$. A Bonferroni test showed a significant increase in the children's scores in the e-book and the printed book (e-book: $M = 52.50$, $SD = 20.34$; printed book: $M = 47.5$, $SD = 16.87$) to posttest (e-book: $M = 75.42$, $SD = 20.10$; printed book: $M = 72.08$, $SD = 20.41$), but no significant change was found in the control group.

Syllabic knowledge

No significant differences, $F(2,87) = 0.14$, $p = .87$, were found in the pretests between children's scores in the three groups, indicating that the groups were well matched on the measured syllabic knowledge. The time × group interaction was significant, $F(2,87) = 6.92$, $p = .002$, $\eta_p^2 = .14$. A Bonferroni test showed a significant increase in the children's scores in the e-book group from pretest ($M = 65.55$, $SD = 29.00$) to posttest ($M = 77.50$, $SD = 20.10$). No differences were found between pretests and protests on electronic book and control.

Since we used two types of words for the syllabic awareness, six from the book and six not from the book, we performed a three-way ANOVA ((2) type of word: from the book/not from the book × (3) group (e-book reading/printed book reading/control) × (2) time (pre and post)) to test whether children's progress was related to word type. The results indicated a significant effect for word type, $F(1,87) = 31.40$, $p < .001$, $\eta_p^2 = .26$. Overall, children succeeded with words not from the book ($M = 74.53$, $SD = 3.25$) (scores are in percentages) more than with words which were from the book ($M = 64.53$, $SD = 2.58$), time × group interaction was significant, $F(2,87) = 6.70$, $p < .001$, $\eta_p^2 = .13$. No interaction was found for type of word and time, $F(1,87) = 2.41$, $p = .12$, $\eta_p^2 = .2$, nor for type of word, time and group $F(1,87) = 1.29$, $p = .28$, $\eta_p^2 = .02$. This means that children's progress in syllabic awareness for words that they encountered in the book reading was similar to new words in which they were not trained in the intervention.

Sub-syllabic knowledge

No significant differences, $F(2,87) = 1.36$, $p = .26$, were found in the pretests between the children's scores in the three groups, indicating that the groups were well matched on

the measured sub-syllabic knowledge. No significant differences were found for time, $F(1,87) = 2.00$, $p = .16$, but significant differences were found between groups, $F(2,87) = 6.52$, $p = .002$, $\eta_p^2 = .13$. It seems that the major source of difference is the difference between the control group score and the other two reading group scores. The interaction between time and group was of borderline significance, $F(2,87) = 2.69$, $p = .074$. Bonferroni tests showed that the children's scores on sub-syllabic skills were significantly higher in the posttest of both intervention groups: reading with e-book ($M = 28.90$, $SD = 27.50$) and reading with printed book ($M = 26.70$, $SD = 28.90$) compared to the control group ($M = 6.40$, $SD = 9.20$). A planned comparison indicates that these mixed differences were only significant for the printed book reading, $F(1,87) = 4.98$, $p = .03$, while the differences over time in the other two groups were non-significant (e-book: $F(1,87) = 1.44$, $p = .23$, control: $F(1,87) = .96$, $p = .33$).

As in the case of syllabic awareness, the sub-syllabic awareness test also contained six items from the book and six not from the book. Here too, we performed a three-way ANOVA ((2) type of word: from the book/not from the book × (3) group (e-book reading/printed book reading/control) × (2) time (pre and post)) to test whether children's progress was related to word type. The results indicated no significant effect for word type, $F(1,87) = 1.93$, $p = .16$, $\eta_p^2 = .02$. No interaction was found for type of word and time, $F(1,87) = 2.20$, $p = .14$, $\eta_p^2 = .2$, or for type of word, time and group, $F(2,87) = .80$, $p = .44$, $\eta_p^2 = .01$. These results indicate that children progressed in sub-syllabic awareness for new words in which they were not trained in the intervention as in words that they encountered in the book reading activity.

Mothers' support

Because our topic units' analysis of mothers' support yielded small representations in each of the nine categories, we grouped them into three general levels. The low level (level 1) included levels 1–3: (1) objects in illustrations, (2) action of characters or objects, (3) text to illustrations. The middle level (level 2) included levels 4–6: (4) details in illustrations not in text, (5) text paraphrasing, (6) word meaning. The high level (level 3) included levels 7–9: (7) personal experience, (8) text comprehension via distancing, (9) language or print. We performed a one-way ANOVA for comparing the mothers' support levels by book reading activity, i.e. printed compared to e-book reading. Table 3 presents the mothers' support levels in the two intervention groups.

As can be seen, there were no significant differences between groups in respect of either the low or the medium levels of support. However, mothers' use of the high level of support was significantly greater in the e-book group.

Predicting children's language skills

In order to elucidate what contributes to children's progress in language skills, we performed a two-step hierarchical regression analysis for each of word comprehension, syllabic awareness and sub-syllabic awareness knowledge. In the first step, we included background parameters: mothers' education level, parent–child book reading frequency, parent–child work on computer and child's level in the pretest. In the second step, we

Table 3. Means (and standard deviations) of maternal mediation level by intervention group.

	Electronic (*n* = 30)	Printed (*n* = 30)	One-way ANOVA
Low	3.90	6.20	$F(1,58) = 1.04, p = .31$
	(6.50)	(10.33)	
Medium	66.10	75.50	$F(1,58) = 2.94, p = .09$
	(21.55)	(20.80)	
High	30.00	18.30	$F(1,58) = 5.11, p = .03$
	(20.35)	(19.60)	
	100	100	

Table 4. Regression analysis prediction of children's improvement in word comprehension.

	First step	Second step
	Beta	Beta
Maternal education	−.13	−.08
Frequency of joint computer work	.07	−.05
Frequency of joint book reading	.10	.10
Children's pretest word meaning level	−.39**	−.50***
Electronic book reading compared to control	−	.43***
Printed book reading compared to control	−	.46***
R^2	.19**	.36**
ΔR^2	.19**	.17**

**p < .01, ***p < .001.

entered each experimental group, comparing its progress to the control group in order to examine the extent to which the activity with the books contributed to their progress beyond the children's background. Because mothers' support did not correlate with the children's language progress, we did not include it in the regression. Tables 4–6 present the regression models for each language skill separately. The regression models were run in two steps. The first step includes only child characteristics and prior performance, while the second step includes the effect of the intervention (electronic and printed books) vs control (none).

Word comprehension

Table 4 shows a significant contribution to the prediction of word comprehension, $F(6,83) = 7.68, p < .001$. The first step contributed 19% of the variance in the children's growth, while the variable that contributed to this progress was the children's pretest measure. This variable has a negative beta value, which means that the children with the lowest pretest scores were those who progressed the most. In the second step, we can see that both interventions significantly contributed another 19% to the children's progress in word comprehension compared to the control, beyond the contribution in the first step.

Table 5. Regression analysis prediction of children's improvement in syllabic awareness.

	First step	Second step
	Beta	Beta
Maternal education	.26**	.29**
Frequency of joint computer work	−.09	−.20*
Frequency of joint book reading	.13	.11
Children's pretest syllabic awareness level	−.35***	−.32***
Electronic book reading compared to control	–	.46***
Printed book reading compared to control	–	.31**
R^2	.25***	.40***
$R^2\Delta$	.25***	.15***

**p < .01, ***p < .001.

Table 6. Regression analysis prediction of children's improvement in sub-syllabic awareness.

	First step	Second step
	Beta	Beta
Maternal education	.07	.08
Frequency of joint computer work	.13	.05
Frequency of joint book reading	.02	.002
Children's pretest sub-syllabic awareness level	−.52***	−.56***
Electronic book reading compared to control	–	.32**
Printed book reading compared to control	–	.29**
R^2	.29***	.38***
$R^2\Delta$	.29***	.09**

**p < .01, ***p < .001.

Syllabic skills

Table 5 shows a significant contribution to the prediction of syllabic skills, $F(6,83) = 9.06$, $p < .001$. The first step contributed 25% of the variance in the children's syllabic skills. The variable that contributed to the progress was maternal education as well as the children's pretest measure. Children's pretest level has a negative beta value. This means that the children with the lowest pretest scores who have mothers with higher education levels were those who progressed the most in syllabic skills. In the second step we can see that both interventions significantly contributed another 15% to the children's progress in word comprehension compared to the control, beyond the contribution in the first step.

Sub-syllabic skills

Table 6 shows also a significant contribution to the prediction of sub-syllabic skills, $F(6,83) = 8.37$, $p < .001$. The first step contributed 29% of the variance in the children's

syllabic skills. The variable that contributed to the progress was the children's pretest measure. This variable has a negative beta value, which means that the children with the lowest pretest scores were those who progressed the most. In the second step we can see that both interventions significantly contributed another 9% to the children's progress in sub-syllabic awareness compared to the control.

Discussion

We researched the extent to which mother–child book reading using an electronic or a printed book format can promote language skills (word comprehension and phonological awareness) of LSES pre-kindergarten children (aged 3–4 years), as compared to controls who did not receive any book reading intervention. As hypothesized, the children in both intervention groups showed greater language knowledge skills following the intervention compared to the control participants. No difference was found in children's language progress in the group that read the e-book compared to the group that read the printed book.

Although mothers who worked with their children with the e-books did show higher levels of support in the activities, this behavior did not contribute more to the children's final language performance. Furthermore, children's initial level in the pretest in all language measures contributed to their language progress following the intervention, beyond all background parameters. Only in the case of syllabic skills did higher educated mothers contribute to the children's progress together with the children's initial level. Children who started with the lowest grades were those who made the greatest progress in all parameters. Both book reading activities (electronic and printed) contributed significantly to the children's language level beyond the background measures.

In agreement with Vygotsky (1978), and congruent with our assumptions, the mother–child book reading activity supported children's vocabulary learning and phonological awareness. These two skills are considered to be the basis for literacy development in the early years and beyond (Whitehurst & Lonigan, 2001). These results could be considered surprising, due the small number of reading sessions that took place in the intervention programs, and especially due to the short support/instruction that the mothers were given by the researchers prior to the intervention. Furthermore, the effect of phonological awareness on both syllabic and sub-syllabic skills appeared not only for the words that the children worked on during the intervention, but also for new words which did not appear in the books. This shows a possibility of processes of transference in these young children's learning.

Although we have evidence for English (Chera & Wood, 2003) and Dutch (Segers & Verehoven, 2002) speaking children that benefited from e-book reading in learning new words and in phonological skills, phonological and grammatical variations do exist between Hebrew and other languages. It may therefore be premature to generalize the current results to other languages, in the specific measures used in this study, but the results are promising and indicate that further research in other language-learning contexts is warranted.

Most of the mothers in the present study had a low education level (high school graduates, with no formal learning beyond this level). The two-step regression shows that the

activity with books was effective beyond the mothers' education level. Only in one case, i.e. the syllabic measure, did mothers with a higher education contribute significantly to their children's progress. This demonstrates that the suggested activity has a good potential for augmenting young children's language knowledge and for showing good results after a short intervention. Previous studies with LSES parents who read printed books to their children without any prior instruction did not show any special contribution to the children's language and literacy, while a similar activity in MSES families showed a significant contribution (around 10%) to the children's language skills (Korat et al., 2007, 2008). The current research clearly shows that with a little guidance to parents (about one hour), LSES parents can be more tuned to their children and can support their language skills in a familiar book reading activity. Evidence shows that this is true for LSES, including immigrant children in other languages and countries (see Segers & Verehoven, 2002; Verhallen, Bus, & de Jong, 2006).

We found no specific advantage in the children's progress following the mother–child e-book reading compared to the printed book reading. These results might be related to the very similar instruction that the mothers were given in both activities. The advantage of the e-book in terms of vocabulary teaching using the digital dictionary and especially the advantage of the phonological awareness activity in the e-book (playing with words from the story) were also given to the children in the printed book reading context. This similarity probably created parallel support behavior which affected the children's language skills to the same extent. Mothers who worked with their children on the e-book showed higher support levels compared to those who read the printed book with their children. When reading the e-book, mothers tended to use high levels of support, including discussing the children's personal experience, elaborating content comprehension via distancing and discussing language and print in the book. This behavior appeared significantly more in the e-book reading than in reading the printed book. This phenomenon could be explained by the special effects of the software that used hidden hotspots supporting the text content. Since this was given by the software, the mothers may have felt that they had more room to discuss the story content beyond paraphrasing, and to lead discussion on personal experience, story comprehension at higher levels (e.g., prediction questions) and discussion on language or print. If this is indeed the case, the support with the e-book could be regarded as a good tool for augmenting parents' support in shared storybook reading, and especially for parents from LSES communities. However, as noted above, although a higher level of support in the e-book context is important, it did not improve the children's language skills to a greater extent than reading the printed book. These results might be related to the small (five) number of sessions of joint readings, which might be not sufficient for presenting the advantage of e-book reading compared to printed book reading. Looking at the gap between the children's pre and post scores, those who worked with their mothers with e-books showed greater progress than those who worked with the printed book in all variables: word comprehension (e-book reading M = 24.50; printed book reading M = 22.90), syllabic awareness (e-book reading M = 9.95; printed book reading M = 4.76) and sub-syllabic awareness (e-book reading M = 11:40; printed book reading M = 6.15), although this progress did not reach significance. This hypothesis should be tested in future studies. Future studies should also

use larger groups of participants, which might show clearer results regarding the above-mentioned tendency.

Another finding of this study was that children who demonstrated the least prior knowledge in each language skill were those who benefited the most from the reading sessions. These results are important, since they show that mothers' interventions with both book formats were especially supportive for those young children who needed this help the most. These results go hand in hand with previous intervention programs that present good results regarding LSES children's progress following intervention programs with parents (Aram & Levin, 2006; Blom-Hoffman, O'Neill-Pirozzi, Volpe, Cutting, & Bissinger, 2006; Whitehurst & Epstein, 1994). Our results add to existing studies that show that using a short intervention program with e-books, even with minimal parental support, could make a difference for such young children who are prone to literacy failure.

One limitation of the current study should be taken into account in future studies. Only one exemplar of each type of book was used. Some of the results are consistent with predictions. However, further research is required to confirm the generality of the pattern found regarding the e-book compared to the printed book reading. Furthermore, the question of whether the improvement which was found among the experimental groups will persist over time is a very important one that calls for further research.

It is important to note that excellent or poor materials in any format could have implications for the quality of the interactions they elicit. This is especially true for the e-book format, since many e-books that are available on the market were proven to be inefficient for language and literacy learning and sometimes are even counterproductive for young children (de Jong & Bus, 2003; Korat & Shamir, 2004; Shamir & Korat, 2006).

The conclusion from the current study is that books in an electronic medium affect mothers' support to their children. The e-book encouraged the mothers to use higher expanding behaviors compared to the printed book. The findings in the e-book context support our claim regarding the potential of this medium to contribute to the quality of mothers' support.

The results of the present research are a first step in looking at the support of parents to their children during joint reading of an e-book and its effect on children's language. Our findings point to the need to continue building and improving electronic programs which support young children's language and literacy. There is also a need to guide adults, including parents, on the potential of this software and its possible use for supporting children's language.

Taking into account the dramatic growth in uptake of e-books, including those targeted at young children, as well as the increasing use of this format (36 minutes a day), it is timely to learn more about young children's use of this option in an individual and a social context. This study contributes to our knowledge on the potential benefits of e-book reading with parents. Shared book reading may be beneficial to young language learners whether the medium of delivery is the traditional printed book or the increasingly popular e-book.

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