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Reading electronic and printed books with and without adult instruction: effects on emergent reading

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Abstract The effects of electronic book (e-book) and printed book reading on children's emergent reading with and without adult instruction were investigated. One hundred twenty-eight 5- to 6-year-old kindergarten children from low SES families were randomly assigned to one of four groups (32 children each): (1) independently reading the e-book (EB); (2) reading the e-book with adult instruction (EBI); (3) reading the printed book with adult instruction (PBI); and (4) receiving the regular kindergarten program (control). The three intervention groups included four book-reading sessions each. Pre- and post-intervention emergent reading measures included concept about print (CAP), word reading, and phonological awareness. The results showed that the EBI group achieved greater progress in word reading and CAP than all other groups. The EBI group also achieved greater progress in phonological awareness than the EB and the control groups. Implications for future research and for educators are discussed.

Keywords Electronic book · Printed book · Emergent literacy · SES · Kindergarteners

Introduction

Use of the computer has become common among young children in educational settings, such as kindergarten and school (Backingham & Scanlon, 2003). Researchers claim that since children regard computer technology as natural and as part of their life, educators can take advantage of computers even in kindergarten in order to promote different fields of learning (Wachob, 1993), including emergent literacy. This field relates to the early steps that young children take in the "written world" in

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reading and writing before formal learning at school (Clay, 1966; Ferreiro & Teberosky, 1982; Whitehurst & Lonigan, 1998).

Electronic books

Electronic books, which are also known as living books or CD-ROM books, are among the computer programs that emerged into young children's world in the past decade. Many e-books are digital versions of classic children's books which were published in a printed format. In most cases the text and illustrations are presented as in the printed version, but integrate multimedia features, such as animation, music, sound effects, illuminated text, and reading of the text out loud by a narrator (de Jong & Bus, 2003; Labbo & Kuhn, 2000; Reinking, 1997).

It has been suggested that many of the e-books that exist in the commercial market emphasize multimedia, colors, sounds, and graphics, but are not necessarily suitable for promoting young children's language and literacy (de Jong & Bus, 2003; Korat & Shamir, 2004; Shamir & Korat, 2006). For example, many of the commercial e-books do not have the option in which the text is highlighted congruently with the narrator's reading. This option is important because it can help children track the text, and this may promote their concept about print (CAP) and reading ability. Furthermore, many of the commercial e-books do not contain the option to see and hear how words from the text can be divided into their sounds. This option may support children's phonological awareness.

Inconsistent results were found in studies that compared the contribution of a child independently reading an e-book to the child's emergent literacy, as compared with an adult reading a printed book to the child. Some studies showed a greater contribution of the e-book reading (de Jong & Bus, 2002; Segers, Takke, & Verhoeven, 2004) and some found a similar contribution of both contexts (de Jong & Bus, 2004; Korat & Shamir, 2007; Wood, 2005). One of the explanations for these results may be related to the quality of the commercial e-books, which are not necessarily suitable for promoting young children's language and literacy (de Jong & Bus, 2003; Korat & Shamir, 2004).

Educational e-books

In the present study we used educational e-books which aim to promote emergent literacy (Korat, 2009; Korat & Shamir, 2007, 2008; Shamir, 2009; Shamir & Korat, 2007). Our emphases when developing these books were to support children's print awareness when working with the software. Emphasis was made on the size and font of the text (big and clear) and on the optimal amount of text which appears on each page. The text was highlighted congruently with the narrator's reading (at the word level), in order to help children connect between the written and the spoken text and thus promote reading ability and CAP. Clicking on specific words enables listening to the sound of the words at the syllabic and sub-syllabic levels in order to promote the children's phonological awareness.

The first series of studies which tested the effectiveness of these programs yielded inconsistent results regarding their efficacy in promoting kindergarten children's spoken language and emergent literacy. Some of the studies showed improvement in children's oral language (Korat, 2009; Korat & Shamir, 2007, 2008; Shamir, 2009) and emergent literacy (Korat & Shamir, 2008; Shamir & Korat, 2007), while others did not find such improvement in these two aspects (Korat & Shamir, 2007; Shamir & Korat, 2007). It is important to note that researchers who tested the effectiveness of e-books designed especially for supporting children's literacy reported consistent improvement of oral language (e.g., vocabulary and story comprehension; Lewin, 2000; Segers, et al., 2004; Segers & Verhoeven, 2002, 2003) and inconsistency regarding emergent literacy (e.g., word reading and phonological awareness; Chera & Wood, 2003; Lewin, 2000; Wood, 2005). Following these results, we suggested that young children may need some augmentation via adult instruction in order to gain more effective results in emergent literacy skills compared to oral language.

Adult instruction

The current study is based on the socio-cultural school of Vygotsky (1978) and neo-Vygotskians, such as Rogoff (1990) and Wertsch (1984), who proposed that culture shapes the mind, especially in collaboration with more experienced others. Adult instruction for children constitutes a central factor in literacy development (Whitehurst & Lonigan, 1998). Learning that is intentionally instructed 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, 1980; Klein, 1996; Vygotsky, 1978).

Research on adult literacy-promoting contexts has focused mainly on joint printed storybook reading (Aram & Biron, 2004; Korat, Klein, & Segal-Drori, 2007; Sénéchal & LeFevre, 2002), and assumes that this activity can set the stage for future differences in children's literacy and academic achievements (Phillips & Lonigan, 2005). Reading the same book repeatedly to young children was found to support their oral language abilities and their emergent literacy knowledge (e.g., CAP, orthographic knowledge; Aram, 2006; Aram & Biron, 2004; Sénéchal, 1997; Whitehurst, et al., 1999). However, similarly to results on reading e-books individually, evidence for emergent literacy is inconsistent and limited (Stahl, 2003).

There are several researchers who claim that adult instruction (or mediation) is necessary in order to promote young children's accomplishments while working on a computer in addition to the children's independent activity (Nir-Gal & Klein, 2004; Tzuriel & Shamir, 2002). According to these researchers, human mediation might provide qualitative teaching which is adjusted to the child from the cognitive and emotional aspects, support which is not necessarily given through the computer's teaching. The adult, as opposed to the computer, is capable of being sensitive to the child's wills, abilities and level of understanding. The adult can change and adjust his behavior to the child's immediate needs, incorporating his

previous acquaintanceship with him/her and the goals he/she set for the future (Klein, 1996). Researches who compared children who worked on the computer with adults to children who worked on the computer independently found greater improvement in cognitive abilities in the former group (Miller & Emihovich, 1986; Nir-Gal & Klein, 2004; Samaras, 1996).

Taking all of these findings into account, it seems important to investigate whether reading an e-book with adult instruction will have a more significant effect on young children's literacy than reading an e-book without adult instruction or reading a printed book with adult instruction. The multimedia features of the e-book (e.g., text which is highlighted congruently with the narrator's reading and words that are divided into their sounds) can help the adult focus on emergent reading skills during the reading and may promote the children in these skills.

Because more and more young children today read not only printed but also electronic books together with adults, the time seems right for investigating the adult–child e-book reading activity and its effects on children's literacy. Our literature search showed that only few studies focused on this topic (Fisch, Shulman, Akerman, & Levin, 2002; Kim & Anderson, 2008; Smith, 2001). All these important pioneering researches were naturalistic, focused on a small sample, and did not examine the contribution of this activity to children's emergent reading. The investigation in the current study was quantitative and included a larger sample than in former researches. Moreover, we compared reading an e-book with adult instruction to children's independent e-book reading and to reading a printed book with adult instruction. These contexts represent authentic current environments for young children (Neuman, 1997) and it is interesting and important to examine the effectiveness of these activities on children's emergent reading.

Emergent reading

This study focused on three significant emergent reading skills: phonological awareness, CAP, and word reading. These skills have been investigated in many studies with reference to young children's emergent literacy development in general and also with reference to the field of e-books (Chera & Wood, 2003; de Jong & Bus, 2002; Korat, 2009; Korat & Shamir, 2007, 2008; Lewin, 2000; Mckenna, Reinking, & Bradley, 2001; Shamir, 2009; Shamir & Korat, 2007; Shamir, Korat, & Barbi, 2008; Wood, 2005).

The development of phonological awareness has been considered to be one of the most important fields for the last 40 years, due to its prediction of later literacy skills, especially in alphabetic languages (Byrne & Fielding-Barnsley, 1993). Studies showed that phonological awareness is a main predictor for the acquisition of reading (Byrne & Fielding-Barnsley, 1993; Speece, Richey, Cooper, Roth, & Schatschneider, 2004). Furthermore, intervention research on phonological awareness indicated improvement in children's reading development (Byrne & Fielding-Barnsley, 1993; National Institute of Child Health and Human Development, Early Child Care Research Network, NICHD–ECCRN, 2005; Stanovitch, 1993).

Concept about print is another important skill that was found to predict early reading acquisition (Levin, Share, & Shatil, 1996; Roth, Speece, & Cooper, 2002; Tunmer, Herriman, & Nesdale, 1988). For example, children's CAP level at the end of kindergarten predicted their reading comprehension in first grade (Shatil, Share, & Levin, 2000). Intervention studies demonstrated that children who practiced assignments of CAP promoted their ability in word reading at a later stage (Justice & Ezell, 2000; Share & Gur, 1999).

Emergent word reading before formal learning is also an important skill in the acquisition of reading. Kindergartners' word reading level was found to be related to phonological awareness and to writing unfamiliar words (Share & Gur, 1999). The word reading level in kindergarten also predicted reading and writing achievements in school (Korat, Bahar, & Snapir, 2003; Scarborough, 1998). The emergent reading level of Hebrew-speaking children in kindergarten explained 25% of the word reading (Aram & Levin, 2004) and reading comprehension in first grade (Aram & Levin, 2004; Shatil, 1997). Intervention studies showed that children who practiced assignments of emergent word reading in kindergarten promoted their ability in this skill as well as in phonological awareness, letter names and letter-sound correspondence in first grade (Blachman, Tangel, Ball, Black, & McFraw, 1999).

Emergent reading among low SES children

The current study focused on children from a low socio-economic status (LSES). Evidence that LSES children have a lower level of emergent reading than children from a high SES (HSES) is well established in the literature (Hecht, Burgess, Torgesen, Wagner, & Rashotte, 2000; Lonigan, Anthony, Burgess, & Barker, 1998). According to the international literacy test—PISA, 2002 the gap between the literacy level of children from a LSES and those from a HSES in Israel is the largest among the countries that participated in the research (Hablin, Walters, Wolf, Siag-Hadad, & Kemersky, 2004). Studies that were carried out in Israel showed that this gap begins in kindergarten (Korat, et al., 2003).

Israeli LSES children were also found to have a lower home literacy level in terms of materials (e.g., books, newspapers, literacy games) and in terms of parental instruction in book reading events (Korat, et al., 2007). Verhallen, Bus and de Jong (2006) claimed that books with multimedia features (e.g., e-books) may have a greater potential for contributing to the process of learning to read than books with static pictures (e.g., printed books) and that this is especially true for children who are at risk of having difficulties in learning to read. They found that LSES kindergartener's who read e-books with dynamic multimedia features independently promoted their vocabulary and story comprehension more than LSES kindergartener's who read e-books with static multimedia features independently.

The few studies which focused on LSES kindergartener's e-books reading and the effect of this activity on their emergent reading skills yielded mixed results. Some of the studies found that an independent activity with an e-book among LSES

kindergarteners promoted their word reading, phonological awareness, and CAP (Korat & Shamir, 2008; Shamir, et al., 2008), while others found that this activity promoted only the children who had a high initial emergent reading level (Korat & Shamir, 2007; Verhallen, et al., 2006). Following these results it is interesting and important to examine whether reading an e-book with adult instruction has a different effect on the emergent reading of LSES children compared with an independent activity with the e-book and compared with reading the same version of the printed book with adult instruction.

The present study

In the present study we investigated the extent to which reading a printed book with adult instruction (PBI), reading an educational e-book without adult instruction (EB), and reading an educational e-book with adult instruction (EBI) can promote LSES kindergarten children's (age 5–6 years) emergent reading (CAP, phonological awareness, and word reading). We hypothesized that the children's emergent reading following the intervention will exhibit an interaction with the type of intervention (EB vs. EBI and vs. PBI). Thus, children in the EBI group will exhibit greater emergent reading than the other groups. We also asked whether there will be a difference in progress in emergent reading of children in the EB group compared with the progress of children in the PBI group. No hypothesis was made regarding the last question.

Method

Participants

The sample consisted of 128 children from 12 kindergarten classes. The mean age of the children in the sample (in months) was 69.65 (SD = 4.14). A nearly equal number of boys and girls were represented in each of the four groups. All children attended kindergartens located in LSES neighborhoods. Neighborhood SES levels were determined according to the Israeli Municipalities' Statistical Report (Central Bureau of Statistics, 2005), which includes data such as the parents' education level, income level, housing density, PC ownership, etc. The means and standard deviations of the parents' demographic details are presented in Table 1. The data about age and school years is in years. The data about profession and occupation were transformed to a five-point scale (from 1 = low to 5 = high).

All the kindergartens which participated in the research had the same educational program. Formal reading and writing instruction in Israel begins in school, at the age of 6–7. In Israeli kindergartens, children are exposed to the written system, including storybooks and educational games, as well as to lists of letters, printed words and different texts that are displayed around the classroom. The children are frequently read to from storybooks and also tend to browse through books independently. Activities such as phonological awareness (e.g., rhyming games or

Table 1 Parents' demographic details (means and SD) by treatment group

	Control ($N = 32$)		EB ($N = 32$)		EBI ($N = 32$)		PBI ($N = 32$)	
	M	SD	*M*	SD	*M*	SD	*M*	SD
Age[a]								
Mothers	35.47	7.52	36.52	5.02	37.09	6.35	35.31	5.87
Fathers	38.63	7.68	38.70	5.42	37.75	7.16	38.47	5.32
Number of school years[a]								
Mothers	11.59	1.38	12.22	1.90	12.56	.91	12.08	1.91
Fathers	11.42	1.86	10.91	1.81	12.38	.91	11.52	1.98
Profession[b]								
Mothers	2.42	1.43	2.52	1.53	3.16	.92	2.78	1.39
Fathers	2.04	1.22	2.35	1.43	3.13	.83	2.13	1.07
Occupation[b]								
Mothers	2.06	1.44	2.13	1.49	2.88	1.04	1.94	1.32
Fathers	2.58	.95	2.57	1.12	2.84	.95	2.40	1.07

[a] In years

[b] Range = 1–5

segmenting words into syllables), letter discrimination, or letter copying are part of the repertoire of many kindergarteners (Shatil, et al., 2000).

Children in each of the kindergarten classes were randomly assigned to four different groups, and each group participated in four book reading sessions. The first intervention group (EB) read the e-book independently without adult instruction. The second group (EBI) read the e-book with adult instruction during the sessions and after them. The third group (PBI) was read the printed book with adult instruction during the sessions and after them. The fourth group received the regular kindergarten program and served as the control group. All children who participated in the study had initial experience with computers individually and in small groups as part of the curriculum.

The children's activity with the computer or the printed book took place in their kindergarten classes, working in pairs in a separate room. The work in small groups of two children was conducted according to results of studies that working in small groups plays a major role in promoting young children's literacy (Blok, 1999; Karweit & Wasik, 1996; Lauren & Allen, 1999). Working in pairs was found to promote young children's emergent literacy in the field of working with e-books (Shamir, 2009; Shamir & Korat, 2007; Shamir, et al., 2008). Working with two children enables them to get the maximum attention of the adult. Furthermore, the reality that exists in kindergartens is that children often work on computers in pairs (Lewin, 1998).

Each session in all three experimental groups lasted about 15–20 min. In the electronic groups each pair of children was shown how the software operates and was given the following instructions: "We have brought you an e-book that you can work and play with on the computer. You're invited to work with it together with your partner. Please take turns in sharing the mouse; one of you will use it on one page, then the other on the next page and so on. After you finish working, we'll ask you

some questions". The children were given technical support as needed and some were encouraged to go on and finish their session. In the EB group no other adult instruction was given during the sessions. In the EBI and PBI groups, instruction was given during and after the sessions. This instruction emphasized the promotion of emergent reading. For example, during the sessions with the electronic/printed book, the adult focused the child's attention on the sounds of 10 focal words from the text and divided them into syllables and sub-syllables. This activity took place repeatedly with the adult and the child with cards. The instruction emphasized the promotion of emergent reading following studies that indicate that discussion of print concept and emergent literacy aspects in shared book reading promote children's literacy skills (Bus & van IJzendoorn, 1988; Justice & Ezell, 2000; Justice, Pullen, & Pence, 2008; Korat, et al., 2007). The activities with the adult after the reading of the books were conducted with reference to the books that the children read before and the instruction that was given by the adult during the reading. The rationale for these activities was pedagogical. Repeated experiences and practices with the children in language skills in the books context were emphasized. These aspects are important in promoting young children's literacy and are mentioned in the Israeli Ministry of Education's (2007) national program for kindergarten.

The printed and educational electronic books

In the current research we used two books, each in a printed and an electronic version. Half of the children in the intervention groups read one book and half read the second book. The e-books were the electronic versions of *Yuval Hamebulbal* (*Confused Yuval*) by Miriam Rot (2000) and the electronic version of the printed book *Hatractor Beargaz Hachol* (*The Tractor in the Sandbox*) by Meir Shalev (1995). They were designed by the authors to capture general educational principles and those found especially beneficial for developing literacy, while avoiding the drawbacks identified in standard e-books (de Jong & Bus, 2003; Korat & Shamir, 2004; Shamir & Korat, 2006). The story's protagonist in *Confused Yuval* 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. The *Tractor in the Sandbox* relates the story of an old farmer (Uncle Aaron) and his special relationship with an old tractor. It takes its users on Uncle Aaron's adventures and exposes them to the touching relationship between the old man and his tractor. A large colored drawing covering more than half of the page appears on each of the two books' 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 story's structure and simple narrative elements—setting, characters, goal/initiating event, problem and solution/ending (Mandler & Johnson, 1977)—appear eminently suitable given the participants' age.

Main functions of the e-book

We scanned the pages from the printed books for the e-books in order to maintain similarity between the versions. An animated figure explains the different options

for activating the story in the electronic version. The children are offered two modes or options: (1) Read story only, (2) Read story and play. Each activation mode includes an oral reading of the printed text by an actor. The e-books also include automatic dynamic visuals that dramatize story details, sections and the complete story scene as well as extra music and film effects that may "bring the story content to life". The e-books have 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 the children 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 helps 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).

Description of the main modes

The "Read story only" mode includes an oral reading of the printed text as well as automatic dynamic visuals that dramatize story scenes, extra music, and film effects. The "Read story and play" mode was designed to enhance the children's story understanding and phonological awareness. Its interactive functions allow the children to activate the story by clicking on hidden hotspots as they appear on (a) characters or objects; and (b) on words appearing in the text. However, because we did not want the hotspots to distract the children from listening to or reading the story, they were programmed so that the children could activate them only after reading/listening to the text on each page. The activation of characters or objects was designed to enrich story comprehension by means such as a discourse between the main characters as well as voice and sound effects. The inclusion of hotspots of words 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 its syllables and sub-syllables, which the narrator reads out loud.

Research tools

Children's emergent reading level

The children's emergent reading level was assessed using several measures before and after the activity with the e-book/printed book.

Phonological awareness

Phonological awareness was measured using 12 two-syllable words which appeared in the target book. The words were presented to the children orally, one at a time, and the children were asked to repeat each word in a sub-syllabic manner, breaking it into three parts (e.g., the word *halon* ["window"] should be divided into *ha-lo-n*). The sub-syllabic level is a combination of a phoneme (consonant) and a vowel

which, according to Hebrew grammar, is sometimes considered a syllable and sometime less than a syllable. This unit 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 their 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 the phonemes (e.g., *g-a-d-o-l*; see Share & Blum, 2005). The scores ranged from 0 to 4 (from high to low) for each word, as follows: 4 = dividing with at least one sub-syllable (e.g., the word *halav* ["milk"] is divided into *ha-la-v*); 3 = dividing with no sub-syllable (e.g., the word *halav* ["milk"] is divided into *ha-la-av*); 2 = dividing into three parts but not by word sounds (e.g., the word *halav* ["milk"] is divided into *ha-la-t*); 1 = dividing into syllables (e.g., the word *halav* ["milk"] is divided into *ha-lav*); 0 = wrong answer or saying "I don't know". The total range of scores for this task was 0–48. The alpha score for this measure was .93.

Word reading

The children were asked to read nine words out loud, each of which appears frequently (4 to 7 times) in the books. The scores ranged from 0 to 4 (from high to low) for each word, as follows: 4 = correct reading of the word; 3 = reading that sounds almost like the word but is not correct (e.g., the word *hadod* ["Uncle"] is read *ha-da-vad*); 2 = correct reading of two sounds with no connection to their place in the word and their dotted letters (*nekudot* in Hebrew) (e.g., the word *hadod* ["Uncle"] is read *ha-do-ga*. The child receives points for the sounds *ha-do*; 1 = correct reading of one sound with no connection to its place in the word and its dotted letter (e.g., the word *hadod* ["Uncle"] is read *ha-ba-ga*. The child receives one point for the sound *ha*; 0 = reading another word or saying "I don't know". The total range of scores for this task was 0–36. The alpha score for this measure was .87.

Concept about print

A Hebrew adaptation of Clay's (1982, 1989) test of the convention of print by Shatil (2001) was used. It required children to answer 16 questions dealing with concepts such as page, line, writing, drawing, knowledge of book, and text handling (for example, where one begins and ends reading a book, a page, a line), as well as the direction in which reading proceeds (from right to left in Hebrew). Two questions were developed specifically for the Hebrew version, which related to the children's awareness of the presence, shape, and location of Hebrew diacritical marks. Each correct answer received a score of 1. The range of scores on this test was from 0 to 16. The alpha score for this measure was .78.

Results

Preliminary analyses of the overall pre-intervention early reading scores were performed using univariant analysis of variance by groups (EB, EBI, PBI, and

Table 2 Children's pre and post emergent reading scores in percentage (means and SD) by treatment group

	Control ($N = 32$)		EB ($N = 32$)		EBI ($N = 32$)		PBI ($N = 32$)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Phonological awareness	85.61 (16.85)	87.63 (12.38)	79.17 (19.34)	87.24 (12.38)	90.04 (8.38)	97.33 (6.13)	73.63 (24.47)	88.02 (14.36)
Word reading	26.82 (23.25)	27.34 (21.21)	16.41 (20.32)	18.32 (16.35)	23.09 (15.25)	83.85 (13.83)	26.48 (22.06)	31.42 (25.96)
Concept about print	59.38 (18.98)	59.18 (17.96)	54.88 (17.80)	63.09 (17.56)	67.77 (14.03)	92.19 (6.92)	40.82 (20.20)	52.73 (20.01)

control). The means and standard deviations of the children's scores are presented in Table 2 (pre–post test columns). Reference here is to the pre-test columns.

The results demonstrated significant differences between the groups before the intervention in two measures: Phonological awareness [$F(3,120) = 5.05$, $\eta_p^2 = .11$, $p < .01$] and CAP [$F(3,120) = 13.08$, $\eta_p^2 = .25$, $p < .001$]. The differences in phonological awareness were between the EBI group and the PBI group in favor of the former. The differences in CAP were between the PBI and the other three groups. The CAP achievements of the children in the PBI group were lower than the achievements of the children in the other three groups. A priori contrasts were performed in order to determine the improvement in the children's early reading measures as a function of their treatment group (EB, EBI, PBI and control). The analysis was conducted with control over the differences that were found between the groups in the pre-tests. Differences and standard errors of the improvement in the children's emergent reading scores by contrasts between the treatment groups are presented in Table 3.

The results demonstrated significant differences in improvement between groups in all three measures: Phonological awareness [$F(3,123) = 4.05$, $\eta_p^2 = .62$, $p < .01$], word reading [$F(3,123) = 144.12$, $\eta_p^2 = .78$, $p < .001$], and CAP [$F(3,123) = 30.21$, $\eta_p^2 = .45$, $p < .001$]. The differences in phonological awareness were between the EBI and the EB and control groups in favor of the EBI group. The differences in word reading and CAP were between the EBI group and the other three groups in favor of

Table 3 A-priori contrasts of children's emergent reading scores (differences and SE) by treatment group

	Control vs. EB	Control vs. EBI	Control vs. PBI	EB vs. EBI	EB vs. PBI	EBI vs. PBI
Phonological awareness	−1.57 (2.56)	−8.35* (2.55)	−4.04 (2.61)	−6.77** (2.60)	−2.47 (2.56)	4.31 (2.67)
Word reading	1.69 (3.50)	−59.14*** (3.45)	−4.32 (3.45)	−60.83*** (3.47)	−6.02 (3.50)	54.81*** (3.45)
Concept about print	−6.73 (3.02)	−27.73*** (3.05)	−5.21 (3.21)	−21.00*** (3.10)	1.52 (.63)	22.52*** (3.42)

* $p < .01$, ** $p < .05$, *** $p < .001$

the EBI group. Univariate one-way analysis of variance with Bonferoni corrections was also performed and the same results were found, except in the difference between the EBI group and the EB group in phonological awareness. In this case a tendency to difference was found in favor of the EBI group with a significance of .06.

Discussion

In the current study, we investigated the extent to which reading an educational e-book with adult instruction (EBI) and without adult instruction (EB), and reading a printed book with adult instruction (PBI) can promote LSES kindergarten children's emergent reading. The results showed that the EBI group exhibited greater progress in word reading and CAP compared to all other groups. The EBI group also exhibited greater progress in phonological awareness than the EB and the control groups. These results are unique, since to the best of our knowledge no research has compared the efficacy of reading an e-book with and without adult instruction in supporting very young children's emergent reading. No such comparison was carried out between these two conditions and reading a printed book to the child.

These results might imply that independent reading of an e-book, even though it is well planned for young children, might not be enough for achieving good levels of progress in emergent reading. The findings show that young children might need some augmentation by adult instruction in order to gain more effective results in emergent reading skills.

The present study's results revealed that adult instruction is an important parameter in the children's success. The combination of instructing the children in the e-book reading context was more efficient than giving identical adult instruction with a printed book. Children who were read the printed book by adults demonstrated progress in phonological awareness. However, it was not enough to promote their word reading and CAP abilities. In contradistinction, adult instruction in the e-book group was sufficient for promoting all three reading skills. It is possible that the combination of adult instruction together with the unique multimedia features that exist in the e-book helped promote the word reading and CAP abilities of the children in the EBI group compared to the PBI group. The e-book, compared to the printed book, included options in which the text was highlighted congruently with the narrator's reading (at the word level) and the children could re-read/re-listen to the text. These options together with the adult instruction might help promote the children's CAP and reading ability in the EBI group compared to the PBI group. These results may also be explained by the number of repeated readings by the children during the research program—four sessions for each group. Korat (2009) found that five independent readings of an educational e-book promoted LSES kindergarteners' phonological awareness and word reading more than three readings. It is possible that five independent readings of the e-book will show better progress.

In the present study, no differences were found between progress in emergent reading of children in the EB group and those in the PBI group. The literature search

on this subject yielded inconsistent results. Some studies showed a greater contribution of the e-book reading (de Jong & Bus, 2002; Korat & Shamir, 2007; Segers, et al., 2004) and some found a similar contribution of both contexts (de Jong & Bus, 2004; Wood, 2005). The outcomes of the current research support the studies that found a similar contribution of both contexts. Some researches claimed that the interactive features which exist in the e-book (e.g., animations and 'hotspots') may distract children's attention from the story and the text and this is why adult reading has an advantage in promoting children's reading (de Jong & Bus, 2002; Labbo & Kuhn, 2000). For example, Labbo & Kuhn (2000) found that when children read a printed book with an adult, they listened to the reading from beginning to end six times, whereas children who read an e-book independently read it two to three times at most and did not always read it from beginning to end. Other researches claimed that the low achievements found among children who read an e-book independently compared to those who were read a printed book by an adult were the result of using e-books which did not have enough animations and 'hotspots' that supported the story (de Jong & Bus, 2004; Korat & Shamir, 2007). In the present research we used "considerate" e-books (Labbo & Kuhn, 2000), which included animations and 'hotspots' that were carefully planned to support the storyline. Furthermore, both the EB group and the PBI group read the book the same number of times and in each session the reading was from the beginning of the story to the end. This might explain the lack of differences between the two groups' progress in emergent reading compared to other studies that reported differences in outcomes in both contexts.

Some limitations of this study, briefly noted below, should be taken into account in future studies. In the current research there was no documentation of the process of reading among the different groups. It is possible that these records might have given information on the learning process in each group and might have clarified the results. Analyses of the interactions between the adults and the children in each group might have explained why children who received adult instruction in reading an e-book had higher achievements than the other groups. Nonetheless, it is important to mention that the adult instruction in the present study was performed according to principles and behaviors which were found to promote cognitive and literate skills (Feuerstein, 1979, 1980; Klein, 1996; Korat, et al., 2007).

Another limitation of the research is related to the fact that we did not include more experience groups which read the electronic or the printed book with the adult instruction only during the readings and not after them. It is therefore difficult to determine what contributed more to the EBI group in the current study, the adult instruction during the e-book reading sessions or his/her instruction after the readings. It is recommended that future studies include more experience groups as mentioned, which might clarify the results in this study.

Another limitation of the study is that the researchers executed the interventions with the children, and not the kindergarten teachers. This decision aimed at controlled and effective implementation. Some studies have found that researchers' intervention is more effective than kindergarten teachers' activity in the field of emergent literacy (Aram & Biron, 2009). However, other researchers claim that the researcher is an 'outside agent' to the kindergarten and when intervention programs

are performed by outside agents their influence is for a short period of time. The goal is that teachers themselves will instruct to the children and that the instruction will be implemented in other literacy interactions and events (Aram, 2006; Aram & Biron, 2004; Klein, Nir-Gal, & Darom, 2000; Lauren & Allen, 1999).

Future studies are recommended in order to expand our investigation and to focus on the contribution of the electronic storybook with and without adult instruction to children's oral language. Previous studies revealed a contribution of reading the e-book to children's oral language (Doty, Popplewell, & Byers, 2001; Korat & Shamir, 2007; Matthew, 1996, 1997) as well as when the reading was done with printed books by adults (de Jong & Leseman, 2001; De Temple & Snow, 1996). Investigating the contribution of adult instruction during reading an e-book might teach us the extent to which we can augment children's language development, and especially children from a LSES.

We also recommend expanding this study to first and second graders. Such an investigation might enrich the understanding of the contribution of reading an e-book with adult instruction to children's literacy when they are in different steps of literacy acquisition, i.e., children who learn reading and writing formally compared to those who do not yet learn these skills formally in school. Children who already have knowledge of print and early reading might gain even more from the adult-software instruction than kindergarten children. These outcomes reveal the need to carry out literacy activities which combine new computer programs such as e-books together with adult instruction. Such activities should be based on books that children read and expand the children's learning in central skills of emergent reading, such as phonological awareness, CAP and word reading.

The present study focused on LSES children. It is known that LSES children may have difficulties in reading acquisition and that they do not receive the needed literacy support before formal school compared to HSES children. This absent literacy support includes literacy activities in a technological environment (Espinosa, Laffey, Whittaler, & Sheng, 2006; Korat, Segal-Drori, & Landau, 2008; Marsh, et al., 2005). According to the current research's outcomes, literacy activities which combine use of new computer programs such as e-books together with effective adult instruction might help young children in general and especially LSES children. This outcome is very important from the educational aspect.

In conclusion, it is very important to carry out literacy activities combined with new computer programs together with effective adult instruction in educational settings such as kindergarten and school. The existence of these activities might promote young children's literacy in general, and especially children from a low socioeconomic status.

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