



Reading electronic books as a support for vocabulary, story comprehension and word reading in kindergarten and first grade

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ABSTRACT

The effect of reading an electronic storybook (e-book) on Israeli children's language and literacy was examined in kindergarten children ($N = 40$; age 5:2–6:3) compared to first graders ($N = 50$; age 6:3–7:4). The children in each age group were randomly assigned to two groups: an intervention group which read the e-book five times and a control group which was afforded the regular school program. Pre- and post-tests included vocabulary and word reading measures. Post-tests included story comprehension and production. Children who read the e-book exhibited significant progress in word meaning and word reading compared to the control group. Kindergarten children progressed in word reading more significantly than first graders across treatment groups. This could be explained by the ceiling effect of the first graders' word reading level which did not leave much room for progress in this skill compared to the kindergarten children. No interaction was found between age and treatment groups. Kindergarten children exhibited a good level of story comprehension, similar to first graders, although their story production was lower. Implications for future research and education are discussed.

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1. Introduction

Reading a storybook to young children is regarded as an important activity that supports literacy development (Bus, Van Ijzendoorn, & Pellegrini, 1995). However, although extensive evidence is available on the relationship between book reading and children's oral language (Bus et al., 1995; Sénéchal, 2006; Whitehurst & Lonigan, 2001), little evidence exists on the positive relationship between this activity and children's early print knowledge (Korat, Klein, & Drori-Segal, 2007; Leseman & de Jong, 1998). One of the explanations offered for this state of affairs is that neither parents nor teachers generally emphasize print while reading to children (Dickinson & Tabors, 1991), and children do not focus on print when looking at books (Evans & Saint-Aubin, 2005; Yaden, Smolkin, & MacGillivray, 1993).

Children of today who live in a highly technological era may be exposed to books not only through an adult's reading, but also by independently activating electronic storybooks (e-books) which are available on the internet or on CD-ROMs. In Israel, 42% of middle socioeconomic status (SES) mothers reported that their pre-school children have e-book software at home (Or, 2009). E-books usually include multimedia effects such as oral reading, written text, oral discourse, music, sound effects, and animations. Most e-books include optional hidden hotspots, which are devices embedded in various screen locations and are intended to provide additional information about the characters, repeat or elaborate text (words or themes), explain a word, duplicate a sound, switch screens (equivalent to flipping pages containing pictures or animation) or provide entry into games and other activities meant to promote the story's understanding. Clicking on a glowing word in the text will sometimes give the children an explanation of the word, an explanation that may be less frequently heard and less well-known to the young child. Built-in dynamic visuals may also elaborate on the story content beyond what appears in the original text and may support better story comprehension. For example, in the e-book *Itamar the Hunter*, Itamar's image runs on the beach with a scary shadow chasing him and making scary sounds as the narrator talks about Itamar's fear of the ghost. Furthermore, before Itamar goes to sleep, his father gives him a lantern and says, "Take the lantern; it will help you illuminate the ghost." This does not appear in the story's written text. Such an activity has the potential to expand the children's knowledge of the story's events beyond the original story text.

The oral reading of the text by the narrator, accompanied by the highlighted text, can provide insights into the nature of the written text by allowing the children to carefully follow the written words, phrases, or passages which are being read to them. In some e-books,

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hotspots may relate to the written text. For example, when clicking on specific words, phrases, or sentences, the children can hear the written text again. Activating e-books that incorporate a built-in dictionary and highlighted text may offer young children the opportunity to learn not only the meaning of new words but also word recognition and word reading.

The current study was based on the assumption that providing children with developmentally appropriate learning experiences may influence their language and literacy learning. We agree with [Haugland and Wright \(1997\)](#) who claimed that software designers should take children's literacy knowledge at different ages into account when developing material to support their language and literacy. We focused on an educational e-book that we developed, which was aimed at supporting the early literacy development of preschoolers who have not yet formally learned reading and writing as well as of school beginners who have already begun this process of learning at school. We assumed that the vocabulary meaning enrichment function, the word tracking option and the hotspot animations can facilitate preschool children as well as school beginners' language and literacy. However, this support could lead to a different progress in each age group. Thus we asked: (1) whether our educational e-book can support young children's vocabulary, story comprehension and early word reading, and (2) whether this support differs for kindergarten children compared to first graders.

2. E-books as a support for oral language

2.1. Vocabulary

Children's rich vocabulary is considered to be one of the important vehicles for reading comprehension and academic achievement ([Beck & McKeown, 1999](#); [National Reading Panel, 2000](#)). Children's vocabularies grow rapidly during early childhood, and the vocabulary level at kindergarten age predicts children's reading and comprehension in school ([Hiebert & Kamil, 2005](#)). It is well-known that there is an enormous difference in the vocabulary volume between young children, and that this affects their future literacy and academic progress ([Chall, Jacobs, & Baldwin, 1990](#); [Hart & Risley, 1995](#); [Snow, Burns, & Griffin, 1998](#)).

The National Panel ([NICHD, 2000](#)) in the USA, being aware of this evidence, has suggested several important principles for vocabulary instruction. These include direct teaching of new words, repetition of word learning, embedding new words in a meaningful context and offering children an active role in this process. It was also suggested that technology tools should be used for fostering children's vocabulary.

In the current study we used an e-book which we developed and which has already been examined (see [Korat, 2009](#); [Korat & Shamir, 2007](#); [Korat & Shamir, 2008](#)) and was found to incorporate all these principles. We offered the children a book which is aimed at their age group and includes a dictionary that supports rare word understanding. Children encounter these words automatically after listening/reading the screen. The words appear in visual format depicting their meaning, including a short oral explanation and the written form of the word. Previous studies which we conducted on kindergarten children who worked independently with this software showed that a short period of activating this software significantly improved their word meaning knowledge ([Korat, 2009](#); [Korat & Shamir, 2007](#); [Korat & Shamir, 2008](#)). These results support other recent evidence about the ability of e-books to foster kindergarten children's vocabulary ([Segers, Takke, & Veroeven, 2004](#); [Segers & Verhoeven, 2002](#); [Segers & Verhoeven, 2003](#); [Verhallen, Bus, & de Jong, 2006](#)) among kindergarten children as well as among school beginners ([Lewin, 2000](#)). When children enter school and begin formal learning of reading they are exposed to different types of texts which might enhance their vocabulary ([Cunningham & Stanovich, 1991](#)). This could lead to the thought that first graders have a better knowledge of word meaning than kindergarten children and may also progress faster following e-book reading. On the other hand, if kindergarten children already know the meaning of several words in the e-book, their progress might be the same or even faster than the first graders. One of the questions in the present study was therefore whether the software we offer to the children supports first graders' vocabulary as it does kindergarteners', and if so, whether its support for these two age groups is similar or different.

2.2. Story comprehension

One of the problematic issues that were raised regarding e-books is that the rich interactive and amusing effects, and especially hotspots which are not congruent with the story-line ([Labbo & Kuhn, 2000](#)), may distract the children's attention from the story's content and interfere with their story understanding ([Okolo & Hayes, 1996](#); [Underwood & Underwood, 1998](#)). For example, Okolo and Hays found that the low comprehension levels of poor second-grade readers who used CD-ROM storybooks resulted from inconsistencies between the animations and the story-line in the e-books. In another study, fourth graders who read an interactive e-book recalled the story's events structure better than those who were engaged in the e-book's play version ([Trushell, Maitland, & Burrell, 2003](#)).

Good quality CD-ROM storybooks that contain hotspots which are congruent with and are integrated into the content of the story (called "considerate" e-books, see [Labbo & Kuhn, 2000](#)) were found to foster children's understanding of the story-line ([Labbo & Kuhn, 2000](#)) and story-recall ability ([Underwood & Underwood, 1998](#)).

The e-book we offered the young children was created using the "considerate" principles by embedding hotspots in pictures which support the story-line. For example, the story's protagonist Yuval, a young boy who tends to be confused, finds it difficult to get dressed properly. When the child clicks on one of Yuval's toys, the child will hear the toy saying: "Yuval, pay attention, the collar of the shirt should be in front". This comment does not appear in the original story text and is not said by the narrator. It was added to the e-book and appears as a hotspot which might support the child's story-line understanding.

We implemented only five hot spots in each screen in order to raise the children's enjoyment while keeping them moving with the story. [de Jong and Bus \(2004\)](#) suggested that kindergarten children in their study understood the story since in their software, only five hotspots were included in each screen. This was compared to [Labbo and Kuhn \(2000\)](#) who found that kindergarten children had difficulties in following the story-line when they had about 19 hotspots in each screen. Our results yielded a good level of story understanding of kindergarten children using two different e-books developed with the same design. The children who participated in these studies were asked to answer yes or no questions regarding the story content. These questions were aimed at factual information of the story as well as referential questions regarding the characters' actions and motivations. Story comprehension may be measured at several levels, beginning with a more simple behavior of answering simple (yes/no or true/false) questions and by a more active and demanding level of story production ([Carlisle & Rice, 2002](#)). In the current study we included these two measures for evaluating the children's story comprehension.

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