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Vocabulary enrichment using an E-book with and without kindergarten teacher's support among LSES children

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ABSTRACT

We examined an intervention in kindergarten using an e-book for vocabulary enrichment. In programme (a), the children read the e-book with a dictionary and the teacher's support. In programme (b), the children read the e-book with the dictionary independently. In programme (c), the children read the e-book without a dictionary (control). The participants included 103 children (aged 5–6) from LSES families. They read the e-book in the kindergarten class six times. The children were tested pre, post 1 and post 2, on story focal words at the receptive, explanation and production level. Children who read the e-book with the dictionary and the teacher's support learned more words than those, who read the e-book with the dictionary independently, and more than the control. Achievements were maintained after one month. Children with an initial low level progressed more than those with a high level. The findings and their implications are discussed.

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Introduction

A rich vocabulary in early childhood is a cornerstone for the development of language and literacy of young children and comprises a solid foundation for reading and reading comprehension (Côté, Rouleau, & Macoir, 2014). Ample evidence indicates that young preschoolers from low socio-economic status (LSES) families lag behind children from middle socioeconomic status (MSES) families in their early oral and literacy skills, and this influences formal reading in school (Dickenson & Morse, 2019; Gardner-Neblett & Iruka, 2015). Educators and researchers in many countries are highly motivated to search for and construct methods or new tools for helping young children from LSES families to narrow their language literacy gap. In the present paper, we present a research on e-books as a possible tool for contributing to vocabulary acquisition together with kindergarten teachers' support among children from LSES families. The possible contribution of technology use, including e-books, to young children's learning has become especially interesting and important following preschool children's increased screen time use during the COVID-19 pandemic, due to closure of schools in many countries (Korat, et al. 2021; Gaudreau et al., 2020).

Vocabulary acquisition in early childhood

Receptive knowledge of a word (measured, for example, by the PVVT test) usually precedes its expressive knowledge, i.e. the ability to explain its meaning (Nation & Snowling, 2004; Ouellette & Beers, 2010). Moreover, the receptive knowledge of a word precedes the ability to use it in practice,

since this requires a higher cognitive effort that includes retrieving the word from memory and using it in an appropriate context (Chan, Cheung, Sze, Leung, & Cheung, 2008; Verhallen & Bus, 2010).

Receptive and expressive vocabulary acquisition in early childhood is of great importance for all children. However, it is especially important for children from LSES families who tend to fall behind MSES children (Fernald, Marchman, & Weisleder, 2013; Levine et al., 2020). There is clear evidence that the primary reason for SES differences in the rate of vocabulary growth during infancy and pre-school age is related to differences in the quantity and quality of language exposure in the home (Golinkoff, Hoff, Rowe, Tamis-LeMonda, & Hirsh-Pasek, 2019; Hoff, 2006).

Direct teaching of words within a supportive context is considered an effective way for enriching vocabulary (Jenkins, Matlock, & Slocum, 1989; Swanborn & De Glopper, 2002). The adult-child book reading activity is well known as a leading context for enriching children's vocabulary, including in LSES families (Dickenson & Morse, 2019; Whitehurst & Lonigan, 2001), especially when adults explain unknown words to young children in this meaningful context (Kotaman, 2020; Toub et al., 2018). Children can engage in conversations with adults through shared book reading, becoming exposed to novel words which they may not hear in typical conversations. This turns it into an ideal activity for explicit vocabulary instruction (Lorio & Woods, 2020).

Electronic book

In our digital era, young children are exposed not only to traditional hard copy printed books, but also to digital books. Electronic books (e-books) for children can be read independently on a computer, via the internet, and with the help of other tools such as the tablet, smartphone and more. These books usually present stories read by a narrator, and are accompanied by a variety of multimedia effects, such as: musical background, sounds, static or animated pictorial presentations which may illustrate the connection between the spoken and written text appearing on the screen (Yow & Priyashri, 2019). These clues can help young children understand the story line and enrich their vocabulary (Takacs, Swart, & Bus, 2015). It is important to note that most e-books which exist on the market tend to have multimedia effects aimed at the story content, and only few have a built-in dictionary for direct word learning support (Korat & Falk, 2017).

Electronic book with dictionary

The authors designed e-books which include a built-in dictionary in order to enrich young children's vocabulary. On each screen of these e-books, after the narrator finishes reading the text, a short oral and pictorial representation (static or animated) is automatically provided for one difficult word which appears in the story text (Korat, Levin, Ben-Shabat, Shneor, & Bokovza, 2014). For example, the explanation of the word 'blossomed' is as follows: At the end of the narrators' reading of the screen, a large bubble with the target written form of the word appears, together with a figurative static presentation of a flower. The narrator concomitantly gives a short explanation of the word ('blossomed is turned from a bud into a flower'), or a large bubble appears on the screen showing an animation of a bud slowly opening into a flower. In a series of studies, we found that children progressed in learning the new words after three repeated readings of these e-books (Korat & Blau, 2010; Korat, Shamir, & Arbiv, 2011). This is in line with Rosenthal and Ehri's (2008) claim that when new words are encountered in print, they are transformed into pronunciations, which are then stored in memory along with the words' meanings.

These findings go hand-in-hand with the dual-coding theory (Paivio, 2007, 2008). According to this theory, verbal and visual information are encoded and stored in separate memory systems, where one is language-specific and the other is visual-spatial. The assumption is that remembering information encoded in one system does not interfere with remembering information encoded in the other system. Moreover, these systems can support and activate each other. This learning process is also supported by the idea of synergy, according to which the cooperation of two or

more sources of representation (media) yields a better result than each representation alone (Fuller & Applewhite, 1979). In other words, use of multimedia based on these two theoretical models supports language learning, including new words, through synergistic relationships (Neuman, 1995; Neuman, Flynn, Wong, & Kaefer, 2020).

Dynamic visuals and static presentations and word learning

Dynamic visuals in e-books were found to be more supportive for learning new words than static presentations (see Smeets & Bus, 2014; Verhallen & Bus, 2010). Smeets and Bus (2014), for example, researched 136 kindergarteners (aged 4-5) who were randomly assigned to one of four conditions: static e-book, animated e-book, interactive animated e-book, and control. In the experimental conditions, four on-screen stories were each presented four times during a 4-week intervention period. Strong treatment effects were found on target vocabulary originating from the story. Children gained most in vocabulary after reading interactive animated e-books, followed by (non-interactive) animated e-books, then static e-books.

The explanation was that young children are more attracted to dynamic than to static presentations, which may support the contiguity between the oral presentation (saying the word) and its illustrations (e.g. Mayer & Moreno, 2002). Animations are regarded as requiring a less effortful process. They may present temporal changes and process durations more explicitly than a static presentation (for example, the blossoming of a flower), the viewer can actually perceive the change, and does not need to infer it from the static figure (Hegarty, Kriz, & Cate, 2003).

Although studies have shown significant progress of children who used an e-book with a dynamic dictionary in learning new words (Korat et al., 2014), progress was modest and it is possible that combining the reading of the e-book with adult support will lead to greater progress.

Adult support during E-book reading

In the current research, reading the e-book was combined with the support of the kindergarten teacher for learning new words. One of the interesting questions regarding young children's independent e-book reading is whether this activity is more effective compared to children using the e-book with adult support. This question is well rooted in the framework of the cognitive-social theory (Vygotsky, 1978), one of whose assumptions is that children's independent learning ability is realized more effectively through a mediator, who knows how to promote the children's understanding. With this help, children might reach higher levels of cognitive function, especially those who lag behind (for example, LSES children), who need the instruction of an adult who can make the adaptation between them and the learning environment and organize it for them for better learning. Similarly, Feuerstein (1979) and Klein (1996) perceived adult support as important for clarifying the meaning of the situation they experience to children, elaborating and expanding it beyond the immediate experience, shaping children's behaviour, and providing feedback and encouragement as needed. According to this approach, learning acquired through other human mediation/support could be more efficient than what is acquired through direct contact with stimuli. Results from recent studies show the importance of adult-child communication during multimedia use (Neuman et al., 2020) and e-book reading (Troseth, Strouse, Flores, Stuckelman, & Johnson, 2020) for vocabulary learning. Troseth et al. (2020), for example, researched 32 parent-child (aged 3-5) pairs while reading an e-book. Their intervention was designed to offer exposure to a model of dialogic questioning with the goal of promoting and training adult-child conversation around stories. The intervention encouraged more parent-child talk, including use of a wider range of words by both parents and children, and longer reciprocal conversations. Similar results were reported by (Korat & Shneur, 2019).

Furthermore, this combined support of the multimedia together with an adult's support makes it possible to preserve the new knowledge over time and serves as a basis for new learning later.

Adult support of young children in printed book reading activities has been studied extensively (Mol, Bus, de Jong, & Smeets, 2008). However, fewer studies examined adult support in e-book reading, especially of kindergarteners, and its impact on language and literacy. The few studies conducted in this field to date have shown that adult support while reading an e-book supported children's emergent word reading (Segal-Drori, Korat, Shamir, & Klein, 2010) phonological awareness and emergent writing (Korat et al., 2011), beyond their independent book reading. To the best of our knowledge, no studies are available on whether teachers who help children to read e-books support their vocabulary development.

Teachers supporting E-book reading

In the studies we reported above on adult support during reading an e-book with a child, the adult support was performed by experimenters. This situation can have certain benefits pertaining to the quality of the research, such as: uniform activity according to a fixed protocol and the application of theoretical and professional knowledge which the students acquired in the field of literacy and language as part of their studies. However, this condition can be problematic, due to its limited effectiveness over time, and due to its low ecological assurance resulting from activation by an experimenter, rather than by the kindergarten teacher.

Although it seems that the kindergarten classroom may be a very suitable framework in which children can listen to or read e-books, and that it is important to examine the effectiveness of this activity, we did not find studies that dealt with this issue. Only few studies implemented intervention programmes aimed at promoting language and literacy among kindergarteners with teachers who actually worked in the kindergarten classroom in which the study took place (Aram, 2006; Fuchs et al., 2001; Roskos & Neuman, 1998). In the present study we produced an e-book that supports vocabulary learning, incorporated into the kindergarten classroom curriculum, with the aim of examining the impact of the kindergarten teacher's support using these books with children from LSES families on learning new words. Beyond the learning achieved only through exposure to the word which was built into the e-book, the children received the teacher's help, which included questions and discourse with the children and elaborations on the built-in dictionary explanation. This combined word support of an automatic built-in dictionary together with the teacher's help for word meaning has not been examined to date.

Shared printed book reading showed that children who were exposed to questions and comments about the words that appeared in the story learned more new words compared to those who were not exposed to this treatment (Ard & Beverly, 2004; Blewitt, Rump, Shealy, & Cook, 2009). It can thus be assumed that a discourse on the meaning of difficult words in the story, which will be provided by an adult during the e-book reading activity, may help the children acquire the words beyond the multimedia contribution of the e-book during the children's independent activity.

Research programmes that included kindergarten teacher training for promoting children's language and literacy in kindergarten classrooms were found to be more effective than those that did not include training (Aram, 2006; Dickinson & McCabe, 2001).

Despite the importance of preserving learning following the implementation of intervention programmes, few studies in the field of language and literacy examined this issue, especially regarding vocabulary learning. Few intervention studies that examined this topic reported promising results in early writing (Levin & Aram, 2012) and phonological awareness (Arest, 2012).

Research aims

In the current research, we examined an intervention programme for kindergarteners using an e-book we developed for promoting vocabulary with a built-in dictionary. The children were also assisted by their home class teacher in learning the dictionary words. The teacher received guidance

by an expert on how to support the children when working with the e-book. Our hypothesis was that children who will participate in the programme of reading the e-book with the dictionary and with their teacher's word support will learn more new words than children who will read the e-book with the dictionary independently. We further hypothesized that children who will read the e-book with the dictionary independently will learn more new words than children who will read it without a dictionary (control). We also examined whether the children's progress was maintained over time. In this study, we aimed to expand our knowledge on maintaining children's progress in learning new words and examined it in the context of reading e-books in kindergarten classrooms.

Method

Participants

The participants included 103 Hebrew-speaking kindergarteners aged 5–6 (43 girls and 60 boys) from LSES neighbourhoods. Based on the teachers' reports, children with recognized developmental or language difficulties, including newcomers from other countries who were not fluent in Hebrew, were not included in the study. SES level was determined according to the Israeli Municipalities' Statistical Report (Central Bureau of Statistics, 2018). Three kindergarten classrooms, from a list of all kindergarten classrooms located in LSES neighbourhoods in one city in the centre of Israel, were randomly chosen for participation. All kindergarten classrooms followed the same Israeli national early literacy curriculum, which includes storybook reading once or twice a week. No special programme for vocabulary support is provided. The three teachers who participated in the study had 5–8 years of teaching experience. All had an early childhood certificate from an Israeli teachers' education college, which usually includes 2 courses in early literacy education instruction.

One of the three kindergarten classrooms was randomly chosen as control ($N = 35$) and the other two as experimental groups ($N = 34$ in each). The option of dividing the children in each kindergarten classroom into 3 different research groups seemed inappropriate, since the home teacher was involved in the intervention programme. Providing different types of support to the different children was both impractical and unethical. All children in a particular kindergarten classroom thus received the same programme.

In the control group, the children read the e-book independently in the channel of 'Read the story-continuous reading' (reading without a dictionary). In experimental group 1, the children read the target e-book independently in the channel of 'Read with dictionary'. In experimental group 2, the children also read the e-book in the 'Read with dictionary' channel. However, this group also received the kindergarten teacher's support after she received focused guidance on the incorporation of the e-book as promoting vocabulary.

Research tools

The e-book

We used the book 'Wonder Needles' (Shimshoni, 2009) which tells about a lovely grandmother, a real wizard in knitting, who uses her talent to help others. The turning point in the story occurs during a meeting with a stranger, who although he has gloves, a scarf and a coat, is still cold because of his feelings of loneliness. The grandmother manages to warm the stranger's heart with affection and listening. The book has a classic story structure and includes a background description (time, characters presentation), a problem, and its resolution (see Rumelhart, 1975; Thorndyke, 1977). The printed book 'Wonder Needles' has 23 pages, and the e-book contains 13 screens. All pages of the e-book contain colourful illustrations that cover half the page, with 4–5 sentences (about 30 words) in Hebrew dotted script. The e-book includes 2 reading channels: (a) 'Read the story', which is a continuous reading of the text by a narrator with no additional support, (b) 'Read with dictionary' which explains one word per page.

The 12 words chosen for the dictionary were chosen following an assessment in 2 kindergarten classrooms located in LSES neighbourhoods. In each kindergarten classroom, the teacher read the printed book 'Wonder Needles' to 10 children in small groups of 3–4 children. During the course of the reading, the children were asked for the meaning of 20 verbs, which seemed to the researchers as less known to kindergarten-age children. The least familiar 12 verbs from the book were chosen (sang, whipped, bound, froze, popped, flowed, waited, hallucinated, lowered, answered, listened, sipped). Twelve words were chosen since we decided to explain only one word on each screen, in order to minimize distraction from the storyline.

The 'Read with dictionary' channel offers an oral reading of the text, together with an oral explanation of a difficult word that appears automatically on the screen after the entire page has been read by the narrator, together with a visual representation of the word. After the narrator finishes reading the screen, a large bubble appears with an animation which presents the word, with the narrator concomitantly saying a short explanation of the word (an example of the dictionary is presented in Figure 1).

We included words from a 'high register', which are less frequent in daily conversation, in the dictionary. The actual explanation of each word was given in the past tense singular. We used verbs in the dictionary, since their acquisition may be more complex than nouns (Armon-Lotem & Berman, 2003; Gentner, 1981; Ravid, 2012), especially for kindergarteners from LSES families. We hypothesized that the animations we used to explain the words in the dictionary could be particularly effective in understanding verbs due to the action presented in them (see Korat et al., 2014; Verhallen & Bus, 2010; Verhallen, Bus, & de Jong, 2006).

Receptive understanding

The children were asked to recognize the meaning of 12 verbs which appear in the e-book's dictionary. Similarly to the PPVT test (Dunn & Dunn, 1981), the children were shown a card with 4 pictures and were asked to point to the one which best represents the word that was told them. A correct answer received 1 point. The possible range of scores is 0–12.

Explaining words

The children were asked to explain the meaning of the 12 verbs from the e-book's dictionary. They were told: 'Now, let's play a game of words. I'll tell you a word and you'll tell me what it means.'



Figure 1. An example of the dictionary in the e-book.

Explain the word to me.’ They were given two examples prior to starting. Analysis of the words’ meanings was based on the children’s answers, and was similar to previous studies (Korat et al., 2014). The scale ranged between 0 and 4 points. For example, we asked the child, ‘What is he froze?’ A score of 0 was given when the child answered: ‘I do not know’ or gave an incorrect explanation. A score of 1 was given when the child gave a wrong explanation and provided a word with a sound similar to the focal word (for example, ‘ka-ra’ or ‘ya-fa’). A score of 2 was given when the child did not give an explanation, but used the word in an appropriate context. For example, the child said: ‘The water froze.’ A score of 3 was given when the child explained the word within a context. For example, the child said: ‘When it feels cold to me.’ A score of 4 was given for the exact explanation of the word, as it appeared in the e-book dictionary. For example, the child said: ‘He was very cold.’ The score range for this test is 0–48 points.

Word production

We presented the children with a printed version of the e-book, which included only the book illustrations without the text. The children were asked to look at each page and tell the story according to what they knew. The instruction given was: ‘Please look at each page and tell me the story.’ The experimenter wrote the children’s retelling of the story verbatim. Target words that appeared in the dictionary were counted and each received one point (score range 0–12) (see also Korat et al., 2011).

Procedure

Pretest: All participants were tested individually in the kindergarten classroom in a separate room prior to the intervention. In the beginning of the pretest, we showed the children the e-book once with straight reading without the dictionary. Then we tested the children in the e-book receptive words knowledge, explaining words and word production when telling the story. Reading the e-book within the framework of the pretest was used to allow the child to become familiar with the story and retell it. In this way we were able to follow the children’s initial knowledge level of the target words and compare it to their level at posttest. We are aware that reading/listening to the story during pretest can be considered an intervention in itself and can perhaps impact the children’s initial abilities in a way that neutralizes the actual intervention. At the same time, there is evidence that a single exposure to a book is not sufficient for children to learn the meaning of new words deeply and fully (see Robbins & Ehri, 1994; Sénéchal, 1997).

Intervention: The children in all three groups worked on the e-book in pairs. They were instructed to operate the e-book as follows: on one screen one child will hold the mouse and lead the process, and in the next screen the second child will do the same, and so on. In all three groups, the children worked with the e-book twice a week for half an hour, with a total of six times over the course of three weeks. The children in the control group (group 1) worked with the channel ‘Read the story’. The children in the experimental groups (groups 2 and 3) worked with the channel ‘Read with dictionary’. Group 2 worked with the channel ‘Read with dictionary’ and no support for e-book reading was provided for children or teachers. In experimental group 3, the kindergarten teacher was provided individual guidance on how to work with the e-book over the course of 4 meetings. Two meetings took place before the intervention, and two during the intervention. Each guidance session lasted one hour.

Teacher training

The experimenter asked the teacher to create small groups of four children in her class, and again divide each quartet into two pairs. The teacher was instructed to meet with every quartet twice a week. She was asked to dedicate 10 min of the activity to the children while mediating reading the e-book, and the following 15 min for the children to work in pairs using the e-book by their own implementation. The teacher was coached to activate the story in the ‘Read with dictionary’

channel with the children, to stop the programme and ask questions about the dictionary words, to respond to them and encourage cooperation between them. For example, on screen number 9, the word 'answered' appears. At the end of the screen reading, the teacher asked the children: 'In the story it is written that the man answered the grandmother, who can explain what is answered?' At the end of the joint activity and before the start of the activity in pairs, the kindergarten teacher gave the children a defined task, in order to strengthen the learning of the new words. For example, in the second reading, the kindergarten teacher instructed the children: 'When you finish reading the book, I will ask you to tell me what new and interesting word you learned today from the story'. After that, the teacher addressed the task, which the children received and dedicated 5 min to it. Each reading sessions lasted 30 min. See Appendix for examples of the protocols of the kindergarten teacher's support. The kindergarten teacher wrote a diary in which she reported what she did during the activity, how the children reacted and what problems came up. Observations were conducted on two activities in each of the two intervention programmes.

Observations took place in the second and sixth sessions. During the observation, the researchers focused on the teacher's and the children's behaviour and comments during the activity. Observations of the activities and the teacher's diary showed a good level of fidelity of implementation as suggested by the researchers. This included the number of reading sessions planned, and the teacher's and children's behaviour in the activities. The teacher guided to work with the e-book closely followed the researchers' suggestions.

Posttests: The first posttest was performed 1–3 days after the end of the intervention. The second posttest was performed 4–5 weeks after the first posttest. The two posttests included vocabulary tests.

Results

A preliminary analysis was performed to assess pre-intervention differences across groups regarding knowledge of target words: receptive understanding, word explanation, and word production.

Table 1 shows significant differences across groups in receptive understanding ($F = 29.22$, $p < .001$, $\eta_p^2 = .37$). More specifically, the pre-intervention performance of independent reading and control groups were higher compared to the group which read the e-book with the dictionary and the teacher's support ('b' vs. 'a'), whereas no other group differences were found in word explanation and word production.

To test our hypotheses, we developed a repeated measures analysis of variance (ANOVA) test. In these testing models we assessed the effect of time (pretest, first posttest, second posttest) as a repeated measure, and the method group (control, independent reading of the e-book with the dictionary, and e-book reading with the dictionary and the teacher's support) effect as an independent factor. Each outcome was examined separately. The presentation of the repeated measures ANOVA results includes subtotals across groups for each time point, and subtotals for each group beyond time. The marginal means were compared to each other and ranked based on these comparisons. Latin letters were used to determine rank from lowest ('a' for time point, or 'A' for group) and so

Table 1. Averages (and standard deviations) of the research indices before the intervention among the various research groups.

Word Measures		Control group	Independent reading	Teacher with guidance	F	η_p^2
Receptive understanding	M	44.28 ^b	41.91 ^b	23.03 ^a	29.22***	.37
	SD	(13.52)	(15.55)	(7.12)		
Explaining words	M	.860	.920	.720	2.58	.05
	SD	(0.41)	(0.37)	(0.35)		
Word production	M	1.03	1.41	1.35	1.82	.04
	SD	(0.89)	(0.96)	(0.85)		

* $p < .05$. ** $p < .01$. *** $p < .001$; Standard deviations in parentheses; Latin letters for subgroup mean ranking, "a" for the smallest.

on. This ranking was based on *post-hoc* pairwise comparisons with the Bonferroni correction for multiple comparisons.

Table 2 shows results for the receptive understanding outcome measure.

Results showed a time main effect across all groups, regardless of the reading channel ($F = 55.53$, $p < .001$, $\eta_p^2 = .36$). Children's receptive understanding in general was higher in both posttests compared to their performance at pre-intervention, as shown by the Latin letters ('b' vs. 'a'). Similarly, each of the three groups made progress in receptive understanding from pre-intervention to post-intervention independently of each other ('b' vs. 'a') ($F = 42.87$, $p < .001$, $\eta_p^2 = .46$). Furthermore, an interaction was found between time and group ($F = 50.59$, $p < .001$, $\eta_p^2 = .51$), showing that at both post-intervention time points (posttest 1 and posttest 2), the children who read the e-book with the dictionary and the teacher's support outperformed the children from the other two groups ('B' vs. 'A'), whereas children's performance did not differ significantly at the pre-intervention point. The model results were subjected to a control variable – prior knowledge of the target words ($F(1, 99) = 132.41$, $p < .001$, $\eta_p^2 = .57$).

Table 3 presents the model results for the word explanations which were measured repeatedly.

At the two posttests (1 and 2), children gave better word explanations than in the pre-test, regardless of their group affiliation ($F = 22.56$, $p < .001$, $\eta_p^2 = .19$). However, the *post-hoc* ranking results showed that the highest level of word explanation was achieved at the second posttest. This was followed by the first posttest, and both were higher than the pretest outcomes ('c', 'b' and 'a', respectively). Beyond time, groups also varied from each other ($F = 26.96$, $p < .001$, $\eta_p^2 = .35$): The group that read the e-book with the dictionary and the teacher's support group received the highest score. This was followed by the group that read the e-book with the dictionary independently. The control group that read the e-book without a dictionary received lowest score. The time by group interaction indicated that these differences varied by group or by time ($F = 21.03$, $p < .001$, $\eta_p^2 = .30$). More specifically, the interaction effect indicated that difference in success levels by time varied across groups. In other words, at pre-intervention, all children performed word explanations at the same levels ('A'), but at the first posttest, the performance of the group that read the e-book with the dictionary and the teacher's support was highest, the performance of the group that read the e-book with the dictionary independently was second best, and the performance of the control group was lowest ('A', 'B' and 'C', respectively). At the second posttest, the performance of the group that read the e-book with the dictionary and the teacher's support was higher than the performance of the group that read the e-book with the dictionary independently and higher than the performance of the control group ('B' vs. 'A').

Lastly, we tested children's word production levels in the different intervention groups. Table 4 provides the modelling results.

We found time and group effects ($F = 14.12$, $p < .001$, $\eta_p^2 = .13$; $F = 27.43$, $p < .001$, $\eta_p^2 = .36$; respectively). The two posttest scores were higher than the pre-intervention score ('b' vs. 'a') and the group

Table 2. Averages (and standard errors) in receptive understanding by group and time.

Group	Time			Sub-total	F values and effect size		
	Pre	Post 1	Post 2		Time	Group	Group X Time
Control group	37.19 ^{aA} (1.25)	43.58 ^{bA} (2.06)	44.80 ^{bA} (2.04)	41.85 ^A (1.49)			
Independent reading	36.74 ^{aA} (1.22)	48.61 ^{bA} (2.02)	48.63 ^{bA} (2.00)	44.66 ^A (1.46)			
Teacher with guidance	35.52 ^{aA} (1.43)	76.62 ^{bb} (2.35)	79.52 ^{bb} (2.33)	63.89 ^B (1.71)			
Sub-total	36.48 ^a (0.68)	56.27 ^b (1.11)	57.65 ^b (1.11)	50.13 (0.81)	55.53*** .36	42.87*** .46	50.59*** .51

Note: Control variable effect $F(1, 99) = 132.41$, $p < .001$, $\eta_p^2 = .57$; *** $p < .001$, ** $p < .01$, * $p < .05$, ~ $p < .10$. Standard errors in parentheses. Latin letters for subgroup mean ranking, "a" for the smallest for time point and "A" for the smallest for group.

Table 3. Averages (and standard errors) in word explanation by group and time.

Group	Time				F values and effect size		
	Pre	Post 1	Post 2	Sub-total	Time	Group	Group X Time
Control group	0.73 ^{aA} (0.06)	0.86 ^{aA} (0.08)	0.93 ^{bA} (0.09)	0.84 ^A (0.07)			
Independent reading	0.83 ^{aA} (0.06)	1.15 ^{bb} (0.08)	1.18 ^{bA} (0.08)	1.05 ^B (0.06)			
Teacher with guidance	0.96 ^{aA} (0.07)	1.89 ^{bC} (0.09)	2.07 ^{cB} (0.10)	1.64 ^C (0.08)			
Sub-total	0.84 ^a (0.03)	1.30 ^b (0.04)	1.39 ^c (0.05)	1.18 (0.04)	22.56*** .19	26.96*** .35	21.03*** .30

Note: Variable control effect $F(1, 99) = 25.12, p < .001, \eta_p^2 = .20$; *** $p < .001$, ** $p < .01$, * $p < .05$, ~ $p < .10$. Standard errors in parentheses. Latin letters for subgroup mean ranking, "a" for the smallest for time point and "A" for the smallest for group.

that read the e-book with the dictionary and the teacher's support produced significantly more words than the other two groups ('B' vs. 'A'). The interaction between time and group was significant as well ($F = 20.60, p < .001, \eta_p^2 = .29$). Table 4 provides the interaction decomposition.

Word production of the group that read the e-book with the dictionary and the teacher's support increased from pretest to posttest 1 and remained at a similar level at posttest 2 ('b' vs. 'a'). Similarly, word production of the children in the group that read the e-book with the dictionary independently was higher in the first posttest than at pre-intervention, but the second posttest score remained the same as the first posttest ('b', 'ab' and 'a', respectively). Among the children in the control group, no change was found in word production from pre-intervention to posttest 1, but word production was higher at the second posttest time point ('a', 'ab', 'b').

We adopted the hierarchical regression modelling approach to estimate the effect of the intervention on the three word measures outcomes. The improvement we tested was threefold: T2 minus T1, T3 minus T2 and T3 minus T1, which followed the three time points at which word learning was assessed. Each dependent measure (receptive, explanation and production) improvement was tested independently in three regression models for each time difference. In the first step, the pre-intervention level of each specific measure was regressed on the improvements in this measure. In the second step, the group effect on the improvement was tested. The hierarchical modelling approach allowed us to assess the intervention group effect by means of a change in R-square. In other words, a change in R-square was expected to result from additional explanatory variables, entered in the second step. Table 5 presents the regression model for receptive understanding outcomes.

The first step showed the so called 'regression to the mean'. The pre-intervention measure was negatively associated with the first and second improvement outcomes ($\beta = -.64, p < .001$; $\beta = -.64, p < .001$). Namely, children with the lowest receptive word knowledge progressed more

Table 4. Averages (and standard errors) in producing target words by group and time.

Group	Time				F values and effect size		
	Pre	Post 1	Post 2	Sub-total	Time	Group	Group X Time
Control group	0.97 ^{aA} (0.16)	1.65 ^{abA} (0.32)	1.72 ^{bA} (0.31)	1.45 ^A (0.22)			
Independent reading	1.37 ^{aA} (0.16)	2.00 ^{bA} (0.31)	1.80 ^{abA} (0.30)	1.72 ^A (0.22)			
Teacher with guidance	1.46 ^{aA} (0.19)	5.07 ^{bA} (0.37)	5.55 ^{bA} (0.35)	4.03 ^B (0.25)			
Sub-total	1.27 ^a (0.09)	2.91 ^b (0.17)	3.02 ^b (0.17)	2.40 (0.12)	14.12*** .13	27.43*** .36	20.60*** .29

Note: Variable control effect $F(1, 99) = 0.06, p = .80, \eta_p^2 = .001$; *** $p < .001$, ** $p < .01$, * $p < .05$, ~ $p < .10$. Standard errors in parentheses. Latin letters for subgroup mean ranking, "a" for the smallest for time point and "A" for the smallest for group.

Table 5. Hierarchical regression results for improvements in receptive understanding, standardized coefficients.

	Improvement in receptive understanding (post 1 minus pre)	Improvement in receptive understanding (post 2 minus pre)	Improvement in receptive understanding (post 2 minus post 1)
Step 1			
Receptive understanding pre	-.64***	-.64***	-.05
R^2	.41***	.41***	.002
F(1, 101)	68.68***	68.08***	.25
Step 2			
Independent reading vs. Control group	.12~	.09	-.08
Teacher with guidance vs. Control group	.74***	.78***	.18
Teacher with guidance vs. Independent reading	.63***	.69***	.26~
ΔR^2	.30***	.34***	.04
R^2	.71***	.75***	.04
F(3, 99)	80.10***	97.24***	1.31

* $p < .05$. ** $p < .01$. *** $p < .001$ ~ $p < .10$.

than those with higher initial scores from pretest to posttest 1 and from pretest to posttest 2. Next, we looked at possible improvement due to the intervention. These included all possible comparisons, e.g. independent reading vs. control; with teacher's support vs. control; and with teacher's support vs. independent reading. These comparisons were completed in two separate models, as only one reference group is allowed in a regression model. The group which read the e-book with the teacher's support improved their receptive score more than the control and the independent reading groups in both the first and the second posttests compared to the pretest level (posttest 1 minus pretest: $\beta = .74$, $p < .001$; $\beta = .63$, $p < .001$; posttest 2 minus pretest: $\beta = .78$, $p < .001$; $\beta = .69$, $p < .001$). However, no group effect was detected in the posttest 2 minus posttest 1 improvement. In the first two models (posttest 1 minus pretest, posttest 2 minus pretest), a high ΔR^2 supported the expected intervention effect, namely, the greater improvement among the group that read the e-book with the dictionary and the teacher's support compared to the other two groups. In other words, adding group effects significantly improved the explanatory power of the regression model.

Table 6 shows results for the word explanation measurement.

Table 6. Hierarchical regression results for improvements in word explanation, standardized coefficients.

	Improvement in word explanation (post 1 minus pre)	Improvement in word explanation (post 2 minus pre)	Improvement in word explanation (post 2 minus post 1)
Step 1			
Word explanation pre	-0.33**	-.35***	-.17~
R^2	.11**	.12***	.03~
F(1, 101)	11.91**	13.68***	2.92~
Step 2			
Independent reading vs. Control group	.18*	.13~	-.08
Teacher with guidance vs. Control group	.72***	.70***	.20~
Teacher with guidance vs. Independent reading	.53***	.57***	.28*
ΔR^2	.40***	.40***	.06*
R^2	.51***	.52***	.09*
F(3, 99)	34.30***	36.06***	3.11*

*** $p < .001$, ** $p < .01$, * $p < .05$, ~ $p < .10$.

In the word explanation outcome, the regression to the mean effect remained: children made a negative improvement from the pre-intervention to the first posttest and from pretest to posttest 2 ($\beta = -.33, p < .001$; $\beta = -.35, p < .001$). Namely, children with lowest word explanation success progressed the most from pretest to posttest 1, and from pretest to posttest 2. In step 2, the performance of the group that read the e-book with the dictionary and the teacher's support was higher compared to the control and the independent reading groups (posttest 1 minus pretest: $\beta = .72, p < .001$; $\beta = .53, p < .001$; posttest 2 minus pretest: $\beta = .70, p < .001$; $\beta = .57, p < .001$). Moreover, the improvement of the group that read the e-book with the dictionary and the teacher's support was higher compared to the independent reading group in posttest 1 to posttest 2 ($\beta = .28, p < .05$). The independent reading group showed greater improvement than the control group from the pretest to posttest 1 ($\beta = .18, p < .05$). The second step resulted in a significant ($p < .05$) R-square change across the three improvement outcomes.

Table 7 shows results for word production improvement outcome.

Step 1 did not show any pre-intervention effect of word production on word production improvements ($p > .05$). However, the group that read the e-book with the dictionary and the teacher's support outperformed the other two groups in the two posttests (posttest 1 minus pretest: $\beta = .67, p < .001$; $\beta = .63, p < .001$; posttest 2 minus pretest: $\beta = .72, p < .001$; $\beta = .73, p < .001$; posttest 2 minus posttest 1: $\beta = .11, p < .01$; $\beta = .11, p < .05$). These additional effects added to the explanatory percent of the three improvement models as shown in the ΔR^2 .

In conclusion, according to these models we revealed the greater improvement of the group which read the e-book with the dictionary and the teacher's support. That is, the teacher's support when reading the e-book with the dictionary led to better performance in receptive understanding, word explanation and word production compared to the group that read the e-book with the dictionary independently and compared to the control group.

Discussion

One of the main findings of this study indicates that children, who participated in the intervention of reading the e-book with the dictionary and their teacher's support learned more words in all three tested measures (receptive understanding, word explanations and word production) than those who read the e-book with the dictionary independently or those who read it without the dictionary

Table 7. Hierarchical regression results for improvements in producing target words, standardized coefficients.

	Improvement in producing target words (post 1 minus pre)	Improvement of producing target words (post 2 minus pre)	Improvement in producing target words (post 2 minus post 1)
Step 1			
Producing target word pre	-.18~	-.18~	-.03
R ²	.03~	.03~	.001
F(1,101)	3.52~	3.46~	.07
Step 2			
Independent reading vs. Control group	.04	-.01	-.13
Teacher with guidance vs. Control group	.67***	.72***	.24*
Teacher with guidance vs. Independent reading	.63***	.73***	.37**
Independent reading vs. Control group			
ΔR^2	.42***	.52***	.11**
R ²	.46***	.56***	.11*
F(3, 99)	27.90***	41.59***	3.89*

*** $p < .001$, ** $p < .01$, * $p < .05$, ~ $p < .10$.

(control). Furthermore, these achievements were maintained after a month. These findings are consistent with results from previous studies that showed that kindergarten teachers' training contributed to children's advancement in language and literacy skills (Blachman, Tangel, Ball, Black, & McGraw, 1999; Elish-Piper & L'Allier, 2007; L'Allie, Elish-Piper, Rita, & Bean, 2010; McCombs & Marsh, 2009). We assume that the guidance for optimal integration of the e-book in the kindergarten classroom curriculum, the effective use of the e-book as a coefficient of vocabulary enrichment, and the teacher's work according to a structured and systematic programme, all helped promote the learning of new words most effectively. We believe that combining the support of the kindergarten teacher with the representation of the difficult word in the animation, together with the short oral explanation provided for the difficult word, contributed to the best learning of new words. The results are consistent with our previous results (Korat et al., 2011; Segal-Drori et al., 2010) that showed that adult mediation (by experimenters) while children use an e-book are more effective for promoting emergent reading (word recognition, phonological awareness) than children using the e-books independently. The current study adds to these earlier results with reference to the combination of the human mediation of the kindergarten teacher within the classroom context and curriculum, along with the unique components in the e-book that support the learning of new words.

Our findings emphasize the optimal combination between the theory of synergy (Neuman, 1995; Neuman et al., 2020) and the cognitive-social theory (Klein, 1996; Vygotsky, 1978). According to the synergy theory, use of motion and visual representation along with a verbal explanation supports the learning of new words through synergistic relationships in which the combined contribution of the various multimedia components exceeds the sum of these components. The cognitive-social theory posits that for children to reach high levels of cognitive function, they need adult mediation to efficiently organize and suit their interests and abilities. Adult support helps children assimilate and preserve new learning over time (Feuerstein, 1979; Klein, 1996). The optimal integration of a well-designed e-book, which included explanations of new words using animations together with the teacher's support, led to the best results. The efficiency of the teacher's discourse with the children, including questions regarding the words' meanings, support the findings of previous studies (Ard & Beverly, 2004; Blewitt et al., 2009).

As for word explanation ability, the results indicated that in the first posttest, the group that read the e-book independently with the dictionary achieved higher scores than the control group that read the e-book independently without the dictionary. Apparently, the dictionary in the e-book was especially efficient in promoting children's ability to explain new words compared to the non-dictionary situation. As mentioned, the dictionary provided a short explanation with suitable very short and concise animations. The intervention of the dictionary was designed to present very short interference in the story flow, aiming to avoid cognitive load for the learner (Kirschner, 2002; Sweller, 1994). However, the learning advantage was not maintained over time (4 weeks after). It is possible that the dictionary design was too limited for children's learning beyond the intervention. It seems that additional support beyond the dynamic illustration was required for the children in order to lead to long-term retention of the learning. For example, clicking on the dictionary word again may preserve children's learning more than one exposure in each reading session. This may of course raise the issue of a longer interaction with the digital dictionary, which might distract the children from the story line (see Takacs et al., 2015). Another possibility is the assistance of an adult beyond the support of the dictionary while reading the e-book, as was performed in the second intervention group in the current study.

Another interesting and important finding in our research is that children with a low initial word understanding level progressed the most from the pretest to posttest 1 and to posttest 2 in two measures: receptive word knowledge and word meaning. It is possible that the dynamic dictionary in the e-book was particularly helpful for the children who were at a low level, and contributed to their retained learning. This could be explained by the idea that young children are more attracted to dynamic than static presentations, which may support the contiguity between the oral presentation (saying the word) and its illustrations (e.g. Mayer & Moreno, 2002). As suggested in previous

research, animations are regarded as requiring a less effortful process and this might be especially helpful for children with a low vocabulary (Hegarty et al., 2003). These findings could also be explained by the dual-coding theory (Paivio, 2007, 2008) which posits that verbal and visual information are encoded and stored in separate memory systems, one which is language-specific and the other which is visual-spatial. The assumption is that remembering information encoded in one way not only does not interfere with remembering information encoded in the other way, but may also be more supportive to learning new words than the static presentation (see Korat et al., 2014; Smeets & Bus, 2014; Verhallen & Bus, 2010). Beyond that, the combination of the dynamic dictionary and adult mediation increased the children's learning and made it even more efficient.

The findings regarding the advantage of the low achieving children do not support Stanovich's (2000) claim that 'the rich get richer'. Here it can be seen that children with low language abilities are the ones who progressed more than the others. The results are consistent with previous findings which described multimedia effects (animation, voiceovers, etc.) as possible successful tools that can support low achieving children and help in narrowing learning gaps (Smeets, van Dijken, & Bus, 2014; Verhallen et al., 2006; Verhallen & Bus, 2010).

Three different levels of word learning (receptive understanding, word explanation, and word production) were measured in this study. We found that the children's initial level of word production progressed much less than the other two measures. These results support the notion that word production is a more difficult ability than the other two, since it requires retrieving the word and using in a suitable context. In contradistinction, it was easier for the children to learn new words receptively and to learn to explain words, especially when the word was actually presented to them by the dictionary and by an explanation mediated by their teacher. This raises thoughts for future research about the type of support which is required for teaching vocabulary at different levels of knowledge in general, and more specifically while using e-books with a dictionary.

Some limitations of the current research should be noted. The present study was performed in three kindergarten classrooms. A larger number of kindergarten classrooms in each type of comparison group may enable better generalization regarding the effectiveness of the intervention programmes we presented. Furthermore, only one e-book was used for the intervention. More e-books with different structures and complexities, including different types of words (not only verbs), may help in better generalization of our findings. Including standardized children's vocabulary measures may also help us to better determine their effects on children's progress following the intervention. It is possible that teacher support of the words learning was expanded (consciously or unconsciously due to a priming effect) into instruction and daily activities beyond the book session. Since the intervention was administered with pairs of students working together, potential influence of the peer context should be taken into account when considering the intervention effects. Finally, since only one teacher implemented the supported condition, caution should be used in assuming that the results can be generalized to teachers from other backgrounds, including implementation of this study in a larger sample of teachers.

In conclusion, intervention programmes which incorporate well-designed e-books that provide vocabulary support may promote LSES children's vocabulary. Kindergarten teachers' support during this e-book reading may add significant and special value to this learning. Our findings reinforce the importance of developing well-designed e-books which support children's vocabulary and further the integration of these e-books into the everyday kindergarten classroom programme.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

- Aram, D. (2006). Early literacy interventions among low SES preschoolers: The relative roles of storybook reading and alphabetic skills activities. *Reading and Writing: An Interdisciplinary Journal*, 19(5), 489–515. doi:10.1007/s11145-006-9005-2
- Ard, L., & Beverly, B. (2004). Preschool word learning during joint book reading: Effect of adult questions and comments. *Communication Disorders Quarterly*, 26(1), 17–28. doi:10.1177/15257401040260010101
- Arest, K. (2012). *Does maternal mediation during book reading promotes children's emergent reading? And does the progress maintains? A comparison between E-book and printed book activity*. M.A thesis. School of Education, Bar Ilan University (Hebrew).
- Armon-Lotem, S., & Berman, R. A. (2003). The emergence of grammar: Early verbs and beyond. *Journal of Child Language*, 30(4), 845–877. doi:10.1017/S0305000903005750
- Blachman, B. A., Tangel, D. M., Ball, E. W., Black, R., & McGraw, C. K. (1999). Developing phonological awareness and word recognition skills: A two-year intervention with low-income, inner-city children. *Reading and Writing: An Interdisciplinary Journal*, 11(3), 239–273. doi:10.1023/A:1008050403932
- Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared book reading: When and how questions affect young children's word learning. *Journal of Educational Psychology*, 101(2), 294–304. doi:10.1037/a0013844
- Bus, A. G., Van Ijzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65(1), 1–21.
- Central Bureau of Statistics. (2018). *Israel demographic profile 2018* [Hebrew].
- Chan, A. S., Cheung, M. C., Sze, S. L., Leung, W. W., & Cheung, R. W. (2008). Measuring vocabulary by free expression and recognition tasks: Implications for assessing children, adolescents, and young adults. *Journal of Clinical and Experimental Neuropsychology*, 30(8), 892–902. doi:10.1080/13803390701861384
- Côté, I., Rouleau, N., & Macoir, J. (2014). New word acquisition in children: Examining the contribution of verbal short-term memory to lexical and semantic levels of learning. *Applied Cognitive Psychology*, 28(1), 104–114. doi:10.1002/acp.2961
- Dickenson, D., & Morse, A. B. (2019). *Connecting through talk: Instructing children's development with language*. Baltimore: Brooks.
- Dickinson, D. K., & McCabe, A. (2001). Bringing it all together: The multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research and Practice*, 16(4), 186–202. doi:10.1111/0938-8982.00019
- Dunn, L. M., & Dunn, L. M. (1981). *Peabody picture vocabulary test*. San Antonio: Pearson.
- Elish-Piper, L. A., & L'Allier, S. K. (2007). *Does literacy coaching make a difference? The effects of literacy coaching on reading achievement in grades K–3 in a reading first district*. Presented in Annual Conference of the National Reading Conference, Austin, TX, USA.
- Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science*, 16(2), 234–248.
- Feuerstein, R. (1979). *The dynamic assessment of retarded performers*. New York: University Park Press.
- Fuchs, D., Fuchs, L. S., Thompson, A., Otaiba, S. A., Yen, L., Yang, N. J., ... O'Connor, R. E. (2001). Is reading important in reading readiness programs? A randomized field trial with teachers as program implementers. *Journal of Educational Psychology*, 93(2), 251–267. doi:10.1037/00220663.93.2.251
- Fuller, R. B., & Applewhite, E. J. (1979). *Synergetic: Explorations in the geometry of thinking*. New York: Macmillan.
- Gardner-Neblett, N., & Iruka, I. U. (2015). Oral narrative skills: Explaining the language-emergent literacy link by race/ethnicity and SES. *Developmental Psychology*, 51(7), 889–904. doi:10.1037/a0039274

- Gaudreau, C., King, Y. A., Dore, R. A., Puttre, H., Nichols, D., Hirsh-Pasek, K., & Golinkoff, R. M. (2020). Preschoolers benefit equally from video chat, pseudo-contingent video, and live book reading: Implications for storytime during the Coronavirus pandemic and beyond. *Frontiers in Psychology, 11*, 2158.
- Gentner, D. (1981). Some interesting differences between verbs and nouns. *Cognition and Brain Theory, 4*(2), 161–178.
- Golinkoff, R. M., Hoff, E., Rowe, M. L., Tamis-LeMonda, C. S., & Hirsh-Pasek, K. (2019). Language matters: Denying the existence of the 30-million-word gap has serious consequences. *Child Development, 90*(3), 985–992.
- Greenlee-Moore, M. E., & Smith, L. L. (1996). Interactive computer software: The effects on young children's reading achievement. *Reading Psychology: An International Quarterly, 17*(1), 43–64. doi:10.1080/0270271960170102
- Hegarty, M., Kriz, S., & Cate, C. (2003). The roles of mental animations and external animations in understanding mechanical systems. *Learning and Instruction, 21*(4), 325–360. doi:10.1207/s1532690xci2104_1
- Hoff, E. (2006). How social contexts support and shape language development. *Developmental Review, 26*(1), 55–88.
- Jenkins, J. R., Matlock, B., & Slocum, T. A. (1989). Two approaches to vocabulary instruction: The teaching of individual word meanings and practice in deriving word meaning from context. *Reading Research Quarterly, 24*(2), 215–235. doi:10.2307/747865
- Kirschner, P. A. (2002). Cognitive load theory: Implication of cognitive load theory on design of learning. *Learning and Instruction, 12*(1), 1–10. doi:10.1016/S0959-4752(01)00014-7
- Klein, P. S. (1996). *Early intervention: Cross cultural experiences with a mediational approach*. New York: Garland.
- Korat, O., Amer, K., Mahameed, W., & Gnaiem Kabha, H. (2021). Screen use during COVID-19 among Israeli young children in Arabic and Hebrew speaking communities. *Researching Early Childhood, 13*, 1–30. (Hebrew)
- Korat, O., & Blau, H. (2010). Repeated reading of CD-ROM storybook as a support for emergent literacy: A developmental perspective in two SES groups. *Journal of Educational Computing Research, 43*, 443–462.
- Korat, O., & Falk, Y. (2017). Ten years after: Can recent e-books for young children serve as a good support for language and literacy learning? *Journal of Early Childhood Literacy, 19*(2), 206–223.
- Korat, O., Levin, I., Ben-Shabat, A., Shneor, D., & Bokovza, L. (2014). Dynamic compared to static dictionary with and without printed focal words in e-book reading as facilitator for word learning. *Reading Research Quarterly, 49*(4), 371–386. doi:10.1002/rrq.78
- Korat, O., & Shamir, A. (2012). Direct and indirect teaching: Using e-books for supporting vocabulary, word reading and story comprehension. *Journal of Education Computing Research, 46*(2), 135–152.
- Korat, O., Shamir, A., & Arbib, L. (2011). E-books as a support for emergent writing with and without adult assistance. *Education and Information Technologies, 16*(3), 301–318. doi:10.1007/s10639-010-9127-7
- Korat, O., & Shneor, D. (2019). Can e-book support LSES parental mediation to enrich children's vocabulary? *First Language, 1*–22. doi:10.1177/0142723718822443
- Kotaman, H. (2020). Impacts of dialogical storybook reading on young children's reading attitudes and vocabulary development. *Reading Improvement, 57*(1), 40–45.
- L'Allie, S., Elish-Piper, L., Rita, L., & Bean, M. (2010). What matters for elementary literacy coaching? Guiding principles for instructional improvement and student achievement. *The Reading Teacher, 63*(7), 544–554. doi:10.1598/RT.63.7.2
- Levin, I., & Aram, D. (2012). Mother-child joint writing and storybook reading and their effects on kindergartners' literacy: An intervention study. *Reading and Writing: An Interdisciplinary Journal, 25*(1), 217–249. doi:10.1007/s11145-010-9254-y
- Levine, D., Pace, A., Luo, R., Hirsh-Pasek, K., Golinkoff, R. M., de Villiers, J., ... Wilson, M. S. (2020). Evaluating socioeconomic gaps in preschoolers' vocabulary, syntax and language process skills with the Quick interactive language Screener (QUILS). *Early Childhood Research Quarterly, 50*, 114–128.
- Lorio, C. M., & Woods, J. J. (2020). Multi-component professional development for educators in an early head start: Explicit vocabulary instruction during interactive shared book reading. *Early Childhood Research Quarterly, 50*, 86–100.
- Masek, L. R., Paterson, S. J., Golinkoff, R. M., Bakeman, R., Adamson, L. B., Owen, M. T., ... Hirsh-Pasek, K. (2020). Beyond talk: Contributions of quantity and quality of communication to language success across socioeconomic strata. *Infancy, 26*(1), 123–147.
- Mayer, R. E., & Moreno, R. (2002). Animation as an aide to multimedia learning. *Educational Psychology Review, 14*(1), 87–99. doi:10.1023/A:1013184611077
- McCombs, J. S., & Marsh, J. A. (2009). Lessons for boosting the effectiveness of reading coaches. *Phi Delta Kappan, 90*(7), 501–507. doi:10.1177/003172170909000710
- Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. H. (2008). Added value of dialogic parent-child book reading: A meta-analysis. *Early Education and Development, 19*(1), 7–28. doi:10.1080/10409280701838603
- Nation, K., & Snowling, M. J. (2004). Beyond phonological skills: Broader language skills contribute to the development of reading. *Journal of Research in Reading, 27*(4), 342–356. doi:10.1111/j.1467-9817.2004.00238.x
- Neuman, S. B. (1995). *Literacy in the television age: The myth of the TV effect*. Westport, CT: Greenwood.
- Neuman, S. B., Flynn, R., Wong, K., & Kaefer, T. (2020). Quick, incidental word learning in educational media: All contexts are not equal. *Educational Technology Research and Development*, doi:10.1007/s11423-020-09815-z
- Ouellette, G., & Beers, A. (2010). A not-so-simple view of reading: How oral vocabulary and visual-word recognition complicate the story. *Reading and Writing, 23*(2), 189–208. doi:10.1007/s11145-008-9159-1

- Paivio, A. (2007). *Mind and its evolution: A dual coding theoretical approach*. Mahwah, NJ: Erlbaum.
- Paivio, A. (2008). Mind and its evolution: A dual coding theoretical approach. *The Psychological Record*, 59, 301–312.
- Ravid, D. (2012). *Spelling morphology: The psycholinguistics of Hebrew spelling*. New York: Springer, doi:10.1007/978-1-4419-0588-8_13
- Robbins, C., & Ehri, L. C. (1994). Reading storybooks to kindergartners helps them learn new vocabulary words. *Journal of Educational Psychology*, 86(1), 54–64. doi:10.1037/0022-0663.86.1.54
- Rosenthal, J., & Ehri, L. C. (2008). The mnemonic value of orthography for vocabulary learning. *Journal of Educational Psychology*, 100(1), 175–191. doi:10.1037/0022-663.100.1.175
- Roskos, K., & Neuman, S. (1998). Play as an opportunity for literacy. In O. N. Saracho & B. Spodek (Eds.), *Multiple perspectives on play in early childhood education* (pp. 100–115). Albany: State University of New York Press.
- Rumelhart, D. E. (1975). Notes on a schema for stories. In D. G. Bobrow & A. M. Collins (Eds.), *Representations and understanding: Studies in cognitive science* (pp. 185–210). New York: Academic Press.
- Segal-Drori, O., Korat, O., Shamir, S., & Klein, P. (2010). Reading electronic and printed books with and without adult's instruction: Effects on emergent reading. *Reading and Writing: An Interdisciplinary Journal*, 23, 913–930. doi:10.1007/s11145-009-9182-x
- Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language*, 24(1), 123–138.
- Shimshoni, E. (2009). *Wonder knitting needles*. Tel-Aviv: Sifriyat Hapoalim Hakibbutz Hameuchad (Hebrew).
- Smeets, D. J. H., & Bus, A. G. (2014). The interactive animated e-book as a word learning device for kindergartners. *Applied Psycholinguistics*, 22(1), 1–22. doi:10.1017/S0142716413000556
- Smeets, D. J. H., van Dijken, M. J., & Bus, A. G. (2014). Using electronic storybooks to support word learning in children with severe language impairments. *Journal of Learning Disabilities*, 47(5), 435–449. doi:10.1177/0022219412467069
- Stanovich, K. E. (2000). *Progress in understanding reading: Scientific foundations and new frontiers*. New York: Guilford.
- Swanborn, M. S. L., & De Glopper, K. (2002). Impact of reading purpose on incidental word learning from context. *Language Learning*, 52(1), 95–117.
- Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, 4(4), 295–312.
- Takacs, Z. K., Swart, E. K., & Bus, A. G. (2015). Benefits and pitfalls of multimedia and interactive features in technology-enhanced storybooks: A meta-analysis. *Review of Educational Research*, 85(4), 698–739. doi:10.3102/0034654314566989
- Thorndyke, P. W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, 9(1), 77–110. doi:10.1016/0010-0285(77)90005-6
- Toub, T. S., Hassinger-Das, B., Nesbitt, K. T., Ilgaz, H., Weisberg, D. S., Hirsh-Pasek, K., & Dickinson, D. K. (2018). The language of play: Developing preschool vocabulary through play following shared book-reading. *Early Childhood Research Quarterly*, 45(4), 1–17. doi:10.1016/j.ecresq.2018.01.010
- Troseth, G. L., Strouse, G. A., Flores, I., Stuckelman, Z. D., & Johnson, C. R. (2020). An enhanced eBook facilitates parent-child talk during shared reading by families of low socioeconomic status. *Early Childhood Research Quarterly*, 50, 45–58.
- Verhallen, M. J., & Bus, A. G. (2010). Low-income immigrant pupils learning vocabulary through digital picture storybooks. *Journal of Educational Psychology*, 102(1), 54–61. doi:10.1037/a0017133
- Verhallen, M. J., Bus, A. G., & de Jong, M. T. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology*, 98(2), 410–419. doi:10.1037/0022-0663.98.2.410
- Vygotsky, L. S. (1978). Interaction between learning and development. In M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.), *Mind in society: The development of higher psychological process* (pp. 79–91). Cambridge, MA: Harvard University Press.
- Whitehurst, G. J., & Lonigan, C. J. (2001). Emergent literacy: Development from prereaders to readers. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research* (pp. 11–29). New York, NY: Guilford.
- Yow, W. Q., & Priyashri, S. (2019). Computerized electronic features direct children's attention to print in single-and dual-language e-books. *AERA Open*, 5(3), 1–15. doi:10.1177/2332858419878126

Appendix

Protocol of one reading session in group 3, reading screens 4, 9 and 12 in the e-book with the dictionary.

Step 1: The teacher worked with a group of four children (for 10 min). She opened the e-book on the first screen, which presents the story's title, and invited the children to a conversation. She asked: 'Do you remember the book's title? What is the story about?' Following the conversation, she operated the e-book on screen 4.

In screen 4, the narrator says: 'On the balcony of Esther the neighbour, the flowers all froze. Grandma quickly knitted a perfect plant-coat for them'.

Dictionary: Frozen: They were very cold.

The kindergarten teacher drew the children's attention by pointing to the illustration that appears on the screen, and asked: 'What happened to Esther's flowers?' (They were very cold), 'What is frozen?'

In screen 9, the narrator says: 'And here one day a strange man came, different from all the others, his eyes lowered, his gaze fixed, quietly-quietly, he enters grandmother's house'.

Dictionary: Lowered, the stranger man lowered his gaze.

The kindergarten teacher drew the children's attention to the illustration on the screen, and asked them: 'Who do you see in the illustration?', 'What did the stranger do?', 'Why did he lower his eyes?', 'What is to lower the eyes?'

In screen 12, the narrator says: 'He finished talking, looked down. Maybe it's time to go home?' So Grandma put down the knitting needles and asked softly, 'What will you drink?' 'She brought cakes and two cups of tea from the kitchen. They sat and sipped, told stories, were so happy to meet each other, laughed and cried, sweetened things until evening fell on the city'.

Dictionary: Sipped: Drank, Grandma and the man drank tea.

The kindergarten teacher drew the children's attention to the illustration that appeared on the screen, and asked them: 'Who do you see in the illustration?', 'What are the stranger and grandmother doing?', 'What did the stranger sip, drink?', 'What is sipped?'

Step 2: The teacher divided the four-child groups into two pairs. Each pair worked on the e-book without the teacher (for 15 min). Each pair continued reading the e-book with the dictionary to the end.

Closing task: (5 min). The kindergarten teacher invited the children to think about how they could make others happy (write and draw).