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The effect of electronic books on enhancing emergent literacy skills of pre-school children

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ABSTRACT

The purpose of this study was to investigate the effects of e-books on enhancing Jordanian preschool children's emergent literacy skills (experimental group), in comparison to children who were exposed to regular printed books (control group). To achieve the objectives of this study, the total of 92 children were assigned to either experimental group ($n = 48$) and control group ($n = 44$). The pre- and post-test data was collected on print awareness, vocabulary, alphabetic knowledge and phonological awareness skills to determine the effectiveness of e-books. The results indicated that children in experimental group performed significantly better than the children in control group. Moreover, significant differences were found according to gender, as the female children exhibited superior emergent literacy skills to the male children. Regarding the different emergent literacy skills, children in the experimental group achieved better improvement in the areas of print awareness and vocabulary. Based on these findings, it is recommended that pre-school institutions incorporate e-books activities into their classrooms.

1. Introduction

The current generation of young children is growing up in a digital media-saturated environment in which they receive daily exposure to a variety of technologies (Hisrich & Blanchard, 2009). As a result of this technology exposure, young children today have many opportunities to observe technology, explore it, and play with it. One of these technologies to which young children are exposed is electronic books (e-books).

E-books represent the combination of the advantages of printed books with the capabilities of computer technology, and this can be helpful to children who do not respond well to traditional print media or who are reluctant to read (Maynard, 2010; Maynard & McKnight, 2001). Through their exposure to e-books, children can explore the story by themselves without the help of an adult, and that is another merit of these digital texts (Gong & Levy, 2009).

Previous research into the effect of e-books on the development of children's language and literacy skills has offered evidence regarding how this digital form of book helps promote different emergent literacy skills (De Jong & Bus, 2004; Moody, 2010; Verhallen & Bus, 2010). However, a number of researchers have taken a more critical view on e-books due to their incorporation of features like animation, sound, music and other multimedia effects, which may distract young readers from the story content and negatively influence their understandings of the story's main theme (Labbo & Kuhn, 2000).

In addition to traditional printed storybooks, e-books are currently used in some Jordanian pre-school classrooms due to the availability of computers in these classrooms. Therefore, this present study was carried out to investigate the effect of e-books on the development of emergent literacy skills for Jordanian pre-school children, and to provide suggestions about how stakeholders can use critical evidence to better support pre-schoolers' literacy development when using e-books activities. Gender differences were also investigated to find out whether significant differences exist between boys and girls in relation to emergent literacy skills.

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2. Theoretical underpinning

The development of information and communication technology (ICT) such as computers, the Internet, and the introduction of hypertext and data storage media such as CD-ROMs have led to the evolution of the concept of the electronic book (Maynard & McKnight, 2001). E-book is a "text converted into digital form, a book in a computer file format, or an electronic file of words and images" (Rao, 2003, p. 86). It contains audio (e.g. music, narration) and visual (e.g. animation) features which are different from the mono-modal features of print books (Unsworth, 2006). These added features provide young children with many opportunities to enjoy storybook animations, hear and follow along with the text, and engage with interactive options provided to readers (De Jong & Bus, 2004; Horney & Anderson-Inman, 1999).

In recent years there has been a growing trend toward the use of digital versions of books in early childhood classrooms (Unsworth, 2006). The International Reading Association (2009) highlighted the importance of integrating technologies, including digital texts such as e-books, into current literacy programs. Research has found that exposure to educational e-books can enhance children's language and literacy development (De Jong & Bus, 2004; Gong & Levy, 2009; Maynard & McKnight, 2001; Moody, 2010; Neuman, 2009; Verhallen & Bus, 2010; Zucker, Moody, & McKenna, 2009). In the views of Zucker et al., (2009) e-books are increasingly used for learning to read by beginners and children with reading difficulties as well. According to Moody (2010), digital reading materials have become commonplace in early years classrooms in efforts to support children's engagement in storybooks while enhancing their emergent literacy.

Emergent literacy is the earliest stage of literacy development. The concept of emergent literacy came from Marie Clay who described young children's early reading and writing behaviors prior to entry into formal instruction in school (Clay, 1967). This concept includes knowledge, skills, and attitudes that are assumed to be developmental precursors to conventional reading and writing (National Early Literacy Panel, 2008; Whitehurst & Lonigan, 1998). According to Whitehurst and Lonigan (1998), emergent skills are categorized into two broad areas: 1) outside-in skills which support reading comprehension (e.g. Vocabulary and oral language development), and 2) inside-out skills which foster the development of early decoding and spelling (e.g. Print knowledge, alphabet letter names, and phonological awareness).

Research has clearly shown that young children must possess these outside-in and inside-out skills in order to become successful readers (Anthony et al., 2002; Niessen, Strattman, & Scudder, 2011). On the contrary, children who start elementary school with poor emergent literacy skills have been shown to be unable to take advantage of reading instruction in pre-school settings (Snow, Burns, & Griffin, 1998).

Because of their many unique features, e-books provide children with many opportunities for promoting their emergent skills. For instance, pictures and animations support word recognition and comprehension (Doty, Popplewell, & Byers, 2001), while computers that read and highlight the text support print awareness and alphabets (Moody, 2010), and word pronunciation tools enhance phonological awareness (Wood, Pillinger, & Jackson, 2010). These skills (e.g. Alphabetical knowledge, phonological awareness, print awareness, and vocabulary) are considered significant to the development of children's emergent literacy abilities.

Alphabetical knowledge refers to young children's ability to identify letter names and letter sounds (Adams, 1990). It is causally related to the development of emergent literacy among children (Treiman, 2006). Research has shown that e-books can enhance children's letter knowledge (De Jong & Bus, 2004). It is worth mentioning that Arabic is the background language for this present study. The Arabic language has its unique features which are different from other language; for instance Arabic does not have the concepts of upper and lowercase letters. That is, children are exposed to the letter in the initial position of the word followed by the different shapes of the same letter according to its location in the word (in the middle of the word and in the final position of the word).

Phonological awareness is an important element of emergent literacy. It deals with the understanding that spoken words are made up of separate units of sounds that are blended together when words are pronounced (Adams, 1990; Bradley & Bryant, 1993). Phonological awareness describes "the ability to notice, think about, or manipulate the individual sounds in words" (Torgesen & Mathes, 1998, p. 2). Early literacy researchers have found that rhyming words, phoneme blending, phoneme identification, and phoneme segmentation are essential aspects of phonological awareness (Catts, Fey, Zhang, & Tomblin, 2001; Torgesen, 2002; Vloedgraven & Verhoeven, 2007; Wood, 1999, 2000). Research has found that e-books contribute to the development of children's phonological awareness (Chera & Wood, 2003; Wood et al., 2010). For instance, Chera and Wood (2003) carried out a study to investigate whether e-books can promote phonological awareness and reading acquisition in kindergarten children, and found that children who were exposed to e-books during a four-week program achieved higher scores on the phonological awareness tasks (e.g. visual and auditory letter sound awareness, visual, auditory and verbal onset awareness, and rhyme awareness) than the children, in comparison to the control group.

Print awareness generally refers to a child's understanding of the nature and uses of print. Research has revealed that print awareness is an important first step in the development of emergent literacy (Christie, Enz, & Vukelich, 2010; Walpole, Chow, & Justice, 2004). Children's print awareness includes identifying the functions and conventions of print such as understanding the difference between print and pictures, knowing that print has meaning, knowing how to handle a book, and noticing print all around, knowing that words are separated by spaces, and that writing is arranged linearly (Heroman & Jones, 2010). Karemaker, Pitchford, and O'Malley (2010) explored whether multimedia software stories enhance children's recognition of written words, and found that children who were exposed to e-stories during a five-week program achieved significant improvement in written/printed word recognition compared to children who were exposed to traditional printed Big Books.

Vocabulary refers to children's ability to understand word meaning in a text. In the view of Thurlow (2009), e-books help children improve their vocabulary when e-books are read aloud and the accompanying pictures help children link them to the spoken words. Moreover, vocabulary is enhanced when an adult provided children with further instruction and encouraged them to link new and prior knowledge from e-books over e-books alone (Higgins & Hess, 1999). Labbo and Kuhn (2000) pointed out that e-books help children better understand word's meaning and story line, thereby contributing to the development of their vocabulary (De Jong, Miller, & Olson, 1997; Moody, 2010; Segers, Takke, & Veroeven, 2004; Thurlow, 2009; Verhallen, Bus, & DeJong, 2006).

Against this background, some educators have nevertheless expressed skepticism regarding the usefulness of e-books in early years education (Labbo & Kuhn, 2000). For example, De Jong and Bus (2004) considered reading from e-books to be an entertainment activity rather than a learning activity. Despite these potential limitations, however, e-books are increasingly coming to be viewed as a useful tool for children's language and literacy development.

One of the most important aims of early childhood curricula is the development of children's emergent literacy skills, as these are the basis for the development of conventional literacy in later years. Literature written on emergent literacy suggested that many instructional

practices could contribute to the development of these skills, such as using computer-assisted instruction (Bayhan, Olgun, & Yelland, 2002), employing shared reading activities (Morrow, 2009), or immersing children in a print-rich environment (Heroman & Jones, 2010). In the current study the focus will be given to only one instructional practice, namely, the use of e-books activity.

Literature written on gender differences in emergent literacy revealed a clear concern for the underachievement of boys when it comes to literacy. For instance, research studies which investigated reading to children from traditional printed books and exposing children to different approaches of literacy suggested that girls achieved significantly higher scores than boys (Ihmeideh, 2009; Lummis & Stevenson, 1990; Phillips, Norris, Osmond, & Maynard, 2002; Powell, 1995). Therefore, it is important to in the current study to find out whether a significant disparity in relation to emerging literacy skills exists between boys and girls when exposing them to e-book experiences.

3. Significance of the study

The main motivation for doing this study is to increase stakeholders' awareness of the fact that technology in early years educational institutions can no longer be considered a luxury but is rather an important and a real learning tool. In recent years e-books have been employed increasingly in educational contexts in western countries. With the entry of computers into Jordanian pre-school settings, e-books also appeared in some pre-school classrooms, and it is thus vital to shed some light on the effect of these e-books in different language and cultural contexts in order to know whether they can produce similar benefits as traditional printed books.

Being the only experimental study at the local level in Jordan and in the Arab region overall to the best of the author's knowledge, this study addresses an important and contemporary issue around children's experiences with e-books and their potential effect on the emergent literacy development of young children. The purpose of this study was to examine whether preschool children advance more in their literacy skills when they engage with e-books than when they engage with traditional books. A second goal was to examine gender differences in emergent literacy skills for boys and girls who used e-books. More specifically, this study sought to answer the following research questions:

- Are there any significant differences between the mean scores in emergent literacy skills for children in e-books group (experimental group) compared to children who were exposed to regular print books (control group)?
- Are there any significant differences between young children's mean scores in emergent literacy that are attributed to gender (boys and girls)?
- In which areas of emergent literacy skills do children show greater progress after the employment of e-books activities?

3.1. Method

3.1.1. Participants

Initially, two private kindergarten schools in Jordan were purposefully chosen from the Private Educational Directorate in Amman for convenience. These kindergartens were selected because 1) they have computers in their classrooms; where many kindergartens do not have, and 2) they employ “story time” period activity in their daily routine. The participants in the current study included 92 pre-school children; 40 boys and 52 girls who were mainly from middle-class or low-class families. The children's ages in the sample ranged from four years and seven months to five years and two months. Two (out of 4) classrooms were randomly assigned to the experimental group ($n = 48$; 21 boys and 27 girls), and two were assigned to the control group ($n = 44$; 19 boys and 25 girls). Children in the experimental groups were exposed to the electronic versions of books, whilst children the control groups were exposed to the same books read to them in the traditional printed format. The participants in both groups do not have special educational needs. Table 1 presents the study participants.

3.1.2. Materials

For the purpose of this study, three Arabic books were selected to be used in this study. They were: 1) *The Conceited Ibex*, 2) *Rami and The Dreams' King*, and 3) *The Three Goats*. All available books in selected kindergartens were given a ticket; the selection was made by a ‘lottery’ random procedure to pick up only three books from both kindergartens. These books were available in the market only in printed format. Because of the absence of e-books existed in Arabic language for preschool-aged children, the printed books used in the current study were converted into digital format (e-books). Although there are a few e-books in Arabic are already existed in the market, they are designed for children in primary schools (for the first three grades).

Before converting these printed books into e-books, they were examined by a panel for five experts, consisting of university lecturers with specialization in children's literature, and were found to be developmentally appropriate books for working with children; the experts agreed that the content and the forms of these books were appropriate for young children.

After that, the researcher converted these books into a digital format, and in the process, the following stages of the design process were taken into consideration:

Table 1
Participants' characteristics per group.

Gender	Group				Total	
	Experimental group (E-books)		Control group (Printed books)			
	N	%	*N*	%	*N*	%
Boys	21	43.8	19	43.2	40	43.5
Girls	27	56.2	25	56.8	52	56.5
Total	48	100	44	100	92	100

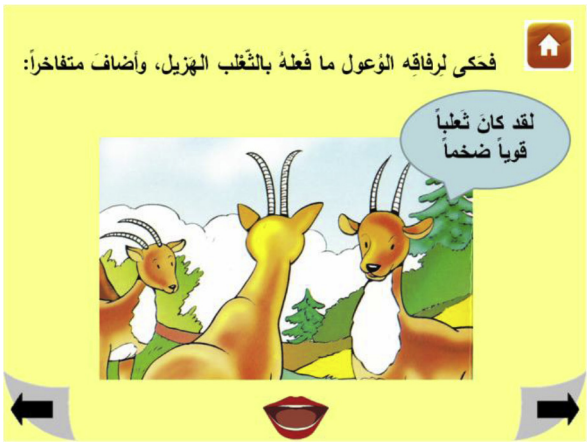

Fig. 1. Example for the story of "The Conceited Ibex".

—*Inserting the story*: In this stage, all pages of each e-book were scanned from the printed book to be like the original hardcopy text.
—*Capturing the media*: In this stage, interactive icons, importing images, animations, and recorded sounds were added to the software program. The story was read orally by an actor. Automatic visual features were also added to the e-books.
—Designing the pages and navigation system: In this stage, the navigation was designed and page transitions were chosen.

In developing the e-books, the researcher ensured that the program was easy to use and that each of the features was used appropriately. Figs. 1–3 present examples of these designed e-books.

The e-books were validated by an 8-expert panel who are early childhood education and instructional technology specialists. Based on the validating panel's comments, simple elements were modified. For instance, the panels suggested that some audio needed to be removed, the title name needed to be re-written using large font, and the voice of the actor needed to read the book more slowly. Additionally, the e-books were field tested, with 20 pre-school children. The field testing showed that e-books appear eminently suitable for the participants' age. In fact, the field testing was helpful in giving the researcher an opportunity to make refinements.

4. Emergent literacy test

An emergent literacy test has been created because of the lack of emergent literacy tests which are existed in the Arabic language and are age and individual appropriate for preschool-aged children. The test was created by the researcher. It was used as both a pre-test and a post-test assessment to find out the effect of e-books activity on the children's emergent literacy skills. In the emergent literacy test the following four areas were measured.

- *Print awareness*: Clay's (1979) test for measuring the concept of print was used and adapted for the Arabic Language. Accordingly, ten questions related to the concept of print were identified to measure children's print awareness. These concepts include knowledge of books, knowing where to start, the function of empty space in establishing word boundaries, the language direction across the line (from right to left and from top to bottom in Arabic), line and word sequences, and print carries a message … etc. Children were asked to respond orally to the research assistants' questions regarding the concepts of print. Each question was corrected by the raters based on one of two domains: "knows the skill" or "does not know the skill".

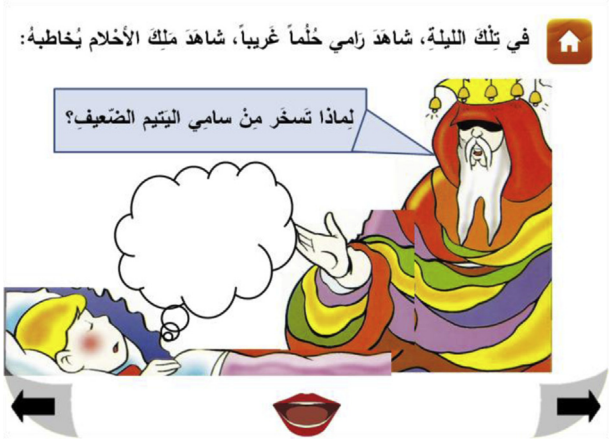

Fig. 2. Example for the story of "Rami and The Dreams' King".

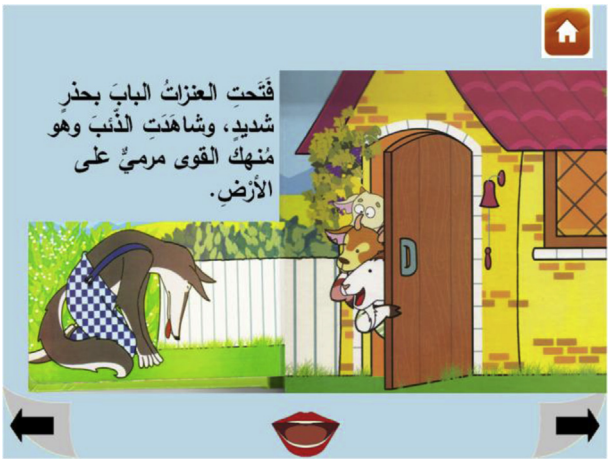

Fig. 3. Example for the story of "The Three Goats".

- *Vocabulary*: Ten words were selected from the e-books' text. These words were the same words that appeared in the traditional printed books. The researcher ensured that children had not been previously exposed to the target vocabulary in their curriculum. Children were shown ten pictures of objects and were asked to say the word of the object. Afterward, children were asked a follow-up question related to the picture shown (e.g. "Where does it live?" when introduced a picture of an ibex, and "What sound do they make?" when introduced with a picture of some goats). The raters corrected children's responses based on one of two domains: "knows the meaning of the word" or "does not know".
- *Alphabetic knowledge*: To assess this ability, ten Arabic alphabet letters were randomly chosen to be introduced to the children. Each letter was presented via a large card (in the initial, the middle, and the final positions of the word). Children were asked to say the name and the sound of each written letter presented to them. These letters include (Ba, (ب), Ta (ت), Ra (ر), Sin (س), Shin (ش), Ain (ع), Fa (ف), Mim(م), Dal (د) Waw (و)).
- *Phonological awareness*: Ten questions were developed to measure four phonological awareness skills (e.g. rhyming, initial phoneme, blending, and breaking words into syllables). This task includes two types of questions: 1) free-response items (e.g. put sounds together to produce new words), and 2) multiple-choice items (e.g. the word that rhymes with 'head' is similar to: horse – bed – eye). Children were asked to respond orally to both types of phonological awareness tasks. The raters corrected children's answers based on one of two domains: "knows" or "does not know".

In the above-mentioned four tests, each correct answer received 1 point, while each incorrect answer was scored 0. The total range of scores for each domain was (0–10). Accordingly, the total scores for all domains ranged from 0 to 40.

4.1. Test validity

The test content was validated by new ten experts specializing in language and early literacy specialists. Their role was to confirm whether the content of the test was accurate and adequate in terms of language clarity, to check the relevance of each question to content, its appropriateness to the research goals, the suitability of the time allocated to the test, and to provide any additional comments or corrections. Changes indicated by the validation panel were incorporated into the test. For instance, the panel suggested that the phonological awareness domain should include items related to blending words. Also, they suggested removing one item in the vocabulary domain, examining the meaning of 'exhausted', and recommended some items to be shortened and re-worded.

4.2. Inter-rater reliability

The inter-rater reliability of the emergent literacy tests was examined on an outside sample of 23 pre-school children from one private kindergarten in Amman, Jordan. Two raters scored each child using the scoring method mentioned above. To test the reliability scores, Kappa equation was administrated (Odeh, 1993). The alpha score of this measure was 0.83 for the alphabetical knowledge domain, 0.87 for the print awareness domain, 0.91 for the phonological awareness domain, and 0.81 for the vocabulary domain. These alpha scores across two raters were considered to be suitable from a statistical point of view for the purpose of this study.

4.3. Procedure

Permission for participation was obtained from the Ministry of Education, the kindergarten schools, and parents of pre-school children before any child was involved in the study.

Teachers in both groups were received three-days training sessions on how to deliver e-books/printed books to children (before, during, and after reading). During the training sessions, the researcher explained to the teachers how to interact with children after reading activity, and how to make sure that each child had a chance to work on an e-book/a printed book.

Initially, children in the experimental and control groups were pre-tested simultaneously to assess the following emergent literacy skills: print awareness, phonological awareness, vocabulary, alphabetical knowledge. The purpose of pre-test was to find out the equivalence of the two groups in their abilities and readiness before the treatment.

Afterward, the children in the experimental groups ($N = 48$) were exposed to the created e-books, whilst the children in the control groups ($N = 44$) were exposed to the printed book. It is worth mentioning that the e-books used by the experimental group were the same original printed format used by control group. The children in both groups were exposed to their books (e-books/printed books) for 15 min each day for eight weeks. In fact, exposing children to e-books in the experiential group was the first experience for those children as they did not engage with e-books before the treatment. After reading, both groups were engaged in book-related activities as a follow-up activity. The activities, which were similar in both groups, addressed the four emergent literacy areas; vocabulary, print awareness, phonological awareness, and alphabetical letters.

After the employment of the e-books/printed books activity in both groups, a post-test was administrated to the two groups of children using the same procedures utilized in the employment of the post-test.

4.4. Data analysis

Data collected from the pretests and posttests were analyzed using analysis of covariance (ANCOVA) with posttest as the dependent variable, group and gender as the independent variables, and pretest as the covariate.

5. Results

5.1. The effect of e-books on children's emergent literacy skills

The first research question asks about the existence of statistically significant differences ($\alpha < 0.05$) between the children's emergent literacy scores that can be attributed to the groups: the experimental groups who were exposed to e-books activity and the control groups who were exposed to the same books in traditional printed format. Table 2 presents the means and standard deviations of the experimental and control groups for the children's emergent literacy post-test.

As shown in Table 2, there were differences between the mean scores on the emergent literacy post-test in all emergent literacy areas for both the experimental group and the control group. There were also differences in the mean scores for both boys and girls. To find out the statistical significance of these differences, analysis of covariance (ANCOVA) was performed on the results of the post-test according to the independent variables of the study (group and gender). The results of ANCOVA are shown in Table 3.

Table 3 indicates no statistically significant differences ($\alpha < 0.05$) in the children's mean scores that could be attributed to the pre-test. The computed (F) value was insignificant for vocabulary area, $F(1, 87) = 1.146$, $p < .287$, print awareness area, $F(1, 87) = .003$, $p < .957$, phonological awareness area, $F(1, 87) = .102$, $p < .750$, alphabetical knowledge, $F(1, 87) = .637$, $p < .427$, and overall emergent literacy, $F(1, 87) = 1.115$, $p < .294$. This shows the equivalence of the two groups in their abilities and readiness before the employment of e-books activity.

On the contrary, there were statistically significant differences ($\alpha < 0.05$) at post-test between the mean scores of children who were exposed to e-books activity (experimental group) and those who were exposed to traditional paper books (control group) in all test domains and in the total. The computed (F) value was significant for vocabulary area, $F(1, 87) = 49.244$, $p < .000$, print awareness area, $F(1, 87) = 16.459$, $p < .000$, phonological awareness area, $F(1, 87) = 7.265$, $p < .003$, alphabetical knowledge, $F(1, 87) = 68.332$, $p < .000$, and overall emergent literacy, $F(1, 87) = 71.712$, $p < .000$. In other words, scores were significantly increased from pre-test to post-test of all emergent literacy areas and the overall emergent literacy, and were statistically significant. This indicates that there was a significant effect of the use of e-books on children's emergent literacy skills. This effect was in favor of experimental group; that is, children (both boys and girls) who were exposed to e-books achieved higher scores on the emergent literacy areas than their counterparts who were exposed only to traditional and regular printed books.

5.2. Gender differences in children's mean scores

The second research question concerns whether there are significant differences between the children's mean scores that can be attributed to gender. The analysis of covariance, as indicated in Table 3, shows that there are statistically significant differences ($\alpha < 0.05$) between the mean scores of boys and girls. The computed (F) value was significant for print awareness area, $F(1, 87) = 10.329$, $p < .002$, phonological awareness area $F(1, 87) = 7.976$, $p < .006$, alphabetical awareness area, $F(1, 87) = 68.332$, $p < .000$, and the overall emergent

Table 2
Means and standard deviations in the post-test for children's emergent literacy areas.

Emergent literacy areas	Group	Experimental			Control		
	Gender	Boys	Girls	Total	Boys	Girls	Total
Vocabulary	Mean	8.76	8.81	8.79	7.26	7.08	7.15
	S.D	.768	.681	.713	.452	.276	.369
Print awareness	Mean	9.00	9.18	9.10	8.00	8.72	8.40
	S.D	.707	.878	.805	.333	.458	.542
Phonological awareness	Mean	6.66	7.62	7.20	6.05	6.44	6.27
	S.D	.577	.492	.713	.848	1.894	1.530
Alphabetical knowledge	Mean	8.76	9.00	8.89	6.36	7.40	6.95
	S.D	.768	1.593	1.292	.830	1.00	1.055
Overall emergent literacy	Mean	33.19	34.62	34.00	27.68	29.64	28.79
	S.D	1.167	2.830	2.352	1.454	2.706	2.435

Boys ($N = 40$); Girls ($N = 50$); S.D = Standard Deviation.

Table 3
Results of analysis of covariance (ANCOVA) for emergent literacy areas in the post-test.

Emergent literacy areas	Source of variance	Some of square	*df*	Mean square	*f*	*p*
Vocabulary	Pre-test	.382	1	.382	1.146	.287
	Group	16.429	1	16.429	49.244	.000*
	Gender	.457	1	.457	1.371	.245
	Group*Gender	.484	1	.484	1.451	.232
	Error	29.025	87	.334		
	Total	90.989	91			
Print awareness	Pre-test	.001	1	.001	.003	.957
	Group	7.021	1	7.021	16.459	.000*
	Gender	4.406	1	4.406	10.329	.002*
	Group*Gender	1.115	1	1.115	2.615	.110
	Error	37.113	87	.427		
	Total	54.207	91			
Phonological awareness	Pre-test	.131	1	.131	.102	.750
	Group	9.348	1	9.348	7.265	.008*
	Gender	10.262	1	10.262	7.976	.006*
	Group*Gender	.819	1	.819	.636	.427
	Error	111.939	87	1.287		
	Total	144.739	91			
Alphabetical knowledge	Pre-test	.830	1	.830	.637	.427
	Group	89.067	1	89.067	68.332	.000*
	Gender	8.584	1	8.584	6.585	.012*
	Group*Gender	3.377	1	3.377	2.591	.111
	Error	113.401	87	1.303		
	Total	212.902	91			
Overall emergent literacy	Pre-test	5.687	1	5.687	1.115	.294
	Group	365.742	1	365.742	71.712	.000*
	Gender	53.592	1	53.592	10.508	.002*
	Group*Gender	2.026	1	2.026	.397	.530
	Error	443.712	87	5.100		
	Total	1136.989	91			

*$p < 0.05$.

literacy area, $F(1, 87) = 71.712$, $p < .000$. This indicates that there was a significant effect attributable to gender. This effect was in favor of girls over boys; that is, girls scored higher on the emergent literacy test than boys. However, the computed (F) value was insignificant for vocabulary area, $F(1, 87) = 1.371$, $p < .245$.

Table 3 also indicated no significant interaction between group and gender ($\alpha < 0.05$) at post-test on all test domains and in the total. That is, the computed (F) value was insignificant for vocabulary area, $F(1, 87) = 1.451$, $p < .232$, print awareness area, $F(1, 87) = 2.615$, $p < .110$, phonological awareness area, $F(1, 87) = .636$, $p < .427$, alphabetical knowledge, $F(1, 87) = 2.591$, $p < .111$, and overall emergent literacy, $F(1, 87) = .397$, $p < .530$. This shows that both boys and girls have been exposed to the same learning opportunities while listening to, using, and interacting with e-books. Therefore, e-books experiences have affected both boys and girls. In other words, using e-books to develop emergent literacy could not be restructured to one gender. Instead, it can be used for boys and girls alike.

5.3. The progress of different emergent literacy skills after the employment of e-books

In which areas of emergent literacy skills do children show greater progress after the employment of e-books activities?

The third research question asks about the most common emergent literacy skills that children improved upon after exposure to e-books. As shown in Table 1, previously mentioned, print awareness was the strong emergent literacy skill after e-books activities ($M = 9.10$), followed by alphabetical knowledge, and vocabulary ($M = 8.89$ and 8.79; respectfully), while phonological awareness skills ($M = 7.20$) were the least of the emergent literacy skills exhibited by children after the exposure to e-books.

6. Discussion

This study was conducted to examine the effect of e-books activity on pre-school children's emergent literacy skills as compared with reading to children from the printed versions. The study was carried out with children in two private kindergarten classrooms located in the city of Amman. It involved the participation of 92 children. The results indicated that the children exposed to the e-books activity achieved significantly higher emergent literacy progress on the post-test when compared with the children exposed only to the traditional printed books activities.

The presumed reason why children in the experimental group outperformed the control group on all test domains is that the children had not seen e-books before and learned more from them than from traditional books because they were so novel. Another possible interpretation is that there is something about the e-books themselves that makes them a better vehicle for learning than traditional books. E-books attracted children's interest and attention because of the unique structure of the interactivity offered by e-books features (Burk, 2001; Parham, 1995). That is to say, although the children in both groups were exposed to the same story content, the children in the e-books group dealt with digital text that includes media effects like written text, oral reading, sound effects, animations, narration and music. These features provide young children with many opportunities to engage with interactive options provided to readers (De Jong & Bus, 2004; Horney & Anderson-Inman, 1999; Unsworth, 2006).

For example, pictures and animations helped children recognize the new vocabulary words (Doty et al., 2001), while the oral reading of the printed text by an actor, accompanied by highlighted text, allowed the children to focus on the printed text, thereby enhancing their print awareness and alphabetical knowledge (Moody, 2010). This improvement in the children's scores in the emergent literacy post-test on all test domains (e.g. vocabulary, print awareness, phonological awareness, and alphabetical knowledge) gives strong evidence that the e-books enhanced children's emergent literacy skills compared to the regular printed books.

This study is consistent with the findings of previous related literature (De Jong & Bus, 2004; Gong & Levy, 2009; Maynard & McKnight, 2001; Moody, 2010; Neuman, 2009; Verhallen & Bus, 2010; Zucker et al., 2009). For instance the work of Moody (2010) is also in line with this result, as she found that e-storybooks support children's emergent literacy skills.

The results of the current study found that the children who participated in e-books activity displayed significant improvement in emergent literacy areas like print awareness and vocabulary. This is because the children in the experimental group were able to see the printed text in an interactive way, which distinguishes this electrical form of books from the printed books. This feature of e-books gave children the opportunity to identify print concepts and rules, and it was thus effective at supporting their print knowledge and awareness. (Wood et al., 2010). Additionally, the unique features of e-books, which present the word in print and use the word in a sentence, allow children to develop their vocabulary (Segers & Verhoeven, 2003).

However, phonological awareness was the literacy skill least improved upon among the children. Although the children in the e-books group performed better in phonological awareness than the children in the printed version group, the improvement was not as high as it was for other emergent literacy skills. This may be due to the fact that increasing phonological awareness requires formal or direct training and activities that are not be available in the e-books. This study diverges from previous research which revealed that children using e-books were more likely to show increased improvement in phonological awareness (Chera & Wood, 2003; Wood et al., 2010).

Finally, the results indicated that the female children who were exposed to the e-books displayed significantly higher emergent literacy improvement than the male children. Researchers have long agreed that females tend to have superior language abilities to males (Dionne, Dale, Boivin, & Plomin, 2003; Ihmeideh, 2009), yet there is no clear evidence as to why females generally perform better in terms of their language abilities. In the past, this was attributed to a belief that mothers tend to speak more with their daughters than with their sons, and many researchers used this explanation to justify their findings (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). However, researchers studying the brain found that females exhibited significantly greater activation in language areas of the brain than boys. In their research on sex differences in neural processing of language among children, Burman, Bitan, and Booth (2008, p. 1349), argued that “bilateral activation in the inferior frontal and superior temporal gyri and activation in the left fusiform gyrus of girls is greater than in boys”. They found that accurate use of language among boys and girls depends on different brain regions, as girls produce language judgments based on linguistic content by accessing a common language network regardless of stimulus modality, while boys depend on a modality-specific network. The above view is consistent with Roulstone, Loader, and Northstone (2002), however, who indicated that female children were superior to male in terms of vocabulary acquisition.

7. Conclusion and recommendations

This study testing the effect of e-book reading compared to regular print book reading in classrooms shows that the e-book group outperforms the print book group. In light of the above discussion, it can be concluded that e-books have the potential to promote children's emergent literacy skills. Moreover, children show significant improvement in the areas of print awareness and vocabularies compared with the other emergent literacy skills. Furthermore, there were significant differences between children's mean scores in emergent literacy attributed gender, with female children outperforming the male children. The study results are the basis for some recommendations for practice. The Ministry of Education should pay more attention to choosing and designing Arabic e-books that effectively utilize specialized electronic and interactive media as well as support children's language and literacy development. Training programs should be conducted for kindergarten teachers to increase their awareness of how to design and use e-books in their teaching practices. Moreover, publishing companies should be encouraged to convert some high quality children's printed books into electronic forms to motivate children and capture their interest. Besides reading from printed books, teachers are advised to use e-books in their teaching practices more frequently.

The selection of the sample was limited to only two private kindergarten schools from one region in Jordan (Amman). These kindergartens were selected purposefully because of the availability of computer facilities. Consequently, the scope of future research should be expanded to collect data from other regions which may yield different results.

Further research needs to look at the perspectives of those involved in e-books activity (e.g. pre-school teachers, parents, and children) to gain comprehensive responses from them. The researcher also recommends conducting more experimental studies into the effect of e-books on different aspects of Jordanian children's learning to give further evidence for the effect of digital books within the Jordanian educational context. Finally, it is important to say that this study does not suggest that only e-books are good for children. It is hoped, however, that this research will be seen as a starting point for increasing the use of e-books in pre-school classrooms to make use of this electronic and interactive media along with regular printed books for the promotion of children's language and literacy development.

References

Adams, M. (1990). *Beginning to read*. Cambridge, MA: MIT Press.
Anthony, J., Lonigan, C., Burgess, S., Driscoll, K., Phillips, B., & Cantor, B. (2002). Structure of pre-school phonological sensitivity: overlapping sensitivity to rhyme, words, syllables, and phonemes. *Journal of Experimental Child Psychology, 82*, 65–92.
Bayhan, P., Olgun, P., & Yelland, N. (2002). A study of pre-school teachers' thoughts about computer-assisted instruction. *Contemporary Issues in Early Childhood, 3*(2), 298–303.
Bradley, L., & Bryant, P. (1993). Categorizing sounds and learning to read: a causal connection. *Nature, 301*, 419–421.
Burk, R. (2001). E-book devices and the marketplace: in search of customers. *Library Hi Tech, 19*(4), 325–331.
Burman, D., Bitan, T., & Booth, J. (2008). Sex differences in neural processing of language among children. *Neuropsychologia, 46*, 1349–1362.

Catts, H., Fey, M., Zhang, X., & Tomblin, J. (2001). Estimating the risk of future reading difficulties in kindergarten children: a research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools, 32*, 38–50.
Chera, P., & Wood, C. (2003). Animated multimedia "talking books" can promote phonological awareness in children beginning to read. *Learning and Instruction, 13*, 33–52.
Christie, J., Enz, B., & Vukelich, C. (2010). *Teaching language and literacy; pre-school through the elementary grades*. New York: Longman.
Clay, M. (1967). The reading behaviour of five-years-old children: a research report. *New Zealand Journal of Educational Studies, 2*, 11–31.
Clay, M. (1979). *Concepts about print tests: Sand and stones*. Portsmouth, NH: Heinemann.
De Jong, M., & Bus, A. (2004). The efficacy of electronic books in fostering kindergarten children's emergent story understanding. *Reading Research Quarterly, 39*, 378–393.
De Jong, Miller, & Olson. (1997). CD-ROM talking books: what do they promise? *Education and Information Technologies, 2*, 121–130.
Dionne, G., Dale, P., Boivin, M., & Plomin, R. (2003). Genetic evidence for bidirectional effects of early lexical and grammatical development. *Child Development, 74*, 394–412.
Doty, D., Popplewell, S., & Byers, G. (2001). Interactive CD-ROM storybooks and young readers' reading comprehension. *Journal of Research on Computing in Education, 33*(4), 374–382.
Gong, Z., & Levy, B. (2009). Four year old children's acquisition of print knowledge during electronic storybook reading. *Reading and Writing, 22*, 889–905.
Heroman, C., & Jones, C. (2010). *The creative curriculum for pre-school: Literacy* (Vol. 3). Washington DC: Teaching Strategies.
Higgins, N., & Hess, L. (1999). Using electronic books to promote vocabulary development. *Journal of Research on Computing in Education, 31*, 425–430.
Hisrich, K., & Blanchard, J. (2009). Digital media and emergent literacy. *Computers in the Schools, 26*(4), 240–255.
Horney, M., & Anderson-Inman, L. (1999). Supported texts in electronic reading environments. *Reading and Writing Quarterly, 15*, 127–168.
Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: relation to language input and gender. *Developmental Psychology, 27*(2), 236–248.
Ihmeideh, F. (2009). The effect of print-rich classroom environment on developing kindergarten children's awareness of written language. *Jordan Journal of Educational Sciences, 5*(1), 59–69.
Karemaker, A., Pitchford, N., & O'Malley, C. (2010). Enhanced recognition of written words and enjoyment of reading in struggling beginner readers through whole-word multimedia software. *Computers and Education, 54*(1), 199–208.
Labbo, L., & Kuhn, M. (2000). Weaving chains of affect and cognition: a young child's understanding of CD-ROM talking books. *Journal of Literacy Research, 32*, 187–210.
Lummis, M., & Stevenson, H. (1990). Gender differences in beliefs and achievement: a cross-cultural study. *Developmental Psychology, 26*, 254–263.
Maynard, S. (2010). The impact of e-books on young children's reading habits. *Publishing Research Quarterly, 26*(4), 236–248.
Maynard, S., & McKnight, C. (2001). Children's comprehension of electronic books: on empirical study. *New Review of Children's Literature and Librarianship, 7*(1), 29–53.
Moody, A. (2010). Using electronic books in the classroom to enhance emergent literacy skills in young children. *Journal of Literacy and Technology, 11*(4), 22–52.
Morrow, L. (2009). *Literacy development in the early years: Helping children read and write*. Boston: Pearson Education.
National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Center for Family Literacy.
Neuman, S. (2009). The case for multi-media presentation in learning: a theory of synergy. In A. Bus, & S. Neuman (Eds.), *Multimedia and literacy development: Improving achievement for young learners* (pp. 44–56). New York: Taylor & Francis.
Niessen, N., Strattman, K., & Scudder, R. (2011). The influence of three emergent literacy skills on the invented spellings of 4-year-olds. *Communication Disorders Quarterly, 32*(2), 93–102.
Odeh, A. (1993). *Measurement and evaluation in the teaching process*. Irbid: Dar Alamal.
Parham, C. (1995). CD-ROM storybooks revisited. *Technology and Learning, 15*(6), 14–18.
Phillips, L., Norris, S., Osmond, W., & Maynard, A. (2002). Relative reading achievement: a longitudinal study of 187 children from first through sixth grades. *Journal of Educational Psychology, 94*(1), 3–13.
Powell, J. (1995). Parents as early partners in the literacy process. In *Paper presented at the National Conference on Family Literacy*.
Rao, S. (2003). Electronic books: a review and evaluation. *Library Hi Tech, 21*(1), 85–93.
Roulstone, S., Loader, S., & Northstone, K. (2002). Descriptive data from the Avon longitudinal study of parents and children. *Early Child Development and Care, 22*, 259–268.
Segers, E., Takke, L., & Verhoeven, L. (2004). Teacher-mediated versus computer-mediated storybook reading to children in native and multicultural classrooms. *School Effectiveness and School Improvement, 15*, 215–226.
Segers, E., & Verhoeven, L. (2003). Effects of vocabulary training by computer in kindergarten. *Journal of Computer Assisted Learning, 19*, 557–566.
Snow, C., Burns, M., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.
The International Reading Association. (2009). *New literacies and 21st century technologies: A position statement of the International Reading Association*. Newark, DE: Author.
Thurlow, R. (2009). Improving emergent literacy skills: web destinations for young children. *Computers in the Schools, 26*(4), 290–298.
Torgesen, J. K. (2002). The prevention of reading difficulties. *Journal of School Psychology, 40*(1), 7–26.
Torgesen, J. K., & Mathes, P. G. (1998). *What every teacher should know about phonological awareness* (Technical Assistance Report ESE 9872). Tallahassee, FL: Florida Department of Education.
Treiman, R. (2006). Knowledge about letters as a foundation for reading and spelling. In R. Joshi, & P. Aaron (Eds.), *Handbook of orthography and literacy* (pp. 581–599). Mahwah, NJ: Erlbaum.
Unsworth, L. (2006). *E-literature for children: Enhancing digital literacy learning*. New York: Routledge.
Verhallen, M., & Bus, A. (2010). Low-income immigrant pupils learning vocabulary through digital picture storybooks. *Journal of Educational Psychology, 102*, 54–61.
Verhallen, M., Bus, A., & DeJong, M. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology, 98*, 410–419.
Vloedgraven, J. M. T., & Verhoeven, L. (2007). Screening of phonological awareness in the early elementary grades: an IRT approach. *Annals of Dyslexia, 57*, 33–50.
Walpole, S., Chow, S., & Justice, L. (2004). Literacy achievements during kindergarten: examining key contributions in an at-risk sample. *Early Education and Development, 15*, 245–264.
Whitehurst, G., & Lonigan, C. (1998). Child development and emergent literacy. *Child Development, 69*(3), 848–872.
Wood, C. (1999). The contribution of analogical problem solving and phonemic awareness to children's ability to make orthographic analogies when reading. *Educational Psychology, 19*, 277–286.
Wood, C. (2000). Rhyme awareness, orthographic analogy use, phonemic awareness and reading: an examination of relationships. *Educational Psychology, 20*, 5–15.
Wood, C., Pillinger, C., & Jackson, E. (2010). Understanding the impact of young readers' literacy interactions with talking books and during adult reading support. *Computers and Education, 54*(1), 190–198.
Zucker, T., Moody, A., & McKenna, M. (2009). The effects of electronic books on pre- kindergarten-to-grade 5 students' literacy and language outcomes: a research synthesis. *Journal of Educational Computing Research, 40*, 47–87.