

THE EFFECT OF ELECTRONIC STORYBOOKS ON STRUGGLING FOURTH-GRADERS' READING COMPREHENSION

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ABSTRACT

This quantitative research examined the differences in struggling readers' comprehension of storybooks according to the medium of presentation. Each student was randomly assigned with one of three conditions: (1) computer presentation of storybooks with animation; (2) computer presentation of storybooks without animation; and (3) traditional print storybooks. 77 participants were selected among fourth-grade students who were reading below current grade level and not meeting Sunshine State Standard as measured by Florida Comprehensive Assessment Test (Reading Level one or Reading Level two). Comprehension was measured by using retelling. Analysis of variance (ANOVA) was used to test research question at the .05 level of significance. The results of statistical analysis indicated that there was significant difference in the students' comprehension scores. When the student controlled the animation functions of electronic storybooks, the animated illustrations were shown to result in significantly higher improvement of comprehension scores, both in terms of the students' ability to retrieve information and to make inferences from the stories. The results of the research also indicated that electronic storybooks can improve reading comprehension and can be beneficial for struggling readers.

Keywords: Literacy and technology, electronic storybooks, reading comprehension, struggling readers

INTRODUCTION

Background

The main objective of reading is to understand a written message (Doty, 1999). National Center for Educational Statistics [NCES], (2005) defines reading as "an active and complex process that involves understanding written text, developing and interpreting meaning, and using meaning as appropriate to type of text, purpose and situation" (p. 2). Reading comprehension is crucial to the development of children's reading skills and thus to their ability to obtain an education. (Durkin, 1993; National Institute of Child Health and Human Development [NICHD], 2000; Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007). Without comprehension, reading words is reduced to imitating the sounds of language, repeating text is simply memorization and oral drill (Paris, & Hamilton, 2008). There are many definitions of reading comprehension. Harris and Hodges (1995) defined comprehension as "intentional thinking during which meaning is constructed through interactions between text and reader" (p. 207). Similarly, the report of National Reading Panel [NRP] (2000) reported that reading comprehension is a complex and cognitive process that requires an intentional and thoughtful interaction between the reader and the text. When readers actively relate the ideas represented in print to their own knowledge, experiences and construct mental representations in memory, text comprehension is improved. All of these definitions and information concluded that reading comprehension is an active cognitive process, and involves interaction between reader and text to construct meaning. Also the reader's schema, prior knowledge, and metacognitive skills play important roles in comprehension as well as characteristics of texts such as coherency, additional aids, and organizational hints (Doty, 1999).

Even though reading comprehension is very important to children's reading skills and it is a predictor of their future academic success, many students struggle with reading. Reading difficulty is not only a problem for younger children; older students also have similar issue. National Assessment of Educational Progress [NAEP] (2007) reported urgency of the problem. Seven hundred and thirty schools and 191,000 fourth-graders participated in a reading assessment. The results of this assessment showed that about one third of fourth graders cannot read at a basic level (NCES, 2007). Furthermore, struggling readers read and learn less than their peers, resulting in the Matthew Effect, where the rich become richer and the poor get poorer (Stanovich, 1986). Therefore, reading problems often continue into adulthood; approximately 23% of U.S. adults meet only basic reading proficiency levels (NCES, as cited in Rapp et al., 2007). All of these issues emphasize the need for effective approaches for struggling readers.

Computer technology has a role to play in the remediation of children with reading problems and successes in reading instruction (NICHD, 2000) such as motivation, personal instruction, and interaction. The NRP's meta-analysis of the extant research in computer technology revealed several findings. First, all the studies report positive results, suggesting that it is possible to use computer technology for reading instruction. Second, new computers have many multimedia presentation functions and research is needed on the use of multimedia presentations in reading instruction. Third, computer-presented text indicates that this may be a promising use of

technology in reading instruction. Fourth, use of computer technology to assist reading is a relatively new field, the number of studies published in this area is small and many questions remain unanswered (NICHD, 2000).

Dalton and Strangman (2006) point out that “technology and computer-mediated text have the potential to support students with reading problems in two ways: providing access to text and helping students learn how to read with understanding” (p. 75). Print is often thought of as a traditional technology that often serves as barrier, rather than a gateway, to learning. Even though traditional print text requires interaction between reader and texts, traditional print texts is passive, non-interactive with non-adaptable features, static with two-dimensional images, and cannot response to individual readers, restricted by their linear composition, and relies heavily on the reader's internal strategies to activate prior knowledge (Doty, 1999; Pearman, 2008). Additionally, readers follow the structure or plot which is designed by the author. On the other hand, electronic texts typically have different and new formats. These new formats are nonlinear, non-sequential, interactive, and can provide a literal interaction between the reader and the text (Coiro, 2003; Reinking, 1992; Schmar-Dobler, 2003; Sutherland-Smith, 2002).

In the last decade, given the promise of the technology for student with reading problems, the technology research literature focused on computer-mediated texts. Progress in software development has dramatically changed the nature of software for reading. Until recently, not many software programs suitable for struggling readers were available (Lewis, 2000). A valuable tool in educational settings, the electronic book has been widely used in classroom literacy learning in the early school years (Chen, Ferdig, & Wood, 2003; Matthews, 1996; Underwood, 2000). Electronic storybooks are reading software for children in illustrated storybooks that help children develop visual recognition. In addition, these interactive electronic storybooks offer more comprehension hints and a better background for story than traditional printed texts (Doty 1999, Reinking 1988). Electronic storybooks are mainly designed to integrate text, graphics, animations, music and other multimedia components in order to bring support to the story line (Chen et al., 2003; Glasgow, 1996-1997). Electronic storybook technology has significantly improved the potential for adding animations for readers. Children could read the stories on their own or listen to the stories read and animate parts of illustrations.

Statement of the Problem

A great number of children struggle with reading. The latest results of a NAEP report clearly show the urgency of problem: 33 % of fourth graders were not able to achieve even a “basic” level of proficiency on the NAEP reading test (NCES, 2007). Although data from NAEP 2007 Reading Report Card shows increased scores for low performing students in the fourth and eighth grades in 2007 as compared to previous years (fourth-graders in 2007 scored two points higher than in 2005 and four points higher than in 1992), there is not a lot of good news on this report. On the average, there was little improvement in the reading skills for fourth graders across the nation since 1992. Furthermore, reading comprehension problems have also been very stubborn. Even 46% of fourth-graders performing at the basic level were not able to demonstrate full comprehension (34% partial or surface comprehension, 11% little or no comprehension, 1% omitted) (NCES, 2007). Anderson-Inman & Horney (1998) add, “Unfortunately, a large percentage of students in our country are not effective in their attempts to acquire and use information from text due to significant deficiencies in reading” (p.15).

Another problem was pointed out by Robb (2000); he claimed that children’s interest in reading for pleasure and motivation to read was being reduced. Electronic storybooks can help these unmotivated and uninterested children. In addition, two-thirds of American classrooms have fewer than 50 children's books, and almost 60% of childcare centers buy less than one book per child a year (Neuman, Celano, Greco, & Shue, 2001). Fourth-graders who reported having 25 books or more at home had higher scores on the NAEP reading test than children who reported they didn't have that many books (NCES, 2001). Through the use of electronic storybooks, educators have a promising solution for very limited availability of children books.

Weak decoding skills and lack of fluency are major barriers to comprehension for struggling readers (Ehri, 1994). Digital texts have the capability to eliminate decoding and fluency problems through text-to-speech and digitized speech (Dalton & Strangman, 2006). New vocabulary and concepts, complex sentence structure, lack of previous knowledge and new text structure are the other reasons for poor comprehension (Lipson & Wixson, 1997). Struggling readers are also less strategic in their approach to text and they have a difficulty for monitoring understanding (Graham & Harrison, 1996, as cited in Dalton & Strangman, 2006; Swanson & Alexander, 1997). Many struggling readers do not view themselves as in charge of their learning and may avoid reading whenever possible (Dalton & Strangman, 2006, p. 80). The problem is critical, and promise of technology apparent, there is continued research, focusing on students with reading problems (MacArthur, Feretti, Okolo, & Cavalier, 2001; Strangman & Dalton, 2005, 2006).

New technologies offer great opportunity and great challenge (Dalton & Strangman, 2006, p. 88). As a scaffolded learning environment, digital texts provide support to the students with diverse learning needs. Digital learning environments, through good quality of flexibility of the medium, have the potential of scaffold instruction in a rich variety of ways (Bus, De Jong, & Verhallen, 2006). For example, images and animated graphics can be incorporated into digital texts to supplement textual definitions, supporting vocabulary understanding and reading comprehension (Anderson-Inman, Horney, Chen, & Lewin, 1994; Boone & Higgins, 1993). Electronic texts also changed to offer strategic scaffolds such as self-monitoring questions (Anderson-Inman & Horney, 1998). Several studies reported encouraging findings using electronic storybooks. For instance, electronic storybooks improve reading motivation for children with reading difficulties (Adam & Wild, 1997; Glasgow, 1996-1997), recognition of words for kindergarten children (De Jong & Bus, 2002; Lewin, 2000), story comprehension (Doty, Popplewell, & Byers, 2001) and story retelling (Matthew, 1996).

However, the results of the few available studies are not consistent. Some of the studies have shown that electronic storybooks elements may also potentially become distractions (De Jong & Bus, 2002; Matthew, 1996; Okolo & Hayes, 1996; Trushell & Maitland, 2005; Underwood & Underwood, 1998). De Jong and Bus (2002) revealed that children's understanding of a story's content was less supported by the electronic version than the traditional print book format. Additionally, the illustrations, games, attractive pictorial options included in the story motivate children but if they are not matching with the story, they can distract the children's focus on the story instead of supporting the narrative's comprehension and could cause passive reading, and delay children's early literacy development (De Jong & Bus, 2002; Labbo & Kuhn, 2000; Matthew, 1996; Shamir & Korat, 2006; Underwood & Underwood, 1998).

This study is different from previous researches in several ways. Firstly, the results of the studies previously carried out in this area have been conflicting and are frequently hard to interpret. If there is any difference, it is not clear whether it is coming from narration and/or animation features of storybooks. Usually there was no obvious explanation or detail about what kind of illustrations or animations were used in the study. The current study is an attempt to address some of the shortcomings of previous research and this study provides an empirical data, to do specific and systematic investigation that confirms which features and types of story presentations are more effective than others for older struggling readers.

Secondly, most of the previous researches are focused on younger children and early grades. Some of these researches claim that electronic books are quite effective in early literacy development, reading comprehension, and language development for young children (De Jong & Bus, 2004; Grant, 2004; Higgins, 1999; Korat, 2008; Lewin, 2000; Maynard, 2005). Korat (2008) stated that young children are found to especially respond well to enhance features of electronic books. Therefore, this study is focused on fourth-grades students' literacy achievement. Thirdly, previous researches often compare two groups, reading paper version texts and electronic versions, as a research design, validity and reliability are a major problem, and the findings are very limited and general, thus, we need more specific and systematic investigations.

Fourthly, the previous studies do not tell us much about how struggling students are reading and understanding the new multimedia texts. We enter a new technological era where computers are readily accessible to children; questions arise as to the potential of this type of software on literacy development (Labbo, 1996). We know very little about specifically which features of electronic text work best for struggling readers, and in relation to different types of texts and reading comprehension. This should be a major area of investigation. Several questions remain unanswered; do children passively view screens that distract their attention away from meaning making? Do electronic storybooks support struggling readers' comprehension? Although, findings from recent studies suggest various elements play important roles in whether electronic books provide proficient scaffolds for children of various literacy ability levels, Bus et al. (2006) emphasized that "additional work is needed to learn more about the effects of considerate animations as scaffolds to children's story comprehension" (p. 134). More studies are needed to test which particular features of electronic storybooks, such as animation interactivity of texts, have potential to improve comprehension when the story is presented as static illustrations, and animated illustrations (De Jong & Bus, 2002; Bus et al., 2006). For all these reasons and questions mentioned above, this research investigated the extent to which use of medium of storybooks positively influenced struggling readers' comprehension.

Purpose of the Research

The objective of this research was to compare and explore the effects of the medium of storybooks presentations on struggling readers' reading comprehension. For this purpose of the research, each student was presented with one of three conditions: (1) computer presentation of storybooks with animation; (2) computer presentation of

storybooks without animation; and (3) printed version of storybooks. These three conditions were compared with respect to reading comprehension as measured by multiple-choice comprehension test and retelling.

Research Question

The following research question was addressed in this research: Do fourth-grade struggling readers differ on reading comprehension as measured by retelling when they read the same storybooks presented in electronic format with and without animation and in a traditional print format?

LITERATURE REVIEW

Comprehension Difficulties of Struggling Readers

Cooper et al. (2006) defines struggling reader as “a student who is experiencing significant difficulty learning to read” (p.11). Many struggling readers exhibit reading difficulties (Rapp et al., 2007). According to Biancarosa and Snow (2004), older struggling readers, who are between fourth and twelfth grade, mostly do not need help to read the words. However, their frequent problem is that they fail to comprehend what they read. Struggling readers are less conscious and have less management of their comprehension process when they are reading (Baker, 2002). Background experiences, oral language, decoding, phonemic awareness, fluency, oral reading, and writing vocabulary, comprehension, maintaining attention, and motivation are likely areas of difficulties exhibited by struggling readers. Struggling readers are not exactly the same; for instance, some may not have difficulty decoding words or fluency but have difficulty comprehending the text (Asselin, 2002; Yuill & Oakhill, 1991).

In the early grades, the primary emphases are on the alphabetical principle, phonemic awareness, decoding, and word recognition (Adams, 1990; Kingham, 2003). However, once students reach upper grade levels, the primary emphasis shift towards reading comprehension and the anticipations of reading comprehension increase. The expectations are to understand more complex texts and to apply appropriate background knowledge in a variety of contexts (Gardill & Jitendra, 1999; Kingham, 2003).

The existing literature provides that reader characteristics, text properties, and instructional contexts are main elements of comprehension difficulties (Rapp et al., 2007). Kingham (2003) claims that there are three basic theories offered to clarify reading comprehension difficulties. The first theory is that comprehension problems are rooted in word recognition problems. Students with good comprehension have stronger word recognition skills than poor comprehenders. Slow decoding causes a block in the working memory of the reader. Since students with poor comprehension do not use their working memory efficiently, this gives them a lower functioning capacity for comprehension purposes (Perfetti & Lesgold, 1979). The second theory claims that readers have difficulties in syntactic and semantic analysis of texts, and are incapable of making use of the structural limit of language. Students with poor comprehension are presumed to pay no attention to the syntactic clues in texts and read word by word instead of processing texts in appropriate units (Cromer, 1970). The third theory hypothesizes that readers have difficulty making inferences from texts, and combining the ideas with them. Poor comprehenders are argued to have enough word recognition and syntactic skills but experience difficulty at inference and integration levels and fall short to monitor their comprehension (Kamhi, 1997; Kingham, 2003; Yuill & Oakhill, 1991).

Research in the cognitive sciences has provided important insights into the challenges and potential sources of reading comprehension difficulties (Gernsbacher, 1990; Graesser, Gernsbacher, & Goldman, 2003). First, “one of the most consistent findings from cognitive psychological research on reading is that the construction of a coherent representation of text in memory is central to successful comprehension” (Rapp et al., 2007, p. 292). Second, a coherent mental representation as a network that shows the meaningful connections between elements of text and the reader's background knowledge (Kintsch & van Dijk, 1978; Rapp et al., 2007). A lack of background knowledge or failure to activate background knowledge is a potential source of difficulty for struggling readers (Cooper et al., 2006). However, some researchers are concerned that struggling readers often over rely on their background knowledge causing them to move further from the intended meaning of texts (McCormick, 1992; Trabasso & Suh, 1993; Williams, 1993, as cited in Rapp et al., 2007). Struggling reader's schema for simple stories is not developed or as efficiently utilized as that of good readers (Rahman & Bisanz, 1986).

The other major sources of comprehension difficulties that influence a student's ability to comprehend are readers' processing capacities, a lack of interest in reading, negative attitudes to reading, and motivation (Rapp et al., 2007). Most struggling readers are particularly uninterested. Struggling readers may perhaps have low self-confidence in their reading skills and they believe they cannot comprehend. The educators in literacy

development suggest that the struggling reader must be expanded to recognize that this individual is disengaged from literacy (Moje, Readance, & Moore, 2000).

The content and format of texts also influence struggling readers' comprehension. The characteristics of text a student is reading, the difficulty of the text, and type of text can also limit his or her ability to comprehend (Alexandar & Jetton, 2000 Kingham, 2003). Struggling readers often have little knowledge of text structures. Using charts, graphs, and diagrams to provide visual aids are helpful for understanding text. For example, if a student is given a full page of text with no illustration, probably the student is overwhelmed by it. "When the student is given the same material spread over more pages, with less text on each page and with some illustrations; the student could read the words and comprehend the text" (Cooper et al., 2006, p. 121).

Another important variable that influences how well students comprehend is their knowledge and ability to use strategies (Paris et al., 1991). Many struggling readers fail to apply reading strategies such as self-questioning or explanations summarization and explicit self-monitoring of comprehension. They are less strategic, and particularly lack effective memory search strategies. Because of repeated failures, struggling readers do not recognize the effective strategies they do use. Instead of learning alternative strategies from their failure, they often give up. NRP (2000) report has shown that struggling readers can increase reading comprehension skills by learning the specific strategies such as prediction, questioning, clarifying, imagining and summarization.

In summary, struggling readers have difficulty with comprehension for a variety reasons. Helping struggling readers overcome problems with comprehension is not an easy task, because they often have multiple difficulties. Every student's needs and the reason for their problems must be evaluated and identified. The findings can be used to supply interventions that teach students how to activate their prior knowledge and how to use various strategies for constructing meaning or comprehending text (Cooper et al., 2006).

Technology and Reading Comprehension

Reading comprehension is influenced by new technology and literacy. Recent literature has stated a long tradition of book and print media is insufficient, students and teachers use new and varied forms of technology. The need for changes in the way we think about reading comprehension is inevitable (Coiro, 2003). Rand Reading Study Group (2002) pointed out "an explosion of alternative texts" and "electronic texts that incorporate hyperlinks and hypermedia introduce some complications in defining comprehension because they require skills and abilities beyond those required for the comprehension of conventional, linear print" (p. 14). These new reading environments bring out cognitive and aesthetic challenges to comprehension (Spires & Estes, 2002) and there is a need for theoretical description of the comprehension process (p.123).

Technology's Effects on Struggling Readers

Review of research on technology involvement with struggling readers demonstrates constantly encouraging findings and studies have agreed the contribution of technology involvement resulted in considerable gains in reading comprehension (Denman, 2004). The NRP meta-analysis has found the 21 studies used to assess computer technology that showed promising results (NICHHD, 2000). Computer-supported environments can help our understanding of the struggling readers' reading problems and "may help compensate for inadequate reading ability" (McKenna et al., 1999, p. 113).

Research findings are also optimistic about the future of multimedia applications for struggling readers. For example, Higgins, Boone, and Lovitt (1996) found that electronic social studies texts improved comprehension for students with learning disabilities. Hegarty, Carpenter, and Just (1991) reported that animation in electronic text help to illustrate unfamiliar processes for students with low mechanical ability. Many features of electronic storybooks are well matched for phonemic awareness, phonics, fluency; vocabulary, and comprehension (Pearman & Lefever-Davis, 2006). Computer software has the exceptional capacity to bring individualized practice to students who need to enhance their reading fluency (Oakley, 2003). In addition to providing practice in developing reading fluency, electronic storybooks can help poor readers' vocabulary development (Pearman & Lefever-Davis, 2006). The ability to recognize sound-symbol relationships is essential, but it is not enough for comprehension. Students must also activate their prior knowledge and use context hints to comprehend what they read. There is growing indication that computer-supported effects such as animation and sound allow students to make these connections (Matthew, 1997). Greenlee-Moore and Smith (1996) indicate that the use of interactive storybooks may help improve reading comprehension for elementary students. In addition, electronic storybooks develop the story setting through animated graphics and sound effects indicating story mood and events and thus supporting comprehension (Lefever-Davis & Pearman, 2005). Visual aids in electronic storybooks are helpful for understanding text and building coherent mental representation. Multimedia

presentation, which includes text, graphics, sound, and animated images, is also helpful motivation for a struggling reader who is particularly uninterested.

Electronic Texts

Electronic texts possess new characteristics that require different types of comprehension processes and a different set of instructional strategies. “Electronic texts introduce new supports as well as new challenges that can have a great impact on an individual's ability to comprehend what he or she reads” (Coiro, 2003, p. 458). In addition, special features of electronic texts provide powerful advantages like facilitating the process of constructing meaning and assisting reader's difficulties (Reinking et al., 1998).

Text features of traditional and electronic texts are completely dissimilar. For example, traditional print text is passive, non-interactive with non-adaptable features, linear, static with two-dimensional images. Additionally, reader follows the structure or plot which is designed by author. On the other hand, electronic texts typically have new formats. For instance, these new formats are nonlinear, and interactive (Coiro, 2003; Schmar-Dobler, 2003; Sutherland-Smith, 2002). Images are more lifelike than in traditional print texts (Sutherland-Smith, 2002). Also electronic texts combine different functions such as animations, cartoons, and audio and visual video clips (Coiro, 2003). For the new text format, the readers need to apply and develop new literacy skills and strategies, because text structure is dissimilar between electronic and conventional texts. Sutherland-Smith (2002) electronic texts necessitate high levels of visual literacy skills, comprehension strategies, and new ways of thinking. Electronic texts users must be skilled in interpreting, evaluating and synthesizing information and all graphic features in new text format (Coiro, 2003; Schmar-Dobler, 2003).

Reading comprehension is influenced by new technology and literacy. Recent literature has stated that a long tradition of book and print media is insufficient; students and teachers use new and varied forms of technology (Coiro, 2003). As a valuable tool in educational settings electronic books have been used in classroom literacy learning (Chen, et al., 2003; Matthews, 1996; Underwood, 2000).

Pearman and Lefever-Davis (2006) claimed that comprehension skills can be developed through electronic storybooks. However, a review of the literature has shown that a limited number of studies have investigated comprehension comparing the use of electronic storybooks to a traditional print text. Basically, there are three groups of studies related to electronic story books and comprehension. The first group early works claimed comprehension can be supported and developed by electronic storybooks. The second group research on electronic storybooks found detrimental effects on comprehension. The third group of studies found mixed results with increase in comprehension depending on the assessment instrument or found no evidence that storybooks support or distract comprehension.

METHODOLOGY

Research Design

In this research, experimental research design with one dependent variable and one independent variable was used for testing three conditions. Dependent variable is reading comprehension as measured by the retelling. The independent variable is the type of medium of presentation. Three conditions: (1) electronic storybooks with animation, (2) electronic storybooks without animation, and (3) printed version of storybooks were tested.

Participants

The subjects were 77 fourth-grade students from five elementary schools in the Alachua, Florida school district. Of the 89 students were eligible to be considered for this study and 77 students returned signed permission letters from their parents. The subjects' ages ranged from 9-11, with a mean of 9.96 years. Forty-eight participants were female, and 29 were male. The subjects were selected among fourth-grade students who were reading below at least one or two years from current grade level and not meeting Sunshine State Standard [SSS] as measured by Florida Comprehensive Assessment Test [FCAT] in 2007 (Reading Level one, ($n=27$); Reading Level two, ($n=50$)). Florida's retention policy requires students to reach a minimum threshold on the reading portion of the Florida Comprehensive Assessment Test (FCAT) to be promoted to the fourth grade. For instance, third-graders must pass the reading test to be promoted to fourth grade. In other words, by State of Florida law, third-grade students who scored at Level one of the FCAT were required to spend at least one extra year in third grade. Therefore, some of the subjects of the research held back and repeated the third grade. According to Florida Department of Education (2004) the FCAT is a highly reliable test. On fourth-grade reading test correlation between the FCAT and Sunshine State Standard in year 2001, 2002, and 2003 were .90. Correlation between FCAT, Sunshine State Standard and Norm Referenced Test (Stanford 9) confirmed that the FCAT demonstrates

concurrent validity. For fourth-grade reading test in 2001, correlation was .80, and following two years .83, and .82. “The evidence of reliability and validity support the claim that FCAT is technically sound and meets or exceeds the professional standards for standardized achievement tests” (Florida Department of Education, 2004, p. 24). The subjects’ selection was based on FCAT scores. The subjects were assigned to each of the three treatment groups by first ranking them on reading ability level using FCAT scores. Once ranked, subjects were matched on reading ability with three students per matched set. Each treatment groups consists of equal number ($n=9$) of reading level one students. The subjects in each matched set were then randomly assigned to read the electronic storybooks under the program’s “read to me” option, or called without animation or passive mode ($n=26$), the second group of students were assigned to read under the program’s “let me play” option, called with animation or active mode ($n=25$) and the last group of students were assigned to read print based story, or called traditional storybook ($n=26$). During the research, using computers skill was not a problem. The students were generally very skilled at using computers. All schools that were visited had computer labs and allocated regular computer time to students in the computer labs. Therefore, there is no significant difference in the using computer skills of these three groups. Students who have previously read and/or seen the storybooks were eliminated from the research. It is important that the storybooks were previously unknown to subjects.

Finally, characteristics of the fourth-grade struggling students participated in this study can be described as following: (1) They are reading below level their current grade level and not meeting Sunshine State Standard as measured and documented by Florida Comprehensive Assessment Test (Reading Level one or Reading Level two). (2) The struggling students at this study usually have the basic decoding skill to be able to read a story which is third or second grade level. (3) They have comprehension difficulties to understand texts in fourth-grade level. Similarly, Catts and Hogan (2002) point out that fourth-grade is particularly critical period for the reading development because some children begin to experience serious comprehension difficulties around fourth-grade. The reason is likely increasing demands of readings and materials in this grade.

Instrument

For this study, it was decided to use a storybook, Sheila Rae, the Brave, which was available in printed paper book form and CD-ROM with an interactive mode (with animation) and passive mode (without animation). Designing of electronic formats of storybooks is similar in concept to printed paper book in that the reader progresses from one page to the next in a linear way. The pages are numbered, with easy directional arrows to either go to the next page or return to the beginning of the book. Electronic format of storybook includes animations, a range of sounds, music and opportunities for interaction. In addition, electronic storybook allows the reader to click on individual words to hear them read aloud but these functions were not used in this study. Groups of words are highlighted as they are read aloud. There are options to select the language (English or Spanish) at the top of the control panel page (see Figure-1). After choosing a language, the reader can begin by selecting “let me play” to play within the story (with animation) or selecting “read to me” to read the story (without animation). Electronic storybook is completely based on printed paper format of the storybook. The contents in the three formats of storybooks, electronic storybooks with animation, electronic storybook without animation, and printed paper based format, were similar in length of texts and with regard to illustrations (see Figure-2). Trushell and Maitland (2005) used Sheila Rae, the Brave in their research and they stated that both electronic and print formats of the story contain 52 propositions, including a lengthy setting and an event structure of two episodes. Both electronic storybooks with and without animation formats include 12 fully interactive pages. Only difference between these two formats is animated storybook provides over 20 hidden click able interactive picture-plays, by cued animations on each page.

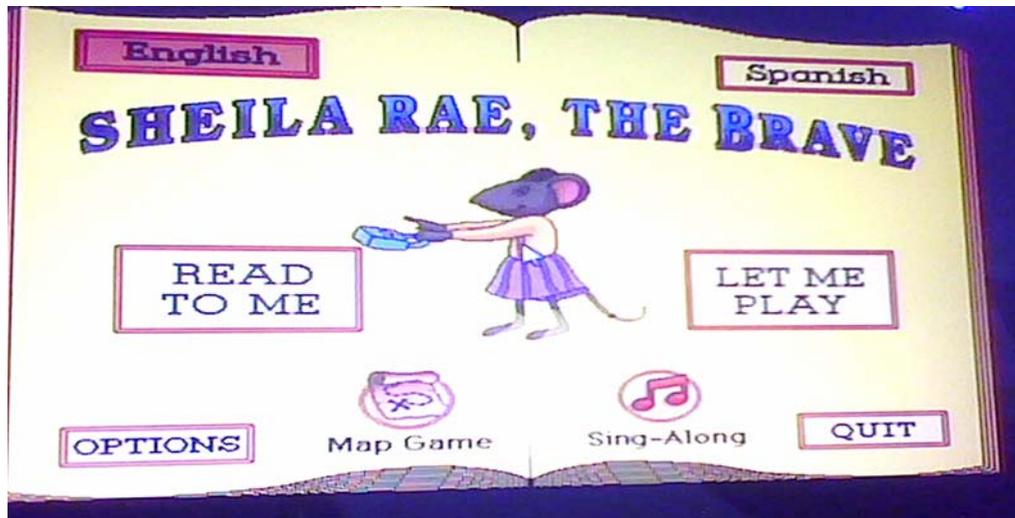


Figure 1: The Control Panel Page of Electronic Storybooks and Options

The storybook was approved by experts, the teachers and fourth-grade coordinator as being suitable for the age group being tested. The electronic storybook, which are part of the Living book series, was selected based on their appropriateness for this age of reader with regard to content and reading level. Storybook was Sheila Rae, the Brave by Kevin Henkes: Developmental Assessment Level (DRA): 18-20. The Interactive storybook offered a “read to me” option, providing linear progression through the text screen by screen, and a “let me play” option which, while encouraging linear progression, permitted linear regression and screen selection. During electronic storybooks word pronunciations, definitions, narration functions were turned off so as not to provide extra help to students.

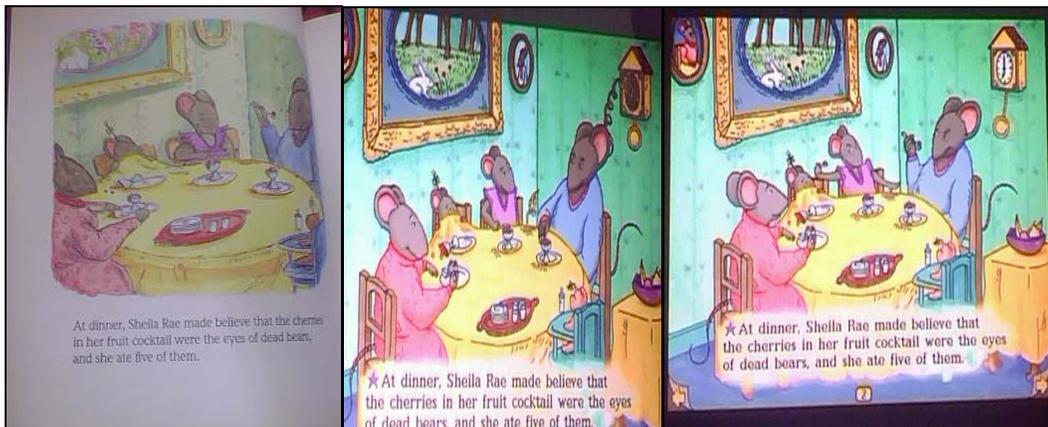


Figure 2: Sample Screen Captures of the Storybooks; Traditional Print Storybook, the Storybook without Animation, and the Storybook with Animation

The electronic storybook was chosen for several reasons. First, the subjects are struggling readers (Reading Level one and Level two) at least one or two years below their current grade level. O'Connor, Bell, Harty, Larkin, Sackor, & Zigmond (2002) found that the reading-level matched texts are more beneficial than grade-level matched texts. It is also essential that struggling readers be given materials on their level. They should know that at least 90-95 percent of the words in a text, that text is at the appropriate level of difficulty to read with no assistance (Leslie & Caldwell, 2001). More difficult text is not appropriate for reading instruction. If given materials on higher level, they are unable to apply reading strategies (Kletzien, 1991). Therefore, the storybook, which is low difficulty level for regular fourth-graders, was chosen by the researcher. The second reason the electronic storybook and paper versions were used in previous studies. For example, Sheila Rae, the Brave by Kevin Henkes used by Trushell et al. (2003, 2005) for year 4 and year 5 primary school children in United Kingdom. It was an evident to the researcher was using the storybook was valid and reliable for this research.

Measurement Tool (Retelling)

In this research, retelling used to assess students' reading comprehension performance.

Comprehension is truly reflected by story retelling, and the use of retellings provides readers with an opportunity to transform the story into their own words, and also to share their individual understanding of text (Doty, 1999).

One of the dependent variable of the research was comprehension as measured by oral retelling. Morrow's 10-Point Scale was used for analysis and evaluation story retellings. Morrow's 10-Point Scale is a reliable assessment instrument for retelling. According to Morrow's research (1986), to verify the reliability of the scale, six evaluators independently analyzed for inclusion of structural elements (setting, theme, plot episodes, resolution) and they scored the same 12 story retellings. Morrow (1986) reported that "mean correlation among evaluators was .93 for setting scores, .88 for theme scores, .90 for plot episodes scores, .90 for resolution scores, .86 for sequence scores, and .90 for total retelling scores" (p. 144). Additionally, the literature review has shown that previous studies applied retelling as assessment of comprehension widely used Morrow's 10-Point Scale. For example, Doty (1999), Doty et al. (2001), Matthew (1996, 1997), and Pearman (2003, 2008) used this scale with retellings.

Data Collection

The research consisted of having each child read the storybook. The research was conducted by researcher with the cooperation of elementary schools in north Florida, USA. Data collection took about 8 weeks. The first group of students ($n=25$) read electronic storybooks with animation of storybooks on the computer. The second group ($n=26$) read electronic storybooks without animation of storybooks on the computer. The third group of students ($n=26$) read the same stories on print version.

Prior to data collection, all students had been trained with *Just Grandma and Me* (by Mercer Mayer) from Living Books series to familiarize themselves with the comprehension measure, story retellings. Additionally, students in the electronic storybooks groups were given directions for using the computer. For the purposes of data collection, the students read the following storybook, which was published in print and electronic formats: *Sheila Rae, the Brave* by Kevin Henkes (1987).

After reading, all students gave an oral retelling after reading the story. Student retellings were recorded for later scoring by independent raters. For the retellings, students were told to tell the story to share with a friend who had never read the story. They were reminded to tell as many details as they could remember.

The retellings were scored in accordance with Morrow's (1986) 10-point scale. Students received two points, one point for partially correct responses, and zero points for an incorrect or missing response each of following items in the retelling: a) setting b) theme c) plot episodes d) resolution (Matthew, 1996). The highest total possible score was 10 points for this assessment. The students responses were scored by the researcher and then by an independent rater who is native English speaker. The independent rater was trained in the general use of Morrow's (1986) 10-Point Scale. The correlation between raters was .81. Scoring differences greater one point were discussed and resolved.

Data Analysis

One-way analysis of variance (ANOVA) was performed to compare the groups on the basis of outcome measures at the .05 level of significance. The Statistical Package for Social Sciences (SPSS) used for the purpose of data entry, manipulation, and analysis. According to Balian (1994), ANOVA is the most traditionally and widely accepted form of statistical analysis. ANOVA can test three or more group means utilizing a single statistical operation. ANOVA accomplishes its statistical testing by comparing variance between the groups to the variance within each group. A significant statistical finding would indicate that group means were significantly different from each other. In case of a significant statistical finding, there is a need to use a Post-Hoc test (Tukey, Scheffe, Bonferroni or others) to find exactly which groups differed from which other groups (Balian, 1994). In this research, because of a significant finding from ANOVA, Bonferroni test was used to find exactly which groups differed from each other. In addition, Kruskal-Wallis one-way analysis of variance was used to decide whether or not the average differences between the groups are due chance. Kruskal-Wallis one-way analysis of variance is the nonparametric statistical test for analyzing data from two or more independent samples of subjects (Shavelson, 1996).

FINDINGS

Analysis of Variance for Retelling Scores

Table 1. Analysis of Variance for Retelling Scores

		df	F	Sig.		N	Mean	Std. Deviation
Retelling	Between Groups	2	5.475	.006	with animation	25	6.88	2.00
	Within Groups	74			without animation	26	5.46	2.16
	Total	76			printed	26	4.81	2.62

To assess the difference in reading comprehension scores on a multiple choice comprehension test and reading comprehension scores on retellings for students reading electronic storybooks with animation, electronic storybooks without animation and traditional printed storybooks, an analysis of variance (ANOVA) was conducted. The findings are presented in Table 1. A one-way ANOVA indicated significant differences in reading comprehension scores on retelling ($F=5.475$, $df=2/74$, $p<.05$) between students reading electronic storybooks with animation, electronic storybooks without animation and traditional print storybooks.

For the reading comprehension scores on retelling, a higher level of comprehension score was reported in the reading electronic storybooks with animation condition ($M=6.88$, $SD=2.00$), followed by electronic storybooks without animation condition ($M=5.46$, $SD=2.16$) and traditionally print storybooks condition ($M=4.81$, $SD=2.62$) (Table 1).

Post-Hoc (Bonferroni) Test Results for Retelling Scores

Table 2. Post-Hoc (Bonferroni) Test Results for Retelling Scores

(I) condition	(J) condition	Mean Difference (I-J)	Std. Error	Sig.
with animation $N=25$, $M=6.8800$ $SD=2.0067$	without animation	1.4185	.6390	.089
	printed	2.0723	.6390	.005*
without animation $N=26$, $M=5.4615$ $SD=2.1583$	with animation	-1.4185	.6390	.089
	printed	.6538	.6327	.914
printed $N=26$, $M=4.8077$ $SD=2.6233$	with animation	-2.0723	.6390	.005*
	without animation	-.6538	.6327	.914

* The mean difference is significant at the .05 level.

Employing the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation, and the traditionally printed storybooks ($p<0.05$). There were no significant differences between the electronic storybook with animation and the electronic storybook without animation ($p=.089$), and the electronic storybook without animation, and the traditional print storybook ($p=.914$) (Table 2).

Kruskal-Wallis Test Results for Retelling

Table 3. Kruskal-Wallis Test Results for Retelling

	Retelling #6	Retelling #8
Chi-Square	9.079	10.362
df	2	2
Asymp. Sig.	.011	.006

a. Kruskal Wallis Test

b. Grouping Variable: Condition

Differences in reading comprehension scores on retellings for the story “Sheila Rae, the Brave” between students reading the electronic storybooks with animation, the electronic storybook without animation and the traditionally printed storybook groups were analyzed through Kruskal-Wallis tests. The findings are displayed in Table 3. Kruskal-Wallis analysis of variance (ANOVA) revealed that accuracy varied significantly across

storybooks presentation conditions (electronic with animation or electronic without animation or printed) on the retelling item #6, $H(2, N=77)=9.079$, $p<.05$, and item #8, $H(2, N=77)=10.362$, $p<.05$ (Table 3).

Table 4. Kruskal-Wallis Means Ranks for Retelling

Retelling	Condition	N	Mean Rank
item #6	with animation	25	48.22
	without animation	26	36.79
	printed	26	32.35
	Total	77	
item #8	with animation	25	47.18
	without animation	26	40.25
	printed	26	29.88
	Total	77	

The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ($n=25$) ranked highest, the electronic storybooks without animation group ($n=26$) ranked second, and the traditional print storybook group ($n=26$) lowest on the retelling items #6, and #8 (Table 4). Other questions did not reveal statistical differences between the electronic storybooks with animation, the storybooks without animation group, and the traditional print storybook group.

DISCUSSION

This research found that electronic storybooks can improve and support reading comprehension of struggling readers. These findings are consistent with earlier research by Doty (1999, 2001), Greenlee-Moore and Smith (1996), Grimshaw et al. (2006), Matthew (1997), McNabb (1998), Miller et al. (1994), Pearman (2003, 2008), Pearman and Lefever-Davis (2006), and Shamir et al. (2008).

However, some previous research on electronic storybooks is inconsistent with the findings of this research (De Jong & Bus, 2002; Labbo & Kuhn, 2000; Trushell & Maitland, 2005; Okolo & Hayes, 1996; Scoresby, 1996; Trushell, Burrell, & Maitland, 2001; Trushell, Maitland, & Burrell, 2003; Underwood, 2000). Those claimed that the electronic environment has detrimental effects on comprehension. Characteristic of kids are different these days. In a digital age, today's kids have exposure to multiple alternatives of the stories and multimedia texts. For example, they may have experience with video games, hypertext, online texts, the Web, and other interactive media that they might not have been able to do in the past. Therefore, the influence of interactive media can be a factor that the findings of this research are inconsistent with the results of some previous studies. In addition, it should be considered that most of those studies' subjects were younger children and also these subjects did not have any reading problems.

In addition to improving comprehension, animation may be beneficial when struggling readers read narrative texts. Therefore, having animation and playing options on electronic storybooks can be helpful for struggling readers to construct meaning from narrative reading materials. This result is supported by ChanLin (2001), and Pearman & Lefever-Davis (2006); however, it is inconsistent with studies by DeJean et al. (1997), Nibley (1993), Okolo and Hayes (1996), and Scoresby (1996). These authors were concerned about the potential distraction of animations in reading comprehension. If animations do not support the text, they may draw students' attention away from the main points of the text; and may even hinder comprehension. Scoresby (1996) found that animation in electronic books diverted from reading rather than improved it and the animation slowed down recall of textual information.

Another result of this research was that struggling readers' comprehension is more improved when the story is presented as animated illustrations instead of static illustrations. The retelling results showed that struggling readers understand theme, plot episodes and resolution in stories better with animations available in electronic storybooks than with static visualizations available in electronic storybook and printed storybooks. The result of the research found that the advantages of animation in improving story comprehension and in supporting struggling readers' ability to make inferences about story events.

This research does not include any quantitative data whether electronic storybooks increase student motivation, and enjoyment, however, the interview results show that the students usually were enthusiastic about reading electronic storybooks.

Electronic storybooks can help struggling readers to build or activate more complete schemas of stories. According to the present research struggling readers reached more complex levels of story understanding with

multimedia storybooks. Additionally, it is clear that the electronic books offer interactive features that may serve as electronic scaffolds for struggling readers (Bus, De Jong & Verhallen, 2006).

A possible explanation of higher comprehension scores for electronic storybooks with animation group lies in the interactivity that electronic storybooks allow. The rich visual support and animation in the electronic storybooks used in this research may be a reason that influenced the amount of comprehension. Sutherland-Smith (2002) stated that images in electronic texts are more lifelike than in traditional print texts. It has been shown that animation on the electronic storybooks, the design quality of on-screen elements can bring in greater interest from the reader, a more effective activation background knowledge, and deeper processing of information (Alvarez, 2006).

Comprehension can be supported by interaction and self-direction which both are available in electronic storybooks with animation. In other words, the interactive features of storybooks can contribute to the readers' comprehension. Dalton and Strangman (2006) stated that the novelty effect and student opportunities for control and choice might be potential sources of students' positive responses to electronic storybooks.

CD-ROM software technologies present new promise for introducing children to reading through computers. For instance, in the Netherlands and other parts of the world, young children can independently practice electronic versions of those books on a computer screen (Bus, De Jong, & Verhallen, 2006). Teachers and families can use electronic storybooks, as less dependent on adult scaffolding, for supporting struggling readers.

CONCLUSION

This research investigated the effects of electronic storybooks on reading comprehension of fourth-grade struggling readers. Many struggling readers exhibit reading difficulties for a variety reasons (Rapp et al., 2007). According to Biancarosa and Snow (2004) a common problem of older struggling readers, who are between fourth and twelfth grade, is that they fail to comprehend what they read. Coiro (2003) says that print media is insufficient. As a valuable tool in educational settings electronic storybooks and the features of electronic storybooks may help the reader in building context and activate student's background knowledge (Doty, 1999; Pearman, 2008).

The results of the study showed that retelling scores were higher for struggling readers reading the electronic storybooks with animation than struggling readers reading the electronic storybooks without animation (static illustration) and struggling readers reading printed storybooks (see Table 1). In other words, animations were shown to positively affect the comprehension of the fourth-grade struggling readers. Struggling readers who read the storybook with animations were being able to remember more story details and information when the story was finished. Another important result of the study was that the retellings of student group who read animated version of story were longer, and more creative related or unrelated the stories. In addition, the electronic storybooks with animation group spent significantly longer time overall in reading when we compare to the other groups. Spending more time in reading might be a clue of engaged reading, reading pleasure, and reading attention. Engagement is clearly an important literacy outcome o for reading in digital environments (Dalton & Strangman, 2006).

There could be a variety of causes for these higher retelling and comprehension test scores of struggling readers reading the electronic storybooks with animation. The most obvious cause is animations that give contextual support and increase readers' understanding of a text (Trushell, Maitland, & Burrell, 2003). Pearman and Lefever-Davis (2006) stated that "when book characters visually react to an event via animations, it is easier for readers to infer word meanings" (p. 306). Another cause can be the connections between multimedia and time (the dual coding) on task, student interest and engagement with the texts, animation and student motivation result in superior memory of story. Multimedia features can support processing, memory, or motivation, which may cause better comprehension (Zucker, Moody, & McKenna, 2009). The group of struggling fourth-grade students reading electronic storybooks with animation spent a longer amount of time reading storybooks. Interactive storybooks caused this result because their formats are more engaging, interesting, and thus, more motivating to readers (Pearman & Lefever-Davis, 2006).

Zucker, Moody, and McKenna (2009) found similar results in their research about e-books. They say that "quality of visual design features, particularly embedded hotspots and animations, can influence the impact of e-books on learning outcomes" (p.53). However, some e-books appear to do too many these features. Too many hotspots or incongruent animations can encourage passive viewing or slow down comprehension by creating visual distractions that lure the child away from the text ((Labbo & Kuhn, 2000; Trushell, Burrell, & Maitland, 2001). In addition, there are some concerns about electronic text that can distract the attention of struggling

readers, and they can also cause cognitive overload or damage comprehension of these readers (Duke et al., 2006). However, this research found that electronic storybooks might be beneficial in helping struggling readers better understand the narratives and animation feature of electronic storybooks which has the potential to improve struggling reader comprehension.

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