

INVESTIGATING THE EFFECTS OF ELECTRONIC CD-ROM STORYBOOKS AND
TRADITIONAL PRINT STORYBOOKS ON READING COMPREHENSION OF FOURTH
GRADE STRUGGLING READERS

By

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To my mom, who always believed in me

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LIST OF TERMS/SYMBOLS/ABBREVIATIONS

CD-ROM	Compact disc read-only memory is a method of storing large amounts of data on a small disc for use in a computer (Maddux, Johnson, & Willis, 1992). For the purpose of this study, the term refers to software programs that maintain text and pictures, a children storybook in its original form (Nakjan, 2002).
Comprehension	Process of simultaneously extracting and constructing meaning through interaction and involvement with written language (RAND Reading Study Group, 2002, p. xiii).
Constructivism	A learning theory that learning as the result of constructing meaning based on an individual's experience and prior knowledge (Bruner, 1966).
DRA Level	A leveling criteria. Measures level of independent reading in a student (Pearson, 2007).
Electronic Literacy	Electronic literacy refers to literacy activities (e.g. in reading, writing, spelling) that are delivered, supported and accessed digitally through computers or other electronic means rather than on paper (Topping & McKenna, 1999, p. 107).
Electronic Storybook	For the purpose of this study, the term refers to software which presents readers with several options for interaction. The text is usually highlighted as it is read allowing students to follow the words as they are read (Doty, 1999, p. 8). Text is statically displayed on a computer screen or interactive computer text, on CD-ROM, that allow readers to activate graphic animations.
FCAT	The Florida Comprehensive Assessment Test (FCAT) is the foundation of the statewide educational assessment and accountability program. The FCAT is administered to students in Grades 3-11, consists of criterion-referenced tests in mathematics, reading, science, and writing, which measure student progress toward meeting the Sunshine State Standards.
Guided Reading Level	A leveling criteria. Guided Reading Levels are based on the works of Irene Fountas and Gay Su Pinnell and reflect a broader gradient of texts (Pearson, 2007).
Leveled Books	Books grouped and graded for difficulty based on specific text characteristics (Literacy Glossary, 2007).
Leveling	A method of determining the gradient of difficulty of texts (Pearson, 2007).

Lexile	A Lexile is a unit measurement that is used to determine the difficulty of text and reading level of readers. It is an equal interval scale and can be used to measure growth (Literacy Glossary, 2007).
Narrative	A text genre that tell as story. Generally includes the elements of character, setting, plot and theme (Literacy Glossary, 2007).
Printed Storybooks	Traditional paper storybooks that consist of paper bound between two covers.
Retelling	For purpose of this study, retelling refers to post reading recalls in which readers tell what they remember of a story (Morrow, 1996).
Struggling Reader	For the purposes of this study, a student was considered to be a struggling reader if she/he was reading below level his/her 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).
Text-explicit Questions	Literal/factual question that requires readers to use information found directly in the text (Raphael & Pearson, 1985).
Text-implicit Questions	Implicit/inference question that requires readers to use information found in the text, but requires the reader to integrate information across sentences or paragraphs (Raphael & Pearson, 1985).

Abstract of Dissertation Presented to the Graduate School
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This study 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.

Two different storybooks were used and 77 students participated. 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). Twenty-five of these students read the electronic version of storybooks with animation, 26 students read the same but without animation and 26 students read the traditional print storybooks. Comprehension was measured by using multiple-choice comprehension test and retelling. Subjects were instructed to read electronic CD-ROM storybooks. After completion of reading, subjects answered multiple-choice comprehension test and performed an oral retelling. The oral retellings were recorded and then scored by two independent raters using Morrow's 10-point Scale.

Analysis of variance (ANOVA) was used to test two research questions at the .05 level of significance. One dependent variable is reading comprehension as measured by the multiple-choice comprehension test, and the second dependent variable is reading comprehension as measured by the retelling. The independent variable is the type of medium of presentation.

The results of statistical analysis indicated that there was significant difference in the students' comprehension scores. In other words, when comprehension was measured by using multiple-choice comprehension test and retelling, the students who read the computer presentation of storybooks with animation showed significantly higher comprehension scores than students who read the computer presentation of storybooks without animation and the traditional print version of storybooks.

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 CD-ROM storybooks can improve reading comprehension and can be beneficial for struggling readers.

CHAPTER 1 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. For example, Kamil (2003) claims that in the United States there are 8.7 million students who are not able to read and understand their textbooks. Reading difficulty is not only a problem for younger children, older students also have similar issue. According to Catts and Hogan (2002) fourth-grade is particularly critical because about 3% of children begin to experience serious comprehension difficulties around fourth-grade. The reason is likely increasing demands of readings and materials in this grade. Similarly, 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.

To comprehend the text, readers must be able to decode words quickly, easily, automatically and read smoothly (NICHD, 2000). Readers who lack word recognition skills and fluency often have difficulties with comprehension. Some educators consider these students low achievers, those who are lack of cognitive competencies including phonological awareness, decoding, fluency, vocabulary knowledge and comprehension strategies (Cooper, Chard, & Kiger, 2006; Rapp et al., 2007). The existing literature provides that reader characteristics, text

properties, and instructional contexts are main elements of comprehension difficulties (Rapp et al., 2007).

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).

In the twenty-first century, important and radical changes are occurring in the area of literacy. Digital technology is changing the nature of literacy (Reinking, McKenna, Labbo, & Kieffer, 1998). Many researchers, theorists and applied scholars support this changing and transforming the nature of literacy, especially within and across new electronic environments (Reinking, 1998; Reinking et al., 1998; Tierney, 2008). Moreover, "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 the mid-1990s, literacy in new digital age, the New London Group engaged in the implications of broad social, cultural, technological change for conception of literacy. The New London group expressed particular attention to multimedia, electronic hypermedia, and the shift from print-based literacy towards digital texts, on-screen texts and literacies (New London

Group, 1996). “Meaning is increasingly embedded in an image or in a non-linear combination of image and print, rather than in what can be decoded from the print alone” (Carrington, 2005, p. 166).

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 CD-ROM 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). CD-ROM 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 CD-ROM 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 (Mac Arthur, 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, CD-ROM 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).

Furthermore, most of the studies are focused on younger children and early grades. Some of these studies 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; Grimshaw et al., 2006; 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. On the other hand, there is still an incomplete picture of higher grades students' literacy achievement.

Additionally, the 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 CD-ROM storybooks support struggling readers' comprehension? Although, findings from recent studies suggest various elements play important roles in whether CD-ROM 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 study investigated the extent to which use of medium of storybooks positively influenced struggling readers' comprehension.

Purpose of the Study

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 study, 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.

Significance of the Study

Although information technology is an essential element of educational reform, K-12 institutions have thus far only minimally integrated computers extensively and effectively within many aspects of the learning process. At the elementary school level, computers are frequently used for teaching isolated basic skills and for playing educational games (Presidents' Committee of Advisors on Science and Technology, 1997). Results from the National Evaluation of Educational Technology study reveal that simply none of the effect sizes, overall, as significantly different from zero for any of the commercial software products on standardized tests of comprehension (Kamil & Chou, 2008). On the other hand, the NRP analysis (2000) has found the 21 studies used to assess computer technology all showed positive results and multimedia presentations promises successful applications in literature. However, there has been relatively little research in computer technology and reading area and research is urgently needed to answer some questions that have not been addressed to date. For example, “what are the conditions under which multimedia presentation is useful or desirable in reading text” still has remained unanswered (NICHD, 2000, p. 6-9). Kamil and Chou (2008) agree NRP’s revealing about the multimedia presentation. “In general, computer software has been effective in teaching a variety of skills related to comprehension. Most of these skills cluster around strategies or metacognitive abilities. Few of these studies used what today are cutting edge technologies, like multimedia...” (Kamil & Chou, 2008, p. 296). More research is necessary to determine which multimedia presentation of text has an impact on the reading comprehension.

There is a growing awareness of the contributions of comprehension skills for successful reading (Rapp et al., 2007); there is also a growing awareness of the contributions of electronic

texts on reading comprehension, however, currently, a small number of studies have examined the use of the electronic storybooks for reading comprehension. Some of the studies measured sight word acquisition, and instructional reading levels of readers (Doty, 1999). Similarly, Pearman (2008) states “there is limited research that compares reading interactive, electronic texts on CD-ROM and traditional print texts...It is necessary to determine the effects of the different presentation modes on readers' comprehension” (p. 595). Findings indicate that some of the studies demonstrate the potential of interactive electronic storybooks that help students make progress in comprehension (ChanLin, 2001; Doty, 1999; Doty et al., 2001; Greenlee-Moore & Smith, 1996; Matthew, 1997; Miller, Blackstock & Miller, 1994; Pearman, 2003, 2008; Pearman & Lefever-Davis, 2006).

However, electronic storybooks may also potentially disrupt rather than support comprehension (De Jong & Bus, 2002; Matthew, 1996; Underwood & Underwood, 1998). In addition, literature review has shown that there is little actual research on evaluating the use of animation in electronic storybooks. Some authors warn about the potential for distraction of animations in reading (Nibley, 1993; Scoresby, 1996). Doty (1999) recommended that future research is needed to determine what students do and what features are most beneficial when extra features and options on CD-ROM storybooks such as animations are available for students. More experimental evidence and more research is needed for examinations of electronic storybooks animations.

The results of the studies previously carried out in this area have been conflicting and are frequently hard to interpret. First, the animation effects were not controlled by the child. Second, narrated condition was integrated with animation as part of storybooks. If there is any difference, it is not clear whether it is coming from narration and/or animation features of storybooks. Third,

usually there was no obvious explanation or detail about what kind of illustrations or animations were used in the study. For this reason, in this study, the stories presented compared both static illustrations, and animated illustrations. Narrative functions, word definitions, and sound effects of storybooks were not used.

Few studies have been performed examining the comprehension of struggling readers when reading electronic CD-ROM storybooks. Pearman (2003) recommended that “future research could specifically target struggling readers from diverse backgrounds” (p. 86-87). Furthermore, Doty (1999) revealed that “...few studies have utilized retellings and comprehension questions together as measures of comprehension” (p. 36). The studies 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. Therefore, this study used retellings and comprehension questions together as measures of comprehension, designed three groups comparison, and conducted data collection procedures twice with the same readability levels but different storybooks for reliability and validity concerns.

Most studies to date have focused on younger children, early grades and normal readers. Some studies have done the contribution of technology in reading comprehension for young children, but much less is known about students in upper grades that comprehend poorly and struggle with comprehension despite exposure to reading. Catts and Hogan (2002) report that some children start to experience significant comprehension problems around fourth-grade because of changes in the demands of reading in later elementary school grades. Approximately 3% of children may show a fourth-grade slump. This represents about 20% of all poor readers in fourth-grade. A meta-analysis of twenty research articles by Moran, Ferdig, Pearson, Wardrop,

and Blomeyer (2008) stated that "...most of the studies in this research corpus have addressed literacy or reading acquisition in the early years of schooling...these technologies may be equally as important for older reader, particularly those who have not experienced great success in their school careers" (p. 8). Due to a lack of evidence about what represents an effective medium of story presentation for older struggling readers, we often borrow from research on younger students. Some findings of effective medium of story presentation for younger readers are appropriate to the older grades, but some are not.

In summary, this research study attempts to address some of the shortcomings of previous research. 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.

Research Questions

The following research questions were addressed in this study:

1. Do fourth-grade struggling readers differ on reading comprehension as measured by multiple-choice comprehension test when they read the same storybooks presented in electronic format with and without animation and in a traditional print format?
2. 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?

Summary

The purpose of this study is to investigate the differences in fourth-grade struggling readers' comprehension of storybooks according to the medium of presentation. Although there have been some studies examining the relationship between interactive computer presented text and comprehension (Doty, 1999), a small number of studies have been conducted using electronic books or CD-ROM storybooks (Doty et al., 2001) particularly with older struggling readers.

Harris and Hodges (1995) defined comprehension as “intentional thinking during which meaning is constructed through interactions between text and reader” (p. 207). It is expected that the use of electronic CD-ROM storybooks help interaction between texts and struggling readers to construct meaning and also improve comprehension for these readers.

This chapter has provided the related background for understanding this study. The purpose of the study, and the research questions were presented. Chapter 2 will discuss major parts of the study such as comprehension, comprehension assessment, struggling readers, technology as well as previous studies that contributed to the work. Chapter 3 describes the theoretical framework of the study, text difficulty and choice of storybooks, the methodology and the instruments. Chapter 4 presents the findings of this study. Finally, Chapter 5 concludes with a discussion of findings, recommendations and implications.

CHAPTER 2 LITERATURE REVIEW

Introduction

A review of the literature relevant to this study includes an overview of reading comprehension, measuring reading comprehension, comprehension difficulties, struggling readers, technology and reading comprehension, electronic storybooks, and the role of animation. The main focus of this literature review is on studies that use technology in literacy or that investigates students' comprehension when reading electronic storybooks in compact disk read-only memory (CD-ROM) software. At the end of each part, the relevance of the literature to this study is discussed.

Reading Comprehension

Understanding the meaning of words and texts is the center of the function of literacy. Without comprehension, reading words is reduced to imitating the sounds of language, repeating text and simply memorization and oral drill (Paris & Hamilton, 2008). Because of wide boundaries of comprehension, it is difficult to describe simply and measure accurately; thus, there is little consensus about definitions of comprehension (Paris, 2007; Paris & Hamilton, 2008). Cognitive perspective refers reading comprehension as a complex cognitive ability requiring the capacity to integrate text information with prior knowledge of the reader and resulting in the elaboration of a mental representation (Anderson & Pearson, 1984). Rumelhart (1994) characterized comprehension as an interactive process that occurs between reader and a text; during this interaction the reader conveys her or his experiences and proficiency which include language proficiency, cognitive resources and world knowledge. Recent national reports also highlight the constructive and interactive process of reading comprehension. For instance, the NRP (2000) explained 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. The National Assessment of Educational Progress (NAEP) Committee describes comprehension 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 (NCES, 2005, p. 2). RAND Reading Study Group (2002) defines reading comprehension as “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (p. 11). According to the RAND report (2002), comprehension contains three main elements: (a) The reader who is doing the comprehending. As a reader, a person brings all the capacities, abilities, knowledge, and experiences to the act of reading. (b) The text that is to be comprehended. Text broadly includes any printed text or electronic text. (c) The activity in which comprehension is a part. The activity includes the purposes, processes, and consequences associated with the act of reading. These three dimensions occurring within a larger sociocultural context interact with each other.

Comprehension is considered a complex but single skill (Schwartz, 1984). To build meaning, readers must decode words fluently, understand vocabulary, draw inferences, relate the ideas in text to their prior knowledge and experiences or find answers to questions, and follow the structure of text (Matthew, 1997; National Reading Panel, 2002; Paris & Hamilton, 2008; Snow, Burns, & Griffin, 1998; Schwartz, 1984). These skills differ with age, experience, instruction, context, and motivation so both the processes and the products of reading comprehension are the building of meaning from text using a wide variety of skills and knowledge (Paris, 2007).

The models and theories of reading comprehension specifically schema theory and interactive theory directly related to comprehension process are reviewed under the title theoretical framework in Chapter III.

Components of Comprehension

Comprehension is multi-componential and developmental, and hence, comprehension entails a number of lower order and higher order process. Several factors are involved during comprehension with four important elements being word level process, prior knowledge, motivation and attitude, and reader strategies (Lipson & Wixson, 1997; Pressley, 2000).

Word-level processes

Word-level processes affects comprehension and word-level processes include recognition of words (i.e., decoding) and understanding of words (Pressley, 2000). Rapid decoding is critical to fluent reading and comprehension (Cooper et al., 2006; Naslund & Samuels, 1992). NRP (2000) report also confirms this claim: students must be able to decode words quickly, simply and automatically and read effortlessly. Pressley (2000) stated that “word-level decoding is a critical bottleneck in the comprehension process, that if the reader cannot decode a word, she or he cannot comprehend” (p. 546). The more skilled the decoding, the less conscious effort is necessary for it and the more conscious capacity is left over for comprehension of the words (Pressley, 2000). The rationale behind this idea is that information stored for comprehension vanishes, while short-term memory is trying to decode the words. In order for higher level comprehension processes to occur, lower level processes, such as those used for decoding, must proceed rapidly and with little effort (Matthew, 1997; Torgesen, 1986; Pearman, 2003).

Along with decoding, extensive vocabulary knowledge promotes comprehension skill (Hirsch, 2003; Pressley, 2000). In recent years, attempts to improve reading have focused on decoding. Although decoding is a requirement for comprehension, comprehension cannot

improve unless building student's word and world knowledge (Hirsch, 2003). Occasionally readers know how to decode and read fluently but have comprehension difficulties because of limited meaning vocabularies (Nagy, 1988). But it does not mean that teaching vocabulary will automatically increase readers' comprehension; context is also important to enhance the ability of readers to recognize words (Pearman, 2003). Researchers have found vocabulary increases as a function of children's reading of text rich in new words (Robbins & Ehri, 1994; Pressley, 2001). Most vocabulary words are gained incidentally as a utility of encounters in context (Pressley, 2000). This is one of the many reasons to support students' extensive reading.

Electronic texts rapidly and easily give students word pronunciations and definitions to assist their comprehension (Matthew, 1997). Poor readers' comprehension is increased with the addition of a speech part of electronic text (Hartas & Moseley, 1993). In addition, Electronic CD-ROM storybooks combine animated graphics and sound effects that give richer context than static, traditional texts that supports vocabulary (Reinking & Chanlin, 1994; Pearman & Lefever-Davis, 2006). Cued animations and sound effects give contextual support by supplying images, associated animations, and audio clips that increase readers' comprehension (Pearman & Lefever-Davis, 2006; Trushell, Maitland, & Burrell, 2003).

Prior knowledge

Comprehension is a process of constructing an interpretation of a text that fits the reader's knowledge of the world (Lipson & Wixson, 1997). Comprehension requires readers to use their prior knowledge and experience to create new knowledge (Alexander & Jetton, 2000). Readers who possess rich prior knowledge about the topic they are reading often understand the reading better than classmates with low prior knowledge (Anderson & Pearson, 1984). Prior knowledge contains topic and genre information about the text, vocabulary, ideas and concepts, related to a particular topic, personal experiences, and cultural expectations (Morgan, 1983; Cooper et al.,

2006). Before reading, students' prior knowledge must be activated if it is to be available to assist them in comprehending the text. Readers do not always relate their world knowledge to the content of a text, even when they possess knowledge relevant to the information it presents. Often, they do not make inferences based on prior knowledge unless the inferences are absolutely demanded to make sense of the text (Hirsch, 2003, Pressley, 2001).

Hirsch (2003) explained that a meaningful mental model cannot be constructed unless we do not know have prior knowledge. Closely related to schema theory, prior knowledge is recognized as one of the most considerable predictors of comprehension (Pearman, 2003). A central premise theory is that much of knowledge is stored in complex relational structures, schemata. From this perspective, a reader's prior knowledge is continuously modified and enhanced during reading. Readers who have developed schemata for a concept are better prepared to read about that topic and to determine if new information fits or alters their own prior knowledge (Gambrell & Dromsky, 2000). In short, schema theorists specify that readers often relate their prior knowledge to ideas in the text, when the ideas in text go beyond to some extent the ideas in their long term knowledge base. Such automatic use of prior knowledge to comprehend text is particularly in contrast to the many reading process that can be consciously controlled (Pressley, 2000). Traditional texts do not present many options, except text or pictures to activate prior knowledge. The interactive, audio, animations, graphics, and pronunciations capability of electronic storybooks might facilitate this limitation (Pearman, 2003).

Motivation and attitude

Motivation is crucial for reading comprehension. Guthrie and Wigfield (2000) emphasized that "A less motivated reader spends less time reading, exerts lower cognitive effort, and is less dedicated to full comprehension than a highly motivated reader" (p. 406). Moreover, children are born with the wish to learn. They are concerned about objects, people, and events in the world

around them. When children constantly experience reading difficulty, they may lose their eagerness and motivation for reading. Instructional planning for students who find reading difficult must include systematic attention to encouraging positive attitudes toward reading (Rasinski & Padak, 2004). Attitudes influence motivation, and motivation influences our thinking about why we are successful or not. Reading failure frequently leads to negative attitudes toward reading (Rasinski & Padak, 2004).

A lack of motivation to read may decrease a student's ability to comprehend. "It is hard to tell whether lack of interest and poor motivation are the result of being a struggling reader or the cause of being one" (Cooper et al., 2006, p.121). They add, however, many upper-grade students are more motivated once they become successful at reading.

The cognitive revolution in learning increased our insights into the nature of comprehension (Anderson & Pearson, 1984). Strategic readers selected the most suitable cognitive strategy. To become strategic reader, students needed both skill and motivation. Motivation characterized the intent to become engaged with reading. Motivation was no longer a simple support to energize a set of predetermined behaviors; instead, it resulted from learner's expectancies, values, and beliefs. Students would not be successful if they obtained the necessary cognitive and metacognitive abilities; however, lacked the motivation to become engaged (Miller & Faircloth, 2008). Good readers have a tendency to read more; they increase their competence, which increases their reading ability. Increasing proficiency is motivating, and increasing motivation leads to more reading. In this perspective, motivation is the initial process for reading engagement and is a major contributor (Guthrie & Wigfield, 2000).

The research provides clear evidence that students with choices in their reading materials are a critical factor for reading development (Allington, 2006). For example: Palmer, Codling,

and Gambrell (1994) investigate the reading preferences of 330 third and fifth-grade students. They found that children were most motivated when they read books they had chosen themselves. Children need effortless access to books and the freedom to choose their own reading material (Rasinski & Padak, 2004). Sweet and Guthrie (1996) explored children's reasons, goals, and motivations for reading, believe that children's motivations are multidimensional and diverse and teachers must learn to recognize the characteristics of these motivations to foster long-term literacy growth. Sweet and Guthrie's research (1996) informed both intrinsic-interest, experience, involvement, curiosity and extrinsic motivations- compliance, recognition, competition, and work avoidance to facilitate comprehension of the text.

In the research of computer use by children, the most consistently found effect is an increase in motivation, enjoyment of reading and writing. The studies reported that students exhibited a higher level of motivational engagement when using technological tool (Daiute, 1983 as cited in Kamil, Intrator, & Kim, 2000). Specifically, the use of electronic storybooks provides positive attitude and motivation to reading. The enjoyment of the extract was enhanced by using computers. Research has shown that electronic storybooks have the capacity to increase children's comprehension, enjoyment and may motivate children to read (Adam & Wild, 1997). Their research points out that interactive storybooks increase positive attitude to reading traditional materials. As McNabb (1998) demonstrated, third-grade struggling readers showed a high level of motivation to read electronic books. Lewin (2000) administrated a survey to 494 teachers; the results of survey indicated that 79% of teachers believed that interactive storybooks would motivate and increase the confidence of children with low-self esteem in reading (67%). Matthew (1996) found that there was no significant difference between the reading attitudes of third grade students in the experimental group (reading CD-ROM storybooks) and those of the

control group (reading traditional storybooks) according to the results of Elementary Reading Attitude Survey. However, she concluded that “these books [CD-ROM books] have the potential to enhance students’ learning and have the potential to motivate them to read” (Matthew, 1996, p. 390).

Reader strategies

Another element that influences students’ comprehension is their knowledge and ability to use strategies (Paris, Wasik, & Turner, 1991). A strategy is defined by Paris, et al. (1991) as a deliberately chosen plan by the reader to achieve a particular goal or to complete a given task. NRP report (2000) underlined that one of the most effective ways to help students improve their comprehension is to teach them strategies (NRP, 2000). Allington (2006) also points out that active thinking connected to reading comprehension can be developed when students are given explicit demonstration of comprehension strategies. Research indicates that expert and less skilled readers are different in several ways. First, expert readers have purposes of reading (Gredler, 2001; Pearman, 2003). Second, they actively control their own reading comprehension, and third, they deliberately use a variety of comprehension strategies to make sense of text. Less skilled readers are not strategic and often encounter difficulties in their reading (Baker & Brown, 1984; Paris, et al., 1991).

The research literature on comprehension identifies many strategies including activating prior knowledge, identifying important information, predicting, monitoring, questioning, thinking aloud, imagery/visualizing, summarizing, synthesizing, and evaluating (Allington, 2006; Cooper et al., 2006; Paris et al., 1991).

Strategies can be taught explicitly to students through modeling/instruction (Pressley & Harris, 1990). Cooper (1993) has several suggestions for teaching the strategies. First, these strategies should be taught providing that a student demonstrates a need for the strategy. Second,

the strategies should be modeled within the real context. Third, use of the strategies should be interactive and collaborative instead of isolated. Pressley (2001) explained that teaching students to use comprehension strategies increases their comprehension of text. Teachers can provide modeling of the effective comprehension strategies; step by step, the use of the strategies can be transferred from the teacher modeling to the student modeling by teacher.

For struggling readers, there are many causes other than decoding and fluency problems such as lack of a repertoire of strategies, unfamiliar vocabulary and concepts, lack of prior knowledge, and unfamiliar text structure which can all slow down comprehension (Lipson & Wixson, 1997; Dalton & Strangman, 2006). Dalton and Strangman (2006) stated that “there is a promising body of research investigating the potential of digital text format to function as a scaffolded learning environment, providing supports to students with various learning needs” (p.80). For instance, illustrations and animations can be integrated into electronic texts to addition textual definitions, supporting vocabulary understanding and reading comprehension (Anderson-Inman, Horney, Chen, & Lewin, 1994; Boone & Higgins, 1993, Dalton & Strangman, 2006). Anderson-Inman and Horney (1998) express that electronic texts also offer strategic scaffolds such as self-monitoring questions, developing important metacognitive skills and graphic organizer summary.

In contrast, others are very concerned about electronic text. For example, Duke, Schmar-Dobler, and Zhang (2006) reveal that too many choices in electronic text can distract the attention of struggling readers and they can cause cognitive overload and damage comprehension of readers. The reader may possibly need more cognitive energy or an extended set of thought process (Coiro, 2003).

Measuring Reading Comprehension

The complex interaction of many factors can influence the assessment of comprehension across texts, instruction, and response formats (Pearson & Johnson, 1978; Paris, 2007). There are many methods to assess reading comprehension so levels of performance for children of different ages and grades must be considered. Knowledge, application, and engagement are all vital outcomes of reading with comprehension; assessments that reflect all three of these products are needed (RAND Reading Study Group, 2002). Assessment of reading comprehension tools can include retellings, constructed responses, choice among multiple-choice answers, and filling in the missing words (e.g. cloze test) which can all be useful for measurement (Paris, 2007). RAND Reading Study Group (2002) found that teachers need sensitive, reliable and valid instruments that are closely tied to their curricula so that they can improve their instruction (RAND, 2002, p. ix). Choosing a measure of reading comprehension depends on the purpose of assessment (Paris, 2007).

There is no single method that can completely represent comprehension (Palingo, 2003). Morrow says that comprehension questions limit comprehension assessment because the child is given only one perspective, isolated literal responses. Similarly, Rhodes and Shanklin (1993) claim that "retellings provide far more information about a student's comprehension than do answers to the more common comprehension questions" (p. 232). However, Leslie (1993) recommended using both comprehension questions and retellings to assess students' comprehension of stories, because different methods measure different things. Doty (1999) also support this opinion; while retelling can give hints about the readers' understand of story structure, the response to explicit and implicit comprehension questions measure readers' information about the story, reader's prior knowledge and their inferences based on the story. Therefore, using retellings together with comprehension questions could provide more

information and insight into student's comprehension of the story. In this study, retellings were used for the purpose of assessment of reading comprehension as well multiple-choice comprehension tests.

Retelling

A retelling is simply the student's post-reading reorganization of the main points of a story (Koskinen, Gambrell, Kapinus, & Heathington, 1988). Rather than responding to question, children transform a story into their own words, taking in what is only really grasped (Brown & Cambourne, 1987). Many researchers declared that retellings are also valuable assessment tool to use in evaluating children's true comprehension (Doty, 1999). According to Johnston (1983) retellings are the most straight forward assessment tool that directly reflect the reader's comprehension.

Retelling is not only an assessment tool to examine story comprehension, but it also has potential for skill development as an instructional method (Pearman, 2003). Retelling helps learning of vocabulary, comprehension, language development, knowledge of story structure, and convention of written language (Brown & Cambourne, 1987; Morrow, 1989; Pearman, 2003).

Reading is a meaning building process (Palingo, 2003) and meanings are negotiated between the reader and the text (Ruddell & Unrau, 1994). Even though all readers utilize information from the text for their retellings, they can vary. The dissimilarity among retellings comes from varying schemata and experiences conveyed in the reading (Palingo, 2003). The more related the story is to the reader, the more correct the retelling will be. Retellings give information about a reader's comprehension process (Palingo, 2003). Moreover, when readers do not remember literal label in the stories, retelling provides the opportunity to show what readers know through explanations.

Story retellings have been used to assess the comprehension of students from kindergarten through college (Baumeister, 1992; Kintsch & van Dijk, 1978; Morrow 1985, 1986). Many studies support the use of story retelling as a comprehension measure (Palingo, 2003). Morrow (1985, 1986, & 1989) carried out three different studies to find out specific benefits of story retelling. In all three studies, the story retelling improved comprehension of story, and knowledge of story structure. Story retelling has been also proven as an effective and appropriate comprehension measurement tool. According to Morrow (1988) the child uses story structure elements (setting, theme, plot episodes, and resolution) to make sense of a story. Moss's study (1997) indicated that a majority of first graders were able to comprehend expository text as measured through oral retellings of an informational book.

Leslie and Caldwell (2008) mentioned some concerns about retellings. First, retellings are open-ended response formats and they are difficult and time consuming to listen, transcribe and score. Reliability of scoring is another concern. "Scoring or analyzing retelling can involve more than just measuring literal recall" (Leslie & Caldwell, 2008, p. 414) and because students frequently present a variety of different personal comments, make inferences besides a factual retelling or paraphrase the text, interscore reliability for retelling is a necessity (Leslie & Caldwell, 2008).

Reading comprehension test (multiple-choice questions)

The measurement of reading comprehension using multiple choice responses has a long research history (Leslie & Caldwell, 2008). The history of reading comprehension tests began as early in 1900. Since World War II, reading comprehension measures have developed quickly. One development of these years is the rising view that reading comprehension is actually a complex skill made up a variety of subskills. This view has brought with it an attempt to measure the subskills supposedly underlying reading comprehension (Schwartz, 1984). For example

Davis (1944) conducted the study of the skills that compromise comprehension as measured by a standardized multiple-choice test and he categorized the fundamental skills describing reading comprehension such as recalling word meanings, drawing inferences, following the structure of a passage, formulating the main idea, finding answers to questions answered explicitly in the content, weaving together ideas in the content, identifying a writer's techniques, tone and mood, and recognizing the author's purpose (as cited in Leslie & Caldwell, 2008, p. 405).

Comprehension questions are an essential part of reading assessment and instruction (Baumeister, 1992). After the accountability requirements of No Child Left Behind in 2002, standardized comprehension assessment measures have become more predominant (Leslie & Caldwell, 2008). Standardized assessments such as multiple-choice question tests meet empirically-based standards of reliability and validity (Stahl, 2008). Comprehension question design is generally based on systems of question categorization. Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, synthesis and evaluation) is mostly used to categorize different types of questions with specific question words indicated for each category (Leslie & Caldwell, 2008).

Typical reading tests measure comprehension skill by having examinees read passages of text that is leveled appropriately for the student, and then ask a series of explicit and inferential multiple-choice questions. These questions require examinees to abstract main idea, recall facts, and draw inferences from what they have read (Schwartz, 1984). Multiple-choice questions are a method of assessment that asks students to choose one option from a given list. Multiple-choice questions are most broadly used for assessing knowledge, comprehension, and application of learning outcomes. They normally have three components: a stem, right answer, and several incorrect answers, called distracters. Multiple-choice questions have some advantages such as

these questions are highly structured, and do well at measure student achievement. In addition, scores are less influenced by estimating than true-false questions, scores are more trustworthy than open-ended questions, and scoring is easy and reliable. When multiple-choice question assessment is used effectively, it can raise student achievement (Black & William, 1998).

On the other hand, there are some serious concerns about multiple-choice comprehension questions that decrease reliability and stability of tests. The first important problem for this type of question is that it leaves completely uncontrolled the influence of individual differences in previous knowledge (Schwartz, 1984). If students already know of the text content prior to reading, they can infer answers based upon extensive prior knowledge. Students also connect in clever guessing of selected response items (Paris, Carpenter, Paris, & Hamilton, 2005). Another issue concerning question usage is whether students answer the questions from memory or have access to the text. Review of literature of standardized measures of reading comprehension also indicated that research has not adequately addressed construct validity (Leslie & Caldwell, 2008).

According to Schwartz (1984), comprehension tests were becoming more and more sophisticated psychometrically; however, they were not making some degree of theoretical progress. Leslie & Caldwell (2008) explain that a valid assessment of reading comprehension needs theoretical foundations. In this study multiple-choice comprehension questions are founded on Pearson and Johnson's (1978) Taxonomy of Comprehension Questions. A textually-explicit question is a factual question and needs readers to use information found directly in the text, frequently within a single sentence or paragraph (Raphael & Pearson, 1985). Text-implicit questions need readers to use information found in the text, but also need the reader to assimilate information across sentences or paragraphs (Baumeister, 1992; Pearson & Johnson, 1978;

Raphael & Pearson, 1985). This type of question might require readers to make low-level inferences. The validity of Pearson and Johnson's (1978) taxonomy is proved by Thompson, Gipe and Pitts (1985).

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; Cooper et al., 2006; Yuill & Oakhill, 1991).

In the early grades, the primary emphases are on the alphabetical principle, phonemic awareness, decoding, and word recognition (Adams, 1991; 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 (NICHD, 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 CD-ROM 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, CD-ROM 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 CD-ROM storybooks may help improve reading comprehension for elementary students. In addition, CD-ROM 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 CD-ROM

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). Reinking et al. (1998, p.1) stated the following important features of electronic text that printed text does not have:

(a) It is interactive in the literal sense, inviting the reader to impose organizations and compose responses; (b) it can accommodate textual supports (electronic scaffolds) for poor or developing readers; (c) it invites and often requires nonlinear strategies; (d) it can incorporate multimedia components; and (e) it is fluid rather than fixed. These characteristics give electronic text a dynamic quality that is changing forever the nature of what it means to be literate.

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).

CD-ROM Storybooks

As valuable tool in educational setting, electronic books have been used in classroom literacy learning in the early school years (Chen, et al., 2003; Matthews, 1996; Underwood, 2000). Electronic CD-ROM storybooks are reading software for children in illustrated storybooks that help children develop visual recognition. 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). Children could read the stories on their own or listen to the stories read and activate dialogue or animated part of illustration. In addition, some CDs also contain games and other interactive features based on the story (Unsworth, 2003). CD-ROM storybooks may also be known as electronic texts, talking books, or interactive books (Pearman, 2003).

Benefits of CD-ROM storybooks

Probably the most significant benefit of electronic CD-ROM storybooks provides reader control. The readers can make choice for themselves when and where they need help. The pronunciation, definition, hearing of the words provides minimum interruption in reader's comprehension (Lefever-Davis & Pearman, 2005). Also these features help students to not spend too much mental energy to decode words nor do they have to struggle with new vocabulary. Therefore, students have more time and energy to process meaning for comprehension (Lefever-Davis & Pearman, 2005; Pearman, 2008). Further, Chiappone (2003) claimed that digital books

help fluency by reducing the cognitive load for the less skilled readers by freeing up short-term memory.

Another benefit of reading and interacting with electronic storybook has likely to be an influential motivating force for even the most unwilling readers (Matthew, 1996). Multisensory features of electronic storybooks such as the sounds effects accompanying the narration, the animations, the colorful pictures and the variety of text styles provide powerful advantages like facilitating the process of constructing meaning, expanding schemata and assisting reader's difficulties (Matthew, 1996; McNabb, 1998; Pearman, 2008; Reinking et al., 1998). Studies also reveal that electronic CD-ROM storybooks give immediate help to students, eliminating the need for teachers to provide students with instant attention (Chen et al., 2003; Doty et al., 2001; Pearman, 2008).

Several studies indicate that CD-ROM storybooks increase reading comprehension (Doty, 1999; Doty et al., 2001; Matthew, 1997; Pearman, 2003, 2008). In addition, vocabulary development is also enhanced through the use of CD-ROM storybooks (Lefever-Davis & Pearman, 2005). Horney and Anderson-Inman (1999) suggested that teachers can use electronic storybooks to build vocabulary and enhance word meaning within the context of interactive, animated stories. Electronic storybooks also provide students with repeated reading experiences that combine story narration and word pronunciation in the context of realistic animations and special effects (Reinking et al., 1998).

Pearman (2008) expresses that traditional print texts are passive, static, and cannot respond to individual readers, are restricted by their linear composition, and rely heavily on the reader's internal strategies to activate prior knowledge. However, electronic CD-ROM storybooks can provide a literal interaction between the reader and the text (Reinking, 1992). Chen et al. (2003)

also investigated and characterized features of electronic storybooks. They explained several benefits of electronic storybooks: (1) They are excellent tools for the integration of technological media and instructional design. (2) Electronic storybooks assist teachers to rebuild their teaching and ideas of how to use stories in their classroom. (3) Electronic storybooks provide exceptional methods of instruction and they also expand the variety of them.

Disadvantages of CD-ROM storybooks

On the other hand, some studies disagree with the view that characteristics of electronic CD-ROM storybooks are useful for children's literacy development (DeJean, Miller, & Olson, 1997; De Jong & Bus, 2002; Labbo & Kuhn, 2000; Matthew, 1996; Nibley, 1993; Okolo & Hayes, 1996; Scoresby, 1996; Trushell & Maitland, 2005; Underwood & Underwood, 1998). Many electronic reading environments bring in a new set of cognitive barriers that can cause experienced readers of traditional print text to be cognitively overloaded (Delaney & Landow, 1991). 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. Interactive features of electronic storybooks can offer too many choices and too many animations that may distract and confuse struggling readers (Coiro, 2003). Furthermore, if the illustrations, games, attractive pictorial options included in the electronic storybooks do not support the story, they can distract and draw attention away the children's focus on the story rather than support the narrative's comprehension, 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).

The electronic text features that improve context and activate background knowledge may be disadvantageous to students (Pearman, 2008). Over time, dependence on electronic text features may delay literacy development of younger readers because the use of reading strategies

does not become an integral part of the reading process (McKenna, 1998). Also, the computer does not offer help or provide instruction in reading strategies as long as the reader does not ask for help (Pearman, 2008). Many of the software programs contain some features such as animations, reading aloud words, sentences, pages, or the whole book. Lewin (1996) and Pearman (2008) expressed concern that with these features readers could rely on the computer to decode words or to read the story instead of developing their own abilities. Moreover, the CD-ROM books, dissimilarly, using hyperlinks to the Internet's resources, exist in a closed environment, which engages the learner in the simulated situation completely on the CD. The CD-ROM is more object-oriented and focused on knowledge delivery or guidance in some specified topic (Chen et al., 2003).

CD-ROM Storybooks and Reading Comprehension

Pearman and Lefever-Davis (2006) reported that as one of five critical components of reading instruction, comprehension can be supported by CD-ROM storybooks. They claim comprehension skills mainly appropriated to being developed through an electronic CD-ROM storybooks format include construction background knowledge, story schema and metacognition. For example, sound effects and animation functions of CD-ROM storybooks rapidly and effectively place the reader directly in the setting thus contributing to reading comprehension. Additionally, metacognition can be supported through CD-ROM storybooks because CD-ROM storybooks provide opportunities to prompt the computer to assist their reading such as pronouncing or defining vocabulary, and contributing reader control (Pearman & Lefever-Davis, 2006).

As seen in Table 2.1, there are three groups of studies. The first group has supported and favored Pearman and Lefever-Davis' claim that comprehension can be supported and developed by CD-ROM storybooks (Greenlee-More & Smith, 1994; Grimshaw, Dungworth, McKnight, &

Morris, 2006; Matthew, 1997; Miller, Blackstock, & Miller, 1994; Pearman, 2003, 2008; Shamir, Korat & Barbi, 2008). The second group found detrimental effects on comprehension (Labbo & Kuhn, 2000; Maitland & Trushell, 2005; Okolo & Hayes, 1996; Scoresby, 1996; Trushell, Burrell, & Maitland, 2001; Trushell, Maitland, & Burrell, 2003; Underwood, 2000). The third group of studies found mixed results with increase in comprehension depending on the assessment tool or no evidence that storybooks support or distract comprehension (De Jong & Bus, 2004; Doty, 1999; Doty et al., 2001; Kim, Yoon, Whang, Tversky, & Morrison, 2007; Lefever-Davis & Pearman, 2005; Matthew, 1996).

A limited number of researchers have investigated comprehension comparing the use of electronic CD-ROM storybooks to a traditional print text. Miller et al. (1994) observed that a small sample of third-graders repeatedly reading interactive CD-ROM storybooks committed fewer meaning related errors than when repeatedly reading the equivalent traditional paper storybooks.

A study conducted by Greenlee-Moore & Smith (1996) to explore the effects of interactive CD-ROM software on children's reading comprehension when reading shorter and easier narrative text against longer and more difficult narrative texts on printed pages as compared to reading the same narrative texts using interactive CD-ROM software presented by the computer. Thirty-one fourth-grade children were involved in her study. Comprehension was measured by six multiple-choice comprehension questions, two literal, one vocabulary, and three inferential questions. The results of study revealed significantly higher comprehension scores when students were reading the longer and more difficult narratives from the interactive software. There was no difference when two treatment groups were reading the shorter and easier narratives. The

interactive CD-ROM software caused higher scores on comprehension questions related to the story on more difficult and longer narratives.

There has been other research on how interactive computer software and CD-ROM books influence children's reading achievement. Kathryn Matthew conducted a study comparing the reading comprehension of third-grade students who read CD-ROM storybooks with those who read traditional printed books. The students' story retelling scores on the two CD-ROM storybooks were compared to traditional print storybooks. Thirty third-grade students were participated in the Matthew's study (1997). Matthew (1997) explains that the comprehension of students may be more accurately reflected in retellings than in the answers to comprehension questions. A statistically significant difference was found between students' story retellings of print stories and their retellings of CD-ROM storybooks. Students scored significantly higher on retellings when reading the CD-ROM stories. Matthew (1997) also declared that additional research is necessary to corroborate these findings.

McNabb (1998) did a qualitative study of four subjects ranging in age from 7-12 years old. These subjects were under one or two grade levels their expected grade reading level. The purpose of this study was to understand comprehension strategies used by struggling readers when reading interactive CD-ROM storybooks differed from those strategies used when reading paper storybooks. Struggling readers were allowed to use animations to help them in words analysis, recognition and fluency. The results of the study showed that multisensory and interactive features and the context expansion features of CD-ROM storybooks assisted struggling readers to read without difficulty and comprehend better than static paper books. Another result was that struggling readers were able to apply reading strategies individually

when support from teacher, tutor, or parent was not available during reading electronic CD-ROM books.

Pearman conducted two studies (2003, 2008) on second grades students with oral retellings. The purpose of first study was to investigate whether second grade students with varying degrees of reading proficiency scored higher on an oral retelling assessment of comprehension when text was presented in an interactive, electronic format than when text was presented in a traditional print format (Pearman, 2003). Participants were 54 second-grade students from a rural elementary school in the Mid-South. A repeated measures design was used with each student reading both an electronic and a traditional print text at their developmental level of Low, Medium, or High as designated by teacher. The results of the study indicate that interactive, electronic text may facilitate reading comprehension for students that are reading below grade level or are struggling with developing reading skills and strategies. In the second study by Pearman (2008) 69 second-grade students were participated. Interactive, CD-ROM storybooks and the traditional print texts were used in this study. Evidence from the study indicates that interactive, CD-ROM storybooks group scored significantly higher in comprehension than traditional paper group. Therefore, the use of CD-ROM storybooks could be beneficial for young readers.

Shamir et al. (2008) explored the effects of electronic storybooks for kindergarteners' emergent literacy skills within the context of paired peer versus individual use of the electronic books. The sample of 110 kindergarteners had a mean age of 5.64 years in a low social economic status. No one had been diagnosed with learning disabilities. Participants were randomly assigned to four groups: 30 tutors, 30 tutees, and 30 individual learners, all of whom used the electronic book and 20 children in a control group who were only exposed to their regular

kindergarten program. Pre- and post-intervention emergent literacy measures included story comprehension, phonological awareness, and word recognition. The overall improvement of the children in the three experimental groups was higher than that of the children in the control group. In addition, electronic book activity increased story comprehension, phonological awareness, and emergent reading, over those who worked with it individually (Shamir et al., 2008).

Grimshaw et al. (2006) investigated the differences in children's comprehension and enjoyment of storybooks according to the medium of presentation. Participants in Grimshaw's study included 132 children aged 9-11. The type of medium did not significantly affect the children's enjoyment of storybook, but it took the children longer to read the electronic versions. For the electronic versions of storybooks, comprehension scores were higher for retrieval-type questions than for inference ones. The use of the online dictionary in the electronic condition was significantly greater than that for the printed dictionary. The provision of narration in the electronic version led to significantly higher comprehension scores than when narration was absent.

However, several studies reported that the same interactive nature of the electronic storybooks can sometimes serve as a distraction from the storyline (De Jong & Bus 2002; Labbo & Kuhn, 2000; Maitland & Trushell, 2005; Okolo & Hayes 1996; Scoresby, 1996; Trushell, Burrell, & Maitland, 2001; Trushell, Maitland, & Burrell, 2003; Underwood, 2000). For example, Okolo and Hayes (1996) evaluated the use of children's literature presented via one of three conditions: an adult reading a book to the child; the child reading a CD-ROM version of a book on the computer but without animation; and the child reading the book on computer with high level animation. The study, in one primary grade classroom, involved 10 students with

learning disabilities and 10 students without disabilities. Students preferred the high animation condition, spending almost four times as much time reading the book but Okolo and Hayes (1996) found that the high animation misled students into drawing wrong conclusion about the text.

Labbo and Kuhn (2000) distinguished between considerate and inconsiderate CD-ROM talking books. Considerate CD-ROM talking books contain multimedia effects that are congruent with and integral to the story. Inconsiderate CD-ROM talking books contain multimedia effects that are incongruent with or incidental to the story. They found that while considerate CD-ROM talking books supported the children's understanding and retelling of the story and involved in meaning making process, inconsiderate talking books fostered children's passive viewing and did not support their story understanding.

Scoresby (1996) assessed the effects of animation and reading ability on recall of illustrated and non-illustrated text information. Eighty-four second graders were included in the study and twenty four open-ended questions were used to test student' recall of story details. The results of the study indicate that readers who viewed animations being able to recall fewer story details once the story was complete.

Underwood (2000) compared both electronic (talking book software) and paper format designed to provide supplementary reading practice. A mixed empirical methodology combining both quantitative and qualitative techniques was employed. Learning gains were measured by story writing, observations and interviews. Sixty-two 8-year old children took part in study. Underwood (2000) reported that pupils' recall of the story of an interactive talking book was poor. In addition, children found the talking books highly motivating.

De Jong and Bus (2002) observed 4–5-year-old children exploring electronic books that included games and other activities. They found that the children’s understanding of the content of the story was less well supported by the electronic version compared to the regular book format. They concluded that “the many attractive options of electronic books seem to distract children’s attention from text, and number of readings of the text in favor of iconic and pictorial explorations” (p. 154).

Trushell, Burrell, and Maitland (2001) study examined Year 5 primary pupils' behaviors when reading and their recall of an interactive storybook. Pupils from three Year 5 classes participated in the study. Data were collected by observations and multiple-choice questions. This study found that pupils' recall of the storyline of an interactive storybook was poor and interactive storybook may provide mere entertainment.

Trushell, Maitland, and Burrell (2003) administered a study on year 4 primary school pupils (8-9 years-old). Data collected by multiple-choice questions, verbal recollections and opinions, and observations. They found that graphic animations and sound effects provide contextual support for readers. However, those do not support the storyline or story events and detriment to readers’ ability to recall story events.

Another study, Maitland and Trushell (2005) included Year 5 and Year 4 pupils participating and two interactive storybooks on CD-ROM were used in this study. Pupils' recall of the interactive storybooks was gauged by two measures, collaborative verbal story retelling and short multiple choice quizzes. The outcomes of the study indicate that access to cued animations and sound effects did have adverse effects on pupils' story recall. The story grammar recall of Year 5 and Year 4 pupils who had read an interactive storybook was found to have deteriorated throughout the event structure.

The following studies had mixed results with increase comprehension depending on the assessment instrument. Doty et al. (2001) investigated interactive CD-ROM storybooks and young readers' reading comprehension. First grade children students read a conventional print storybook or an interactive CD-ROM version offering word pronunciations, definitions, and labels for illustrations; narration was turned off. Children reading the CD-ROM version of CD-ROM storybooks significantly scored higher than conventional print group on comprehension questions but oral retelling scores were not different.

Matthew (1996) investigated the impact of interactive CD-ROM storybooks on the reading comprehension and attitudes toward reading of 37 matched pairs of third grade students. The students were assessed through story retellings and 10 open-ended comprehension questions. The results pointed out that when comprehension was assessed through open-ended questions, there was no statistically significant difference in reading comprehension. When comprehension was assessed by story retelling, students who read the interactive CD-ROM storybooks obtained significantly higher scores than students who read the print version of the storybooks. There was no significant difference between the reading attitudes of the students in the groups.

Another study of interactive CD-ROM storybooks and reading comprehension was presented by Doty (1999). The purpose of her study was to “determine if there was a difference in the level of young readers’ reading comprehension when one group of students read an interactive CD-ROM storybook and one group of students read the same story from a conventionally printed book” (Doty, 1999, p.1). The participants were 39 second-grade children. The study used oral retellings and comprehension questions for data collection. Study findings differed from Mathew’s studies (1996, 1997). Doty’s study found that there was no significant difference in mean scores on the retellings between the scores but there was a significant

difference in mean scores on the comprehension questions between the two groups (Doty, 1999). Doty (1999) concluded that “evidence from this study, as well as others indicates that reading comprehension can be enhanced through the use of interactive CD-ROM storybooks” (p.6).

De Jong and Bus (2004) studied the efficacy of electronic books in fostering kindergarten children's emergent story understanding. The study compared effects of children's independent reading of stories electronically with effects of printed books read aloud by adults. Participants were 18 four- to five-year-old Dutch kindergarten children in the initial stages of developing story comprehension. Electronic reading produced experiences and effects similar to adult-read printed books. Children frequently interacted with the animations often embedded in electronic stories, but there was no evidence that the animations distracted children from listening to the text presented by electronic books, nor that the animations interfered with story understanding. Findings suggested that children at this stage of development profited from electronic books.

Lefever-Davis & Pearman (2005) conducted a study on 11 first-grade students. Five girls and six boys representing a wide range of reading levels took part in the study. Each child read two CD-ROM talking books. During each reading, a running record was administered to assess student reading accuracy rate. Results from this study indicate CD-ROM storybooks have the potential to support readers and promote reading skill. In contrast, this study also found that features of CD-ROM storybooks may prove to be distractions for students. The length of time it takes for pages to turn disrupts the reading process, delays the opportunity for students to begin reading, and increases their frustration level. This frustration seemed particularly evident for the more proficient readers.

Recent advances in multimedia, CD-ROM technologies offer new possibilities for introducing children to the world of reading through computer (Bus et al., 2006). Digital

environment supporters in education believe that CD-ROM storybooks have the potential to change reading comprehension. Unfortunately, these claims have yet to be supported by the very limited research. The results of the studies previously carried out in this area have been conflicting and often hard to interpret. Additionally, mixed results have been found for variables reader's prior knowledge, experience with electronic storybooks, cognitive style, reading strategies, reader opportunities for control and choice, novelty effects, and separate functions of electronic storybooks such as animation (Dalton & Strangman, 2006). Also, there are very few experimental studies that investigate the effects of electronic CD-ROM storybooks on struggling readers' comprehension. Most participants have been regular younger children and below third-grade. And these studies usually used methodically two group comparisons. The researcher has found only four experimental studies related to struggling readers (McNabb, 1998) or students with learning disabilities (Okolo & Hayes, 1996) or low reading ability students (Pearman, 2003, 2008). Therefore, more work is needed to better understand about the effects of electronic storybooks on struggling readers' comprehension.

Role of Animation and Research

As computer technology highly developed and authoring system become more friendly and powerful, computer special effects like animation are now becoming a reality (Braden, 1996). Animation refers to the use of a series of graphics that change over time and or space. The use of computer animations is relatively new in education. Computer animation offers many potential benefits that improve learning (Okolo & Hayes, 1996; Rieber, 1990; 1994). In multimedia technology, animation provides two different visual elements; images and motion which are both essential for understanding and memorization (ChanLin, 2001; Rieber, 1994).

With the fast expansion of multimedia technology, animation research is becoming more significant. Although there has been a common belief that animation is superior to still graphics,

studies reveal contradictory findings (ChanLin, 2001; Rieber, 1990; Rieber, Boyce, & Asad, 1990). Rieber, et al. (1990) found that “animation helped decrease the time necessary to retrieve information from long-term memory and then subsequently reconstruct it in short-term memory” (p. 50). Rieber (1991), in an experiment with fourth-graders, “showed that students successfully extracted incidental information from animated graphics without risk to intentional learning, but were also more prone to developing a scientific misconception” (p. 318). Rieber (1994) stated: (1) Although animation can be a remarkable visual effect, research point out that animation’s effects on learning are relatively restrained. (2) Children seem able to take out information incidentally from animated displays, although they may for misconceptions without suitable guidance. (3) Visually based imitation is motivating to children.

The current study is focused on animation in electronic CD-ROM storybooks. Literature review shows that there is little actual research evaluating the use of animation in electronic storybooks. Scoresby (1996) report that “there may be little research which directly relates to the study of animations and narrative text... literature implies a potential problem but fails to empirically establish that problem indeed exist, the need for actual research in this area is clear” (p. 31). Some authors caution about the potential distraction of animations in reading comprehension (Nibley, 1993; Okolo & Hayes, 1996; Scoresby, 1996). 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. DeJean et al. (1997) and Scoresby (1996) found that animation in CD-ROM books diverted from reading rather than improved it and the animation slowed down recall of textual information. Scoresby (1996) also revealed that animation-available groups spent the most time engaged in reading CD-ROM books. However, this extra time on

task did not cause higher recall scores; the animation-available groups had significantly lower recall scores than other groups who spend much less time within the storybook.

However, many studies have shown that illustrations and animations that support or amplify accompanying text improve students' comprehension. For example, Matthew (1996), and Miller et al. (1994) demonstrate CD-ROM storybooks in stimulating children in reading development. Trushell et al. (2003) found that graphic animations could offer background support for readers by providing supplemental information. Electronic CD-ROM storybooks combine sound effects and animations to provide rich context that support vocabulary and concepts (ChanLin, 2001; Pearman & Lefever-Davis, 2006). Electronic CD-ROM technology contains extensive sequences of animation that are not found in traditional texts (Ocolo & Hayes, 1996; Scoresby, 1996).

Summary

Understanding the meaning of words and texts is the center of the function of literacy. Without comprehension, reading words is reduced to imitating the sounds of language, repeating text is simply memorization and oral drill (Paris & Hamilton, 2008). Several factors are involved in comprehension with four important elements being word recognition, prior knowledge, motivation and attitude, and reader strategies (Lipson & Wixson, 1997; Pressley, 2000).

Assessment of comprehension is complex because comprehension is measured indirectly (Pearson & Johnson, 1978; Paris, 2007). There is no single method that can completely represent comprehension (Palingo, 2003). Leslie (1993) recommended using both comprehension questions and retellings to assess students' comprehension of stories, because using retellings together with comprehension questions could provide more information and insight into student's comprehension of the story.

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.

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 CD-ROM storybooks. However, a review of the literature has shown that a limited number of studies have investigated comprehension comparing the use of electronic CD-ROM 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 CD-ROM storybooks. The second group research on CD-ROM 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. The next chapter describes the theoretical framework, text difficulty, and the methodology used to collect and analyze the data presented.

Table 2-1. Summaries of the studies related to electronic storybooks and texts

Author & Year	Participants	Materials	Assessment	Results
Miller, Blackstock, & Miller (1994)	Third-graders	CD-ROM storybooks Discis Books	Miscue analysis	Electronic CD-ROM storybooks increased decoding ability and fluency and decreased meaning related errors
Greenlee-More & Smith (1994)	Fourth-graders	Interactive CD-ROM software	Multiple-choice questions	CD-ROM storybooks increased comprehension when reading longer and difficult narratives. No differences the shorter and easier narratives
Matthew (1996)	Third-graders	CD-ROM stories	Open-ended questions	There were no significant differences in reading comprehension
Okolo & Hayes (1996)	Second-graders with learning disabilities and without disabilities	CD-ROM version of a book Living books Discis books	Retellings and comprehension questions	There were no statistical differences between students
Scoresby (1996)	Third-graders	Electronic storybooks	Open-ended questions	Animations within electronic storybooks were detrimental on story recall
Matthew (1997)	Third-graders	CD-ROM format stories	Story retellings	Students scored significantly higher on retellings when reading the CD-ROM stories

Table 2-1. Continued

Author & Year	Participants	Materials	Assessment	Results
McNabb (1998)	Struggling readers 7-12-year old	CD-ROM storybooks	Qualitative	Multisensory features of CD-ROM storybooks made them easier for struggling readers to read and comprehend than paper books
Doty (1999)	Second-graders	Interactive CD-ROM storybooks	Oral retellings and comprehension questions	Students who read the CD-ROM storybook scored higher on comprehension questions. No significant difference in the retelling scores
Underwood (2000)	8-year old children	Talking book software	Story writing, observations and interviews	Children's recall of the story of an interactive talking book was poor
Trushell, Burrell, & Maitland (2001)	Year 5 primary school pupils	Interactive CD-ROM storybooks	Multiple-choice questions and observations	Pupils' recall of the storyline of an interactive storybook was found to be poor
Doty, Popplewell, & Byers (2001)	Second-graders	Interactive CD-ROM storybooks	Retellings and comprehension questions	Children who read the CD-ROM scored higher on test, but no difference in mean scores on the retellings
Pearman (2003)	Second-graders	Interactive electronic texts	Oral retellings	Electronic texts facilitate comprehension for kids that are reading below grade level

Table 2-1. Continued

Author & Year	Participants	Materials	Assessment	Results
Trushell, Maitland, & Burrell (2003)	Year 4 primary school pupils (8-9 year-old)	Interactive storybooks on CD-ROM	Multiple-choice questions, verbal recollections and opinions, and observations	Animations and sound effects could provide contextual support for readers but they negatively affect readers' ability to recall story events
De Jong & Bus (2004)	Kindergarteners (4-5 year-old)	Electronic books	Orally presented short comments and questions	There was no evidence that the animations distracted children, or that the animations interfered with story understanding
Lefever-Davis & Pearman (2005)	First-graders (6-7 year-old)	Interactive CD-ROM talking books	Running record	The digital pronunciations were a predominant feature of the CD-ROM storybooks were interpreted as a support and a distraction for developing beginning readers' skills
Maitland & Trushell (2005)	Year 5 and Year 4 primary school pupils	Interactive storybooks on CD-ROM	Verbal story retelling and short multiple choice quizzes	Access to cued animations and sound effect did have unhelpful effects on pupils' story recall. Storybook was found to have deteriorated throughout the event structure

Table 2-1. Continued

Author & Year	Participants	Materials	Assessment	Results
Grimshaw, Dungworth, McKnight, & Morris (2006)	9-11 years children	Electronic version of storybooks with an online dictionary.	The comprehension tests (Standard Attainment Tests)	The type of medium did not significantly affect the children's enjoyment. Comprehension scores were higher for retrieval-type questions. The narration in the electronic version led to significantly higher comprehension scores than when narration was absent
Kim, Yoon, Whang, Tversky, & Morrison (2007)	Fourth and sixth graders	Animated computer presentation	True-false comprehension test questions and attitude questionnaire	Animated computer presentation increased enjoyment and motivation, but not comprehension test score
Shamir, Korat & Barbi (2008)	Kindergarteners (5-6 year-old)	Electronic CD-ROM storybooks	Pre- and post-intervention. Comprehension test, six questions about the electronic book	Electronic book CD-ROM provided an advantage in comprehension, phonological awareness, and emergent reading
Pearman (2008)	Second-graders	Interactive CD-ROM storybooks Discis Books	Oral retellings	Interactive, CD-ROM storybooks are beneficial for young readers' comprehension

CHAPTER 3 METHODOLOGY

Introduction

The aim of this research was to compare and explore the effects of the medium of storybooks presentations on struggling readers' comprehension. To accomplish this, each student twice read one of three types of presentation of storybooks. Then, comprehension was measured by using multiple-choice comprehension test and retelling to understand differences among the groups. Specifically, this chapter describes theoretical framework of the study, text difficulty, leveling books, choice of storybooks, and methodology: research design, participants, measurement procedures, data collection, and analysis.

Theoretical Framework

This section will discuss the theoretical foundation of this research. This study is based on cognitive theory, mainly from schema and mental model theories. Therefore, theoretical framework will begin with reviewing constructivism. This section will be followed by cognitive constructivism, schema theory, interactive theory and function of these theories in this research and the connections to technology specifically electronic storybooks.

Constructivism

Constructivism, a student-centered learning approach, is a main trend today in literacy education (Willis, Stephens, & Matthew, 1996). The constructivist theory's basic idea is that knowledge is constructed by each person individually. Constructivism refers to a broad term for a wide diversity of views. "However, constructivism has two common views that (1) learning is an active process of construction rather than acquiring knowledge, and (2) instruction is a process of supporting that construction rather than communicating knowledge" (Duffy & Cunningham, 1997, p.171). Learners construct new knowledge upon the foundation of previous

experience and prior knowledge. Constructivist theory is against the passive transmission of information from one individual to another or from a text to another. Learners are active rather than passive. They engage in their own knowledge building by assimilating new information into their schema in a meaningful way. Constructivism has two major trends: individual cognitive and sociocultural (Willis et al., 1996). The individual cognitive constructivism originates from Piagetian theory. This view emphasizes the constructive activity of individuals as the learner tries to make sense of the world. Learning is seen to happen when the learner's expectations are not met, and the learner must resolve the inconsistency between what was expected and what was actually encountered. Thus, the learning is in the individual's constructions as the learner tries to resolve the conflict, or construct themselves and their world by accommodating to experiences. Within this framework, the focus is on the individual within the group, and cognition happens in the head of the individual (Duffy & Cunningham, 1997).

In the contrast to Piaget focus on individual constructions, the sociocultural constructivism highlights the socially and culturally situated context of cognition. This approach stresses the social origins of cognition, for example, the impact of an individual's appropriation of language as a mediating tool to construct meaning (Duffy & Cunningham, 1997; Willis et al., 1996).

As with the multimedia presentations implemented in this study, the theoretical foundation is obtained from constructivist theory. Constructivism provides many of the basic principles of this study; the study is also based on cognitive constructivism.

Cognitive Constructivism

Cognitive constructivism is based on the work of educational philosopher John Dewey, Lev Vygotsky, Jean Piaget, and Jerome Bruner. They offer that children actively construct knowledge and this construction of knowledge occurs in a social context (Conway, 1997).

Cognitive constructivism views learners as agents of their own learning. Bruner (1966) revealed

that cognitive structure such as schema and mental model supplied meaning and organization to experiences and allowed the individual to go beyond the information given.

Another constructivist researcher Vygotsky mentioned that all learning occurs in the zone of proximal development. This zone is the difference between what a child can do alone and what he/she can do with assistance. By constructing on the child's experiences and giving moderately challenging tasks, teachers can provide the intellectual scaffolding to help children learn and progress through the different stages of development (Conway, 1997). Interactive electronic books like the Living Books series, which are used in this study, supply scaffolding to help students advance within their zone of proximal development (Willis et al., 1996).

Cognitive constructivism adopts Piaget's thoughts as a foundation for practice (Conway, 1997). Three key Piagetian principles can guide teachers as they make a technology-rich environment: learning is an active process, learning is a social process, and learning is a developmental process (Willis et al., 1996). Piaget (1972) also claimed that people are born with schemes helping them to organize their thinking processes that shows a way do mentally represent the object and events of the world. He explained construction of meaning:

It's easy to assimilate information as we read provided that it fits within our existing schemata. When there is a conflict between what we think we know and what we are learning, then accommodation must occur to rebuild those schemata. Readers must be capable of learning through reading in the sense of assimilating new knowledge to established schemata and also of accommodating existing schemata to new knowledge. But the ability of a reader to comprehend a given text is very much limited by the conceptual and experiential background of the reader, and there are strong limitations on how much new knowledge can be gained from a reading of a given text (p. 1127).

Cognitive constructivist researchers are also interested in the cognitive process of reading and writing. For example, Goodman (1994) views reading as a process of sense making rather than simply attempting to accurately decode and pronounce symbols.

Literacy is not restricted to ink on paper. Various forms of technology can encourage and challenge the students' natural processes as they engage in literacy activities. The most exciting of these is multimedia. Cognitive constructivist researchers found that multimedia tools allow to students explore the environment for a new type of literacy that adds visual images, sound, moving images such as animation, video, and hypertexts (Willis et al., 1996).

Technology, particularly multimedia, offers many opportunities. Beginning in the 1990s many innovative educational computer programs were based on constructivist theories (Conway, 1997). Teachers can supply a learning environment that helps increase the conceptual and experiential background of the reader, however, CD-ROM programs that can provide the visual support and informative text to increase the reader's background are plentiful and relatively inexpensive. This is mainly important for students who lack the background relevant to the content and the texts (Willis et al., 1996).

In sum, technology supplies are fundamental tools to achieve the goals of a constructivist classroom:

1. Through their exploration of multimedia packages, students learn to connect images with text and to follow their own interests. Therefore, they can engage in activities that will increase their schemata as they naturally seek new information.
2. Interactive electronic books for students that associate animation, images and explanations help to build conceptual and experiential background and construct meaning (Willis et al., 1996).

Further, this study used principles of schema and interactive theories.

Schema Theory

The conception of schema is fundamental to cognitive theories of representation (Winn & Snyder, 1996). There are a number of descriptions of schema. For instance, Rumelhart (1984) describes schema as the organized knowledge networks that one has about people, places, things, and events. According to Bartlett (1932) schema is a mental framework for understanding,

organizing and remembering information. Graesser (1981) stated the following common functions of schema: (1) Schema provides background knowledge to interpret a specific event. (2) It provides background knowledge to infer beyond the information given. (3) It produces predictions of information. (4) It facilitates a person's recognition of regularities so that more attention can be allocated to accommodating new information.

Reading theorists such as Anderson (1984) views comprehension as constructing a schema that is related the elements in a text. A schema provides a framework for comprehending a story. A schema also helps maintenance, as students use it to organize their reconstruction of the events.

Schema theory principally is a theory of how knowledge is mentally represented in the mind and used (Rumelhart, 1980). Schema theory also represents interactive view of reading comprehension rather than merely text-based activity (Anderson & Pearson, 1984; Doty, 1999). In this view, there is an interconnected relationship between text comprehension and a reader's prior knowledge (Doty, 1999). Reading comprehension does not occur in a vacuum; however, it is connected to the reader's experiences of prior knowledge or schemata (Tierney & Pearson, 1994). Reading is perceived as an active process of constructing meaning by relating old knowledge with new information in text. Readers construct meaning by engaging in a series of interactions. In each interaction readers create a model that presents the best possible fit with the data perceived to be in the text. New text data gives an invitation to review the adequacy of the model; new information either is made to conform to the existing model or assist a modification of the model. Readers build their own meaning. That meaning probably looks like what the author had in mind, but the reader does not develop the same model as the author, nor do any two readers build up exactly the same model. When readers of different degrees of capability

read the same passage, they interact with the text in dissimilar ways (Pearson, Roehler, Dole, & Duffy, 1992).

Activating schemata is vital in reading. Building schemata for the reader is not simply filling slots. Active readers are constantly connecting what they are reading to other experiences they have had, other information in the text they have read, and texts previously read (Gunning, 2004). Over all this information, reading cannot be narrowed to print alone; interpretation of other elements such as storybook illustrations, animations might also be considered parts of reading (Scoresby, 1996).

The schema theory based on the interactive view of comprehension is the appropriate use of electronic CD-ROM storybooks. CD-ROM storybooks provide the opportunity to the reader to interact and control the text in manners not capable with printed text (Doty, 1999). An interactive exchange of information between the reader and text might be created by technological features of the computer (Reinking & Schreiner, 1985, as cited in Pearman, 2003).

Interactive Theory

There are several models and theories of reading comprehension. The bottom-up model highlights decoding and word meaning. This model explains reading as a linear, detailed, letter by letter, word by word analysis of text to gain meaning (Bruning, Schraw, & Ronning, 1999). Comprehension occurs when the reader recognizes the words (Doty, 1999). In contrast with the bottom-up model, the top-down model of reading comprehension is based on the idea that reader's expectations about the text and their background knowledge establish the comprehension process. The bottom-up model of reading comprehension pays no attention to the effects of readers' knowledge and the effects of context. On the other hand, the top-down model focus directly on the role of knowledge but tend to overlook the value of the bottom-up process

such as phonemic knowledge and word decoding in reading comprehension (Bruning et al., 1999).

The interactive model was a response of these obvious limitations of the bottom-up and the top-down models and it is a combination theory of both the bottom-up and the top-down processes. Reading comprehension is a product of their interaction. The interactive reading model recognizes the interaction of bottom-up and top-down processes at the same time throughout the reading process. In other words, the interactive theory gives the same importance to the role of prior knowledge and obtaining meaning from text. When a reader has limited prior knowledge about the topic, she or he is likely to rely on information in the text. Otherwise, the reader more likely applies prior knowledge instead of the text information. According to this theory, reading is an active process to comprehend text, readers apply strategies and prior knowledge to build meaning; readers make connections to a number of factors associated with themselves, the selection being read, and the context (Rumelhart, 1994; Bruning et al., 1999; Doty, 1999).

Text Difficulty and Leveling Books

Leveling reading materials is an old concept and a complex task (Rog, & Burton, 2002). Leveled texts were generally considered a central component of elementary reading instruction for years (Hoffman, Roser, Salas, Patterson, & Pennington, 2001). Reading materials are categorized according to "characteristics that are related to the supports and challenges in the text for young readers" (Fountas & Pinnell, 1999, p. 15). Clay (1991) stated that students require texts that give a balance between support and challenge. Namely, story text should be easy enough to help comprehension, but complex enough to provide a challenge. One of the advantages of leveling reading materials according to difficulty is to provide teachers a guideline to rapidly and simply select appropriate reading materials for each student (Rog & Burton,

2002). There are some disagreements on how texts are to be leveled and what factors should be considered when leveling texts. Several different publishers (Scholastic, Wright Group, Pearson Education), and researchers (Clay, 1991; Fountas & Pinnell, 1999; Peterson, 1991) have attempted to develop leveling system for books based on difficulty (Rog & Burton, 2002; Pearman, 2003). Rog and Burton (2002) have criticized that the publishers explicitly have not defined the criteria and the characteristics by which their materials are leveled.

Leveling and readability are related in their focus on text difficulty when determining proper texts for readers (Dzaldov & Peterson, 2005). Allington (2006) declares that “the most common approach for estimating text difficulty of texts has been use of structural readability formulas” (p. 63). There are different existing formulas to estimate text difficulty, but each mainly applies procedures that measures sentence difficulty and word difficulty (Allington 2006; Rasinski, 2003). Allington (2006) warns that “any of these procedures is just an estimate” and “all formulas have some error in measurement” (p. 63). Also, these formulas fail to take into account the many additional factors such as picture support, the length of the book, the appearance and placement of print on the page, the complexity of concepts, the degree of predictability of the text, level of interest, or a student’s prior knowledge about the topic that influence the difficulty of texts for students (Klare, 1984, as cited in Allington 2006; Rog & Burton, 2002; Weaver, 2000). Despite their limitations, the use of conventional structural readability formulas can be helpful if only for providing an approximate text difficulty, “since even a ballpark estimate is better than none at all” (Allington, 2006, p.64).

In the mid-1980s, basal readers were marked by the lack of "any systematic attention to the decoding demands of the texts" (Hoffman, Sailors, & Patterson, 2002, p. 272). Basal programs focused on teaching children only a core of sight words and used controlled vocabulary as well

repeating particular patterns (Rog & Burton, 2002). The leveled books were initially developed for the Reading Recovery program (Fry, 2002). Rapidly, reading educators from different viewpoints showed concern over the appropriate text difficulty. The basic principle of Reading Recovery program is gradually increasing text difficulty from the beginning (Clay, 1991; Peterson, 1991).

In this study several structural readability procedures were used for matching storybooks to struggling readers. Used readability formulas are explained in the following paragraphs.

Guided Reading is focused on comprehension. Children learn to predict what might happen or what they might learn. They learn about the story elements of characters, setting, and plot, and they learn how to organize and compare information learned from informational text. The basic principle is when the proper books are selected; students are able to read with approximately 90% accuracy (Cunningham & Cunningham, 2001). Guided Reading Level developed and introduced to educators by Irene C. Fountas and Gay Su Pinnell. The levels identified by the letters A - Z and organized along a continuum of increasing difficulty. Levels are assigned based on different factors including, book length, layout, illustrations, internal text structure, content, and theme (Pearson, 2007; Fountas & Pinnell, 1996).

DRA (Developmental Reading Assessment) leveling criteria was developed and introduced to educators by Joetta Beaver through her various assessment tools. DRA determines the level of independent reading in a student and it utilizes a numeric code that reveals the broader need for guided reading sessions to change over time (Pearson, 2007).

The Lexile Framework provides a free tool to evaluate text difficulty using the Lexile method (Allington 2006). Lexile measures are based on two predictors of how difficult a text is to comprehend: word frequency and sentence length. The Lexile measure is the numeric

representation of a text's difficulty. The Lexile scale is a developmental scale for reading ranging from 200L for beginning readers to above 1700L for advanced text. This process is referred to as measuring, and the result is a text measure that represents the difficulty of analyzed text (Lexile Framework for reading, 2005; Pearson, 2007).

With the choice for estimating text difficulty, all have a potential function in making it possible that children will have access to books they can actually read. When teachers recognize their students well and are more proficient about estimating the complexity of text, they usually do not require readability estimates to find suitable books for the children in their classrooms (Allington, 2006).

Choice of Storybooks

For this study, it was decided to use two different storybooks, Sheila Rae, the Brave, and Arthur's Teacher Trouble which were available in printed paper book form and CD-ROM with an interactive mode (with animation) and passive mode (without animation). Both electronic versions of storybooks are Living Books series from Broderbund. Living Books are similar in concept to paper texts in that the reader progresses from one page to the next in a linear way. Living Books include animations, a range of sounds, music and opportunities for interaction. In addition most Living Books allow the reader to click on individual words to hear them read aloud but these functions were not used in this study. There are options to select the language (English or Spanish) at the top of the control panel page. After choosing a language, the reader can begin by selecting "let me play" to play within the story (interactive mode) or selecting "read to me" to read the story (passive mode).

Both storybooks were approved by experts, the teachers and fourth-grade coordinator as being suitable for the age group being tested. The books are approximately the same length and have a third-grade readability level (Matthew, 1996). The CD-ROM storybooks, which are part

of the Living book series, were selected based on their appropriateness for this age of reader with regard to content and reading level. First storybook was Arthur's Teacher Trouble by Marc Brown, Developmental Assessment Level (DRA): 18-20. Second storybook was Sheila Rae, the Brave by Kevin Henkes: Developmental Assessment Level (DRA): 18-20. Those interactive storybooks offered both 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 CD-ROM storybooks word pronunciations, definitions, narration functions were turned off so as not to provide extra help to students.

These two electronic storybooks were 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, these two storybooks, which are low difficulty level for regular fourth-graders, were chosen by the researcher. The second reason these storybooks both CD-ROM and paper versions were used in previous studies. For example, Arthur's Teacher Trouble by Marc Brown used by Matthew (1996) for regular third-graders, Scoresby (1996) for third-graders. 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 these storybooks were valid and reliable for this study. Third, two storybooks from living book series are approximately equal in length, readability level, and function such as animation.

Restatement of Purposes and Research Questions

The purpose of this research was to compare and explore the effects of medium in storybooks presentations on struggling readers' reading comprehension. The following research questions were addressed in this study: 1) Do fourth-grade struggling readers differ on reading comprehension as measured by multiple-choice comprehension test when they read the same storybooks presented in electronic format with and without animation and in a traditional print format? 2) 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?

Research Design

There are two dependent variables and one independent variable in this study. First dependent variable is reading comprehension as measured by the multiple-choice comprehension test, and the second dependent variable is reading comprehension as measured by the retelling. The independent variable is the type of medium of presentation. Three conditions: (1) CD-ROM with animation, (2) CD-ROM without animation, and (3) printed version of storybooks were tested two times through the use storybooks: Arthur's Teacher Trouble, and Sheila Rae, the Brave.

Participants

The subjects were 77 students ($N=77$) enrolled in a fourth-grade classroom and from economically and culturally diverse elementary schools in the United States. 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 study held back and repeated the third grade. There were three treatment groups. The subjects were 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 ($n=26$). Each treatment groups consists of equal number ($n=9$) of reading level one students.

Florida Comprehensive Assessment Test (FCAT)

The subjects' selection was based on FCAT. In this section, some essential information about FCAT is explained. The FCAT is the foundation of the statewide educational assessment and accountability program. The FCAT consists of criterion-referenced tests in mathematics, reading, science, and writing, which measure student progress toward meeting the Sunshine State Standards. The reading area is assessed by FCAT for students in grades 3 through 10 (Florida Department of Education, 2005). The score ranges for achievement levels 1 through 5 and the minimum score necessary for the student to be on Grade Level (Level 3). A level two score means student has had limited success with the challenging content of the Sunshine State

Standard. A level one score means little success with the challenging content of the Sunshine State Standard (Florida Department of Education, 2004).

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).

Measurement Procedures

In this study, there are two common response formats: multiple-choice and retelling used in this study to assess students’ reading comprehension performance because an average of scores across these two tests may give a more accurate indicator of reading comprehension performance. If only one measure of reading is given, the results can potentially be misleading in this case. Leslie (1993) recommended using both comprehension questions and retellings to assess students’ comprehension of stories, because they measure different things. Doty (1999) also supported this opinion; while retelling can give hints about the readers’ understanding of story structure, the response to explicit and implicit comprehension questions measure readers’ information about the story, reader’s prior knowledge and their inferences based on the story. Therefore, using retellings together with comprehension questions could provide more information and insight into student’s comprehension of the story.

Comprehension Tests (Multiple-choice Questions)

The multiple-choice questions were written by the researcher according to Pearson and Johnson's (1978) taxonomy of comprehension questions. Textually explicit (factual questions), and textually implicit (inferential questions) were used to examine whether the students understood the elements of the story (Leslie, 1993). The questions for Arthur's Teacher Trouble are based on a modified version of the "Recall Questions" originally developed by Scoresby (1996). Content validity was used for validity evaluation of comprehension tests. Content validity is a subjective form of validity evaluation. It consists of opinion and judgment as the method to derive valid test. In more sophisticated situations, a test designer may begin with original instrument, and then receive additional test item assessments from experts in the field. Items may be added, modified, or dropped, relative the experts' opinion. This method is the strongest form of content validity (Balian, 1994). The American Psychological Association (1985) also declared that: "Content-related evidence of validity is a central concern during test development...Expert professional judgment should play an integral part in developing the definition of what is to be measured..." (p. 11). For content validity, the multiple-choice comprehension questions (Appendix D) were reviewed and approved by experts; the teachers and fourth-grade coordinators, as appropriate for the students being studied. Originally there were 20 comprehension questions to answer but seven questions were eliminated by teachers as not appropriate for the students. 13 questions remained and used for the comprehension test (Appendix D).

Retellings

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 study was comprehension as measured by oral retelling. Morrow's 10-Point Scale (Appendix C) was used for analysis and evaluation story retellings. Morrow's 10-Point Scale is a reliable assessment instrument for retelling. According to Morrow's study (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 study consisted of having each child read two storybooks. The study was conducted by three researchers with the cooperation of elementary schools in Alachua County (FL). Each school provided access to a Personal Computer with a CD-ROM drive. The researchers provided electronic storybooks.

Data collection took about 8 weeks. During the study, using computers skill was not a problem. The students were generally very skilled at using computers. According to the student survey results, 92.2% of students, either they have a computer at home or get to use a computer outside of school. And also, all schools that were visited had computer labs and allocated regular computer time to students in the computer labs. Two Ph.D. students majoring in education trained about data collection process helped the main researcher during data collection.

The participants were first asked to fill in a short survey requesting basic demographic characteristics such as age, gender, and information about their computer experience as well as whether they have previously read or seen these storybooks on TV/DVD/Video/ CD-ROM. Students who have previously read and/or seen the storybooks were eliminated from the study. It is important that the storybooks were previously unknown to subjects. The first group of students ($n=25$) read electronic CD-ROM with animation of storybooks on the computer. The second group ($n=26$) read electronic CD-ROM 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 measures, story retellings, and multiple-choice questions. Additionally, students in the electronic CD-ROM storybooks groups were given directions for using the computer. For the purposes of data collection, the students read the following two storybooks, all of which were published in both print and electronic CD-ROM formats: (1) *Arthur's Teacher Trouble* by Marc Brown (1992), and (2) *Sheila Rae, the Brave* by Kevin Henkes (1987).

After reading, the students answered on paper 13 multiple-choice questions. The time limit was 20 minutes. They were not allowed access to the stories during testing. The comprehension tests contained multiple-choice questions that required the student to select the one correct answer. Students received one point for correct responses, and zero points for an incorrect or missing response. The highest total possible score was 13 points for this assessment. The students' responses were scored by the researcher.

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 time limit was 15 minutes.

The retellings were scored in accordance with Morrow's (1986) 10-point scale (Appendix C). 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.

The researcher made observation during reading the stories process and took field notes about time, and the other details. In addition, short interviews were conducted by several students to get some feedback about using electronic storybooks.

The students received pencils at the end of data collection. The researcher sent appreciation letters to school principals and administrators.

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. Separate analyses were carried out for the two stories, Arthur's Teacher Trouble and Sheila Rae, the Brave. 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 study, 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).

The Student Survey Results

A student survey was conducted with students prior to the reading of the storybooks. Seventy-seven respondents completed the survey instrument. An analysis of the student survey showed that males represented a smaller proportion of the sample (37.7%; $n=29$) than females (62.3%; $n=48$) (Table 3-1). The respondents' ages ranged from 9-11, with a mean of 9.96 years. Seventeen participants were nine years old (22.1%), forty-seven participants were ten years old (61%), and thirteen participants were eleven years old (16.9%) (Table 3-2). The largest group of respondents were African-Americans (40.3%; $n=31$), followed by White (Anglo-American) (33.8%; $n=26$), others (10.4%; $n=8$), Hispanic-Americans, Asian-Pacific Islanders, and Native-Americans each (5.2%; $n=4$). The results of this category are presented in Table 3-3.

Students who had previously read and/or seen the storybooks were eliminated from the study. Therefore, the storybooks were previously unknown to subjects. All of the respondents reported that they have not read the storybooks prior to the study.

Table (3-4) reports the percentages and frequencies of participants who read or had not read a storybook on a computer. Thirty-nine participants (50.6%) had previously read a storybook on a computer before while thirty-eight of them (49.4%) had not. Seventy-one

students (92.2%) either have a computer at home or get to use a computer outside of school but six students stated that they do not have access computer outside of school (Table 3-5).

Respondents described their computer usage in a week at home as follows; twenty one of them (27.3%) stated every day in a week, four of them (5.2%) stated six days in a week, five of them (6.5%) stated five days in a week, eleven of them (14.3%) stated four days in a week, five of them (6.5%) stated three days in a week, nine of them (11.7%) stated two days in a week, and seven of them (9.1%) stated one day a week, of computer use at home. Fifteen of the respondents (19.5%) stated that they do not use computer at home. The results are shown in the Table 3-6.

Respondents described their computer usage in a week at school as follows; three of them (3.9%) stated every day in a week, two of them (2.6%) stated six days in a week, eight of them (10.4%) stated five days in a week, thirteen of them (16.9%) stated four days in a week, six of them (7.8%) stated three days in a week, nineteen of them (24.7%) stated two days in a week, and fifteen of them (19.5%) stated one day in a week, of computer use at school. Eleven of the respondents (14.3%) stated that they do not use computer at school (Table 3-7).

Participants can select more than one choice for the last survey question (question #8). When the students' responses for survey question #8 were analyzed, it was found that fifty-six of the participants (72.7%) use a computer to play games (Table 3-8). Of those participating in the study, twenty-five of them (32.5%) stated that they use a computer for writing purposes while fifty-two of them (67.5%) stated that they do not use a computer for writing purposes outside of school (Table 3-9).

Of those participating in the study, thirty-two of them (41.6%) answered that they use a computer to access e-mails while forty-five of them (58.4%) answered that they do not use a computer to access e-mails outside of school (Table 3-10). Forty-five participants (58.5%) were

allowed to access the Internet at home (Table 3-11). Eleven participants (14.3%) reported that they use a computer to read books while sixty-six students (85.7%) reported that they do not use a computer for reading purposes outside of school (Table 3-12). Fifteen of them (19.5%) stated that they use a computer to study lessons while sixty-two of them (80.5%) stated that they do not use a computer to study lessons outside of school (Table 3-13). Of those participating in the study, twenty-two of them (28.6%) answered that they use a computer for activities other than those listed in the survey while fifty-five participants (71.4%) stated they do not use a computer other than for activities listed in the survey (Table 3-14). The number of students' responses to each category is presented at the end of this chapter.

Summary

This study was designed to compare fourth-grade struggling readers' comprehension across three types of storybooks presentations: (1) computer presentation of storybooks with animation; (2) computer presentation of storybooks without animation; and (3) printed version of storybooks.

This chapter presented the research design, the instruments, the procedures, and the methods used to collect, analyze and score the data as well as the theoretical framework to the study. Seventy-seven fourth-grade struggling readers participated in this study. Two different storybooks were used. To measure students' comprehension, data were collected using two instruments: (1) multiple-choice comprehension test, and (2) retelling. All students responded survey questions. Morrow's 10-Point Scale was used to score retellings. One-way ANOVA was used to determine whether there was a significant difference in scores among the groups. The Bonferroni test was used to find exactly which groups differed from each other. Kruskal-Wallis one-way analysis of variance test was used to decide whether or not the average differences

between the groups are due chance or to treatment effect. Chapter 4 presents the results of the research.

Table 3-1. Participant characteristics based on gender

	Frequency	Percent
female	48	62.3
male	29	37.7
Total	77	100.0

Table 3-2. Participant characteristics based on age

	Frequency	Percent
9.00	17	22.1
10.00	47	61.0
11.00	13	16.9
Total	77	100.0

Table 3-3. Participant characteristics based on race/ethnicity

	Frequency	Percent
White	26	33.8
African American	31	40.3
Hispanic	4	5.2
Asian-pacific islander	4	5.2
Native American	4	5.2
Other	8	10.4
Total	77	100.0

Table 3-4. Electronic storybooks experience

	Frequency	Percent
No	38	49.4
Yes	39	50.6
Total	77	100.0

Table 3-5. The use of computer outside of school

	Frequency	Percent
Yes	71	92.2
No	6	7.8
Total	77	100.0

Table 3-6. The use of computer frequency in a week

	Frequency	Percent
none	15	19.5
1day	7	9.1
2days	9	11.7
3days	5	6.5
4days	11	14.3
5days	5	6.5
6days	4	5.2
7days	21	27.3
Total	77	100.0

Table 3-7. Computer usage frequency in a week at school

	Frequency	Percent
none	11	14.3
1day	15	19.5
2days	19	24.7
3days	6	7.8
4days	13	16.9
5days	8	10.4
6days	2	2.6
7days	3	3.9
Total	77	100.0

Table 3-8. The use of computer for playing games

	Frequency	Percent
No	21	27.3
Yes	56	72.7
Total	77	100.0

Table 3-9. The use of computer for writing

	Frequency	Percent
No	52	67.5
Yes	25	32.5
Total	77	100.0

Table 3-10. The use of computer for electronic mail

	Frequency	Percent
No	45	58.4
Yes	32	41.6
Total	77	100.0

Table 3-11. The use of computer for the Internet

	Frequency	Percent
No	32	41.5
Yes	45	58.5
Total	77	100.0

Table 3-12. The use of computer for reading a book

	Frequency	Percent
No	66	85.7
Yes	11	14.3
Total	77	100.0

Table 3-13. The use of computer for lessons

	Frequency	Percent
No	62	80.5
Yes	15	19.5
Total	77	100.0

Table 3-14. The use of computer for other activities

	Frequency	Percent
No	55	71.4
Yes	22	28.6
Total	77	100.0

CHAPTER 4 RESULTS

Introduction

This chapter presents the research findings of the study. The purpose of the study was to compare and explore the effects of medium of storybooks presentations on struggling readers' reading comprehension. For the purpose of this study, 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) traditional print version of storybooks and these were compared with respect to reading comprehension as measured by multiple-choice comprehension test and retelling. The findings are presented in the tables that are included at the end of this chapter.

Restatement of Research Questions

This study investigated the effects of electronic CD-ROM storybooks on the reading comprehension of fourth-grade struggling readers. Specifically, the following research questions were addressed in this study:

1. Do fourth-grade struggling readers differ on reading comprehension as measured by multiple-choice comprehension test when they read the same storybooks presented in electronic format with and without animation and in a print format?
2. 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 print format?

Results

The researcher conducted the study using two different storybooks. This section reports the results from those two different storybooks. The first storybook (I) is Arthur's Teacher Trouble by Marc Brown (1992). The second storybook (II) is Sheila Rae, the Brave by Kevin Henkes (1987).

Reliability Report for Comprehension Test and Retelling

Reliability refers to the consistency of a measuring instrument. Reliability is combination of true score and measurement error (Shavelson, 1996). The researcher analyzed the data along with the comprehension test, retelling and using both retelling and comprehension test to determine the reliability of the instruments. Two different storybooks were used in this study and the same measurement process repeated for these storybooks. Therefore, the researcher separately analyzed the reliability of the instruments for the first storybook (I) and the second storybook (II). Table (4-7) includes each group's reliability scores with the number of participants and means for the first storybooks (I) instruments. Alpha value was .66 for the first comprehension test and .70 for the first retelling items (Table 4-7). On the other hand, Table (4-8) includes each group's reliability scores with the number of participants and means for the second storybooks (II) instruments. Alpha value was .55 for the second comprehension test and .65 for the second retelling items (Table 4-8). In addition, Morrow (1986) found that the retelling measuring instrument's (Morrow's 10-point scale) alpha value was .90.

The First Storybook (I): Analysis of Variance for Comprehension Test and Retelling Scores

To assess the difference in reading comprehension scores on a multiple-choice comprehension test and reading comprehension scores on retellings for students reading the electronic storybooks with animation, the electronic storybooks without animation, and the traditional print storybooks, one-way analysis of variance (ANOVA) was conducted. The findings are summarized in Table 4-1. A one-way ANOVA indicated significant differences in reading comprehension scores on a multiple-choice comprehension test ($F=12.529$, $df=2/74$, $p<.05$) and reading comprehension scores on retellings ($F=7.879$, $df=2/74$, $p<.05$) between students reading electronic storybooks with animation, electronic storybooks without animation and traditional print storybooks.

For the reading comprehension scores on a multiple-choice comprehension test, a higher level of comprehension score was reported in reading electronic storybooks with animation condition ($M=9.60$, $SD=3.15$), followed by traditional print storybooks condition ($M=7.62$, $SD=2.37$), and electronic storybooks without animation condition ($M=6.19$, $SD=1.58$).

For the reading comprehension scores on retelling, a higher level of comprehension score was reported in the reading electronic storybooks with animation condition ($M=6.76$, $SD=2.03$), followed by electronic storybooks without animation condition ($M=5.12$, $SD=2.57$) and traditional print storybooks condition ($M=4.15$, $SD=2.46$).

The Second Storybook (II): Analysis of Variance for Comprehension Test and Retelling Scores

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 4-2. A one-way ANOVA indicated significant differences in reading comprehension scores on a multiple-choice comprehension test ($F=9.642$, $df=2/74$, $p<.05$), and 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 a multiple-choice comprehension test, a higher level of comprehension score was reported in reading electronic storybooks with animation condition ($M=9.44$, $SD=2.66$), followed by traditional print storybooks condition ($M=9.27$, $SD=1.66$), and electronic storybooks without animation condition ($M=7.00$, $SD=2.26$) (Table 4-2).

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 4-2).

The First Storybook (I): Post-Hoc (Bonferroni) Test Results for Comprehension Test Scores

In this study, a Bonferroni test was applied to the alpha levels to control for the possibility of a Type 1 error because of the number of tests used (Morgan, Reichert, & Harrison, 2002). Employing the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation group and the electronic storybooks without animation group ($p < 0.05$), and between the electronic storybook with animation, and traditional print storybook ($p < 0.05$). There was no significant difference between the electronic storybook without animation and the traditional print storybooks ($p=0.116$). These findings are summarized in Table 4-3.

The First Storybook (I): Post-Hoc (Bonferroni) Test Results for Retelling Scores

Employing the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation, and electronic storybooks without animation ($p < 0.05$), and between the electronic storybooks with animation, and the traditional print storybook ($p < 0.05$). There was no significant difference between the electronic storybook without animation and traditional printed storybook ($p=0.442$). These results are displayed in Table 4-4.

The Second Storybook (II): Post-Hoc (Bonferroni) Test Results for Comprehension Test Scores

Employing the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation, and the electronic storybooks without animation ($p < 0.05$), between the electronic storybooks without animation, and traditional print storybooks ($p < 0.05$).

Table 4-5 shows that there was no significant difference between the electronic storybooks with animation and the traditional print storybooks ($p=1.000$).

The Second Storybook (II): Post-Hoc (Bonferroni) Test Results for Retelling Scores

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 4-6).

The First Storybook (I): Kruskal-Wallis Test Results for Comprehension Test

Differences in reading comprehension scores on the multiple-choice comprehension test on the story “Arthur’s Teacher Trouble” between the electronic storybooks with animation group, the electronic storybooks without animation group, and the traditional print storybook groups were analyzed through Kruskal-Wallis tests. The findings are presented in Table 4-9. 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 question #1 $H(2,N=77)=9.065, p<.05$, question #4 $H(2,N=77)=16.974, p <.05$, question #6 $H(2,N=77)=15.079, p<.05$, and question #10 $H(2,N=77)=6.279, p<.05$ (Table 4-9). The comprehension questions #1 and #10 are text-explicit (literal) questions, questions #4, and #6 are text-implicit (inferential) questions (Appendix D).

The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ($n=25$) ranked highest, the traditional print storybook group ($n= 26$) ranked second, and the electronic storybooks without animation group ($n=26$) ranked lowest on the multiple-choice comprehension questions #1, #4, #6, and #10. Other questions did not reveal significant

statistical differences between the electronic storybooks with animation group, the electronic storybooks without animation group, and the traditional print storybook group (Table 4-10).

The First Storybook (I): Kruskal-Wallis Test Results for Retelling

Differences in reading comprehension scores on retellings for the story “Arthur’s Teacher Trouble” between students reading electronic storybooks with animation, the electronic storybook without animation and the traditionally printed storybook groups were analyzed through Kruskal-Wallis tests. The findings are shown in Table 4-11. 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 #2 $H(2,N=77)=7.168, p<.05$, item #3 $H(2,N=77)=7.492, p<.05$, item #6 $H(2,N=77)=9.261, p<.05$, item #7 $H(2,N=77)=12.749, p<.05$, item #8 $H(2,N=77)=6.702, p<.05$, and item #9 $H(2,N=77)=7.449, p<.05$ (Table 4-11).

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 ($n=26$) the lowest on the retelling items #3, #6, #7, and #9 (Table 4-12).

The Kruskal-Wallis mean ranks revealed that traditional print storybook group ($n=26$) ranked highest, electronic storybooks without animation group ($n=26$) ranked second, and electronic storybooks with animation group ($n=25$) lowest on the retelling item #2. And the Kruskal-Wallis mean ranks revealed that interactive storybooks with animation group ($n=25$) ranked highest, the traditional print storybook group ($n=26$) ranked second, and electronic storybooks without animation group ($n=26$) the lowest on the retelling item #8 (Table 4-12).

Other questions did not reveal statistical differences between the electronic storybooks with animation, the storybooks without animation group, and the traditional print storybook group.

The Second Storybook (II): Kruskal-Wallis Test Results for Comprehension Test

Difference in reading comprehension scores on the multiple-choice comprehension test on the second story “Sheila Rae, the Brave” between the electronic storybooks with animation group, the electronic storybooks without animation group, and the traditional print storybook groups were analyzed through Kruskal-Wallis tests. The findings are presented in Table 4-13. Kruskal-Wallis analysis of variance (ANOVA) showed that accuracy varied significantly across storybooks presentation conditions (electronic with animation or electronic without animation or printed) on question #1 $H(2,N=77)=7.949, p<.05$, question #4 $H(2,N=77)=6.178, p<.05$, and question #10 $H(2,N=77)=7.429, p<.05$ (Table 4-13).

The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ($n=25$) ranked the highest, the traditional print storybook group ($n= 26$) ranked second, and the electronic storybooks without animation group ($n=26$) ranked the lowest on the multiple-choice comprehension question #4. However, mean ranks were changed for questions #1 and #10. The printed storybook group ($n=26$) ranked the highest, the animation group ($n=25$) ranked second and without animation group ($n=25$) ranked the lowest for questions #1 and #10. Other questions did not revealed significant statistical differences between the electronic storybook with animation group, the electronic storybook without animation group, and the printed storybook group (Table 4-14).

The Second Storybook (II): Kruskal-Wallis Test Results for Retelling

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 4-15. 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 4-15).

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 4-16). Other questions did not reveal statistical differences between the electronic storybooks with animation, the storybooks without animation group, and the traditional print storybook group.

Research Question #1

Do fourth-grade struggling readers differ on reading comprehension as measured by multiple-choice comprehension test when they read the same storybooks presented in electronic format with and without animation and in a traditional print format?

The first storybook: ANOVA indicated that there was a significant differences in reading comprehension scores on a multiple-choice comprehension test ($F=12.529; p<.05$) between students reading electronic storybooks with animation, electronic storybooks without animation and traditional print storybooks. For the reading comprehension scores on a multiple-choice comprehension test a higher level of comprehension score was reported in the reading electronic storybooks with animation condition ($M=9.60, SD=3.15$), followed by traditional print storybooks condition ($M=7.62, SD=2.37$) and electronic storybooks without animation condition ($M=6.19, SD=1.58$). The results are displayed in Table 4-1.

According to the Bonferroni Post-Hoc test results, significant differences were found between the electronic storybooks with animation group and the electronic storybooks without animation group ($p < 0.05$), and between the electronic storybook with animation, and traditional print storybook ($p < 0.05$). There was no significant difference between the electronic storybook without animation and the traditional print storybooks ($p = 0.116$) (Table 4-3).

In Table 4-9, Kruskal-Wallis tests revealed a significant difference between storybooks presentation conditions (electronic with animation or electronic without animation or printed) for both the text-explicit (#1 and #10) and text-implicit questions (#4, and #6).

The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ranked highest, the traditional print storybook group ranked second, and the electronic storybooks without animation group ranked lowest on the multiple-choice comprehension questions (Table 4-10).

Second storybook: ANOVA indicated there was a significant difference in reading comprehension scores on a multiple-choice comprehension test ($F = 9.642$; $p < .05$), between students reading electronic storybooks with animation, electronic storybooks without animation and traditional print storybooks. For the reading comprehension scores on a multiple-choice comprehension test a higher level of comprehension score was reported in the reading electronic storybooks with animation condition ($M = 9.44$, $SD = 2.66$), followed by the traditional print storybooks condition ($M = 9.27$, $SD = 1.66$), and the electronic storybooks without animation condition ($M = 7.00$, $SD = 2.26$) (Table 4-2).

Using the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation, and the electronic storybooks without animation ($p < 0.05$), and between the electronic storybooks without animation, and traditional print storybooks

($p < 0.05$). Table 4-5 shows that there was no significant difference between the electronic storybooks with animation and the traditional print storybooks ($p = 1.000$).

Kruskal-Wallis analysis showed that accuracy varied significantly across storybooks presentation conditions (electronic with animation or electronic without animation or printed) for text-explicit questions (#1 and #4) text-implicit question (#10). (Table 4-13). The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ranked the highest, the traditional print storybook group ranked second, and the electronic storybooks without animation group ranked the lowest on the multiple-choice comprehension question #4. However, mean ranks were changed for questions #1 and #10. While the printed storybook group ranked the highest, the electronic storybook with animation group ($n = 25$) ranked second and the electronic storybook without animation group ranked the lowest for questions #1 and #10. Other questions did not reveal significant statistical differences between with animation group, without animation group, and printed storybook group (Table 4-14).

Research Question #2

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?

First storybook: ANOVA indicated there was a significant difference in reading comprehension scores on reading comprehension scores on retellings ($F = 7.879$; $p < .05$) 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 ($M = 6.76$, $SD = 2.03$), followed by electronic storybooks without animation condition

($M=5.12$, $SD=2.57$) and traditional print storybooks condition ($M=4.15$, $SD=2.46$). The results are shown in Table 4-1.

Employing the Bonferroni Post-Hoc test, significant differences were found between the electronic storybooks with animation, and electronic storybooks without animation ($p<0.05$), between the electronic storybooks with animation, and the traditional print storybook ($p<0.05$). There was no significant difference between the electronic storybook without animation and traditional printed storybook ($p=0.442$). These results are displayed in Table 4-4.

Kruskal-Wallis analysis of variance (ANOVA) revealed that accuracy varied significantly across storybook presentation conditions (electronic with animation or electronic without animation or printed) on the story characters (item #2, #3) plot episode (item #6), resolution (item #7, #8), and sequence (item #9) (Table 4-11).

The second storybook: ANOVA indicated there is a significant difference in reading comprehension scores on retelling ($F=5.475$; $p<.05$) 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 traditional print storybooks condition ($M=4.81$, $SD=2.62$) (Table 4-2).

Employing the Bonferroni Post-Hoc test, significant differences was 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 ($p=.089$), or the electronic storybook without animation and the traditional print storybook ($p=.914$) (Table 4-6).

Kruskal-Wallis analysis of variance (ANOVA) revealed that accuracy varied significantly across storybook presentation conditions (electronic with animation or electronic without animation or printed) on the retelling item #6, and item #8 (Table 4-15).

The Kruskal-Wallis mean ranks revealed that the electronic storybooks with animation group ranked highest, the electronic storybooks without animation group ranked second, and the traditional print storybook group ranked lowest on plot episodes of the story (items #6), and resolution of the story (item #8) (Table 4-16).

Observations

The observations were conducted while each student was reading and retelling the stories to the researcher. Field notes from observations of students while they read indicated that their reading of the electronic version of stories took longer time than printed version of stories. Specifically, animated groups spent significantly longer time overall when comparing to the other groups. Pearman and Lefever-Davis (2006) explained that motivational factors were the reason behind spending longer time on reading of the animated CD-ROM storybooks. They also reported that animated CD-ROM storybooks can extend students interest and engagement with texts. The use of animation contributes to students' motivation to read. Storybooks in electronic format are likely to be more engaging, interesting and thereby more motivating for readers (Pearman & Lefever-Davis, 2006). Spending more time in reading can be an indication of engagement, enjoyment, and attention to the text. Guthrie (2001) says that engaged reading is a combination of motivation and thoughtfulness. Additionally, engagement is an important literacy outcome for reading in digital environments (Dalton & Strangman, 2006). It was obvious that the retellings of student group who read animated versions of stories were longer related or unrelated to the stories than the other groups. Another observation was that the electronic storybooks were

more demanding in skill and strategy for students to read. It may be a result of the medium or unfamiliarity.

After the students read electronic storybooks the researcher interviewed with them. The researcher asked the students what they liked and did not like. The majority of the students mentioned that they like and enjoy animations, and illustrations of the electronic storybooks. In addition, students generally wanted to read another animated storybook. However, several students stated that the electronic storybooks are simple, slow and boring.

Summary

This chapter presented the findings of the study. Analysis of variance (ANOVA) was used to test two research questions at the .05 level of significance. The Bonferroni test was used to find exactly which groups differed from each other. Kruskal-Wallis one-way analysis of variance was used to decide whether or not the average differences between the groups are due to chance. The results of statistical analysis indicated that there was significant difference in the students' comprehension scores. In other words, when comprehension was measured by using multiple-choice comprehension test and retelling, the students who read the computer presentation of storybooks with animation showed significantly higher comprehension scores than students who read either the computer presentation of the storybooks without animation or the traditional print version of storybooks.

Table 4-1. Analysis of Variance for comprehension test and retelling scores I

		df	F	Sig.		N	Mean	Std. Deviation
Comprehension Test Total	Between	2	12.529	.000	with animation	25	9.6000	3.1491
	Groups							
	Within	74			without animation	26	6.1923	1.5753
	Groups							
	Total	76			Printed	26	7.6154	2.3677
Retelling Total	Between	2	7.879	.001	with animation	25	6.7600	2.0265
	Groups							
	Within	74			without animation	26	5.1154	2.5664
	Groups							
	Total	76			Printed	26	4.1538	2.4608

Table 4-2. Analysis of Variance for comprehension test and retelling scores II

		df	F	Sig.		N	Mean	Std. Deviation
Comprehension Test Total	Between	2	9.642	.000	with animation	25	9.4400	2.6627
	Groups							
	Within	74			without animation	26	7.0000	2.2627
	Groups							
	Total	76			Printed	26	9.2692	1.6627
Retelling Total	Between	2	5.475	.006	with animation	25	6.8800	2.0067
	Groups							
	Within	74			without animation	26	5.4615	2.1583
	Groups							
	Total	76			Printed	26	4.8077	2.6233

Table 4-3. Post-Hoc (Bonferroni) test results for comprehension test scores I

		Mean Difference (I-J)	Std. Error	Sig.
(I) condition	(J) condition			
with animation <i>N</i> =25, <i>M</i> =9.6000, <i>SD</i> =3.1491	without animation	3.4077	.6832	.000*
	printed	1.9846	.6832	.015*
without animation <i>N</i> =26, <i>M</i> =6.1923, <i>SD</i> =1.5753	with animation	-3.4077	.6832	.000*
	printed	-1.4231	.6764	.116
printed <i>N</i> =26, <i>M</i> =7.6154, <i>SD</i> =2.3677	with animation	-1.9846	.6832	.015*
	without animation	1.4231	.6764	.116

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

Table 4-4. Post-Hoc (Bonferroni) test results for retelling scores I

		Mean Difference (I- J)	Std. Error	Sig.
(I) condition	(J) condition			
with animation <i>N</i> =25, <i>M</i> =6.7600, <i>SD</i> =2.0265	without animation	1.6446	.6630	.046*
	printed	2.6062	.6630	.001*
without animation <i>N</i> =26, <i>M</i> =5.1154, <i>SD</i> =2.5664	with animation	-1.6446	.6630	.046*
	printed	.9615	.6565	.442
printed <i>N</i> =26, <i>M</i> =4.1538, <i>SD</i> =2.4608	with animation	-2.6062	.6630	.001*
	without animation	-.9615	.6565	.442

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

Table 4-5. Post-Hoc (Bonferroni) test results for comprehension test scores II

		Mean Difference (I-J)	Std. Error	Sig.
(I) condition	(J) condition			
with animation <i>N</i> =25, <i>M</i> =9.4400 <i>SD</i> =2.6627	without animation	2.4400	.6240	.001*
	printed	.1708	.6240	1.000
without animation <i>N</i> =26, <i>M</i> =7.0000 <i>SD</i> =2.2627	with animation	-2.4400	.6240	.001*
	printed	-2.2692	.6179	.001*
printed <i>N</i> =26, <i>M</i> = 9.2692 <i>SD</i> = 1.6627	with animation	-.1708	.6240	1.000
	without animation	2.2692	.6179	.001*

(2) The mean difference is significant at the .05 level.

Table 4-6. Post-Hoc (Bonferroni) test results for retelling scores II

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

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

Table 4-7. Reliability report for comprehension test and retelling I

The First Storybook (I): Arthur's Teacher Trouble			
	Comprehension Test (13 Items)	Retelling (9 Items)	Comprehension Test & Retelling (22 Items)
N	77	77	77
Alpha	.6594	.7040	.7617
Mean	7.7532	5.2987	13.0519

Table 4-8. Reliability report for comprehension test and retelling II

The Second Storybook (II): Sheila Rae, the Brave			
	Comprehension Test (13 Items)	Retelling (9 Items)	Comprehension Test and Retelling (22 Items)
N	77	77	77
Alpha	.5484	.6484	.7047
Mean	8.5844	5.6753	14.2597

Table 4-9. Kruskal-Wallis test results for comprehension test I

	Question #1	Question #4	Question #6	Question #10
Chi-Square	9.065	16.974	15.079	6.279
<i>df</i>	2	2	2	2
Asymp. Sig.	.011	.000	.001	.043

a. Kruskal Wallis Test

b. Grouping Variable: Condition

Table 4-10. Kruskal-Wallis means ranks for comprehension test I

Comprehension Test	Condition	N	Mean Rank
question #1	with animation	25	46.92
	without animation	26	32.23
	printed	26	38.15
questions #4	with animation	25	50.38
	without animation	26	28.35
	printed	26	38.71
question #6	with animation	25	49.38
	without animation	26	28.83
	printed	26	39.19
question #10	with animation	25	45.30
	without animation	26	32.27
	printed	26	39.67

Table 4-11. Kruskal-Wallis test results for retelling I

	retelling #2	retelling #3	retelling #6	retelling #7	retelling #8	retelling #9
Chi-Square	7.168	7.492	9.261	12.749	6.702	7.449
<i>df</i>	2	2	2	2	2	2
Asymp. Sig.	.028	.024	.010	.002	.035	.024

a. Kruskal Wallis Test

b. Grouping Variable: Condition

Table 4-12. Kruskal-Wallis means ranks for retelling I

Retelling	Condition	N	Mean Rank
item #2	with animation	25	33.18
	without animation	26	39.58
item #3	Printed with animation	26 25	44.02 45.10
	without animation	26	41.25
item #6	Printed with animation	26 25	30.88 45.68
	without animation	26	41.71
item #7	Printed with animation	26 25	29.87 50.22
	without animation	26	34.35
item #8	Printed with animation	26 25	32.87 47.18
	without animation	26	34.33
item #9	Printed with animation	26 25	35.81 45.14
	without animation	26	41.23
	Printed	26	30.87

Table 4-13. Kruskal-Wallis test results for comprehension test II

	Question #1	Question #4	Question #10
Chi-Square	7.949	6.178	7.429
df	2	2	2
Asymp. Sig.	.019	.046	.024

a. Kruskal Wallis Test
b. Grouping Variable: Condition

Table 4-14. Kruskal-Wallis means ranks for comprehension test II

Comprehension Test	Condition	N	Mean Rank
question #1	with animation	25	40.26
	without animation	26	31.73
	printed	26	45.06
	Total	77	
question #4	with animation	25	43.84
	without animation	26	32.23
	printed	26	41.12
	Total	77	
question #10	with animation	25	42.18
	without animation	26	30.81
	printed	26	44.13
	Total	77	

Table 4-15. Kruskal-Wallis test results for retelling II

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

a. Kruskal Wallis Test

b. Grouping Variable: Condition

Table 4-16. Kruskal-Wallis means ranks for retelling II

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	

CHAPTER 5 DISCUSSION

Introduction

A synthesis of the study presented in this chapter includes a summary of the study's findings, discussion, implications, recommendations, limitations, and conclusion of the present study. The purpose of this study was to compare and explore the effects of the medium of storybooks presentations on struggling readers' reading comprehension. For the purpose of this study, 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. One dependent variable was reading comprehension as measured by the multiple-choice comprehension test, and the second dependent variable was reading comprehension as measured by the retelling. The independent variable is the type of medium of presentation.

Summary of Findings

In this section, findings of related questions are reviewed together.

Research Question I. Do fourth-grade struggling readers differ on reading comprehension as measured by multiple-choice comprehension test when they read the same storybooks presented in electronic format with and without animation and in a traditional paper based format?

- When fourth-grade struggling readers responded to multiple-choice comprehension tests for two different storybooks, there was a significant difference in reading comprehension scores among fourth-grade struggling readers who read electronic storybooks with animation, the electronic storybooks without animation and the traditional print storybook (Table 4-1, Table 4-2).
- Specifically, significant differences were found between the electronic storybooks with animation group and the electronic storybooks without animation group; and between the

electronic storybook with animation group and traditional print storybook group. There was no significant difference between the electronic storybook without animation group and the traditional print storybooks group (Table 4-3).

- There was a significant difference between storybook presentation conditions (electronic with animation or electronic without animation or printed) for both multiple-choice, the text-explicit (#1 and #10) and multiple choice, text-implicit questions (#4, and #6). (Table 4-9 and Table 4-13). The students reading the electronic storybooks with animation received higher scores on both text-explicit and text-implicit questions than the other two groups of students.
- The results of study showed that struggling readers who read the electronic books with animation had the highest scores as measured by multiple-choice comprehension tests, followed by the struggling readers who read the printed storybooks and struggling readers who read the electronic storybooks without animation had the lowest scores as measured by multiple-choice comprehension tests (Table 4-10 and Table 4-14).

Research Question II. 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 paper based format?

- When fourth-grade struggling readers were compared by the retellings scores for two different storybooks, there was a significant difference in retellings scores among three groups (Table 4-1, Table 4-2).
- Statistically significant differences were found between the electronic storybooks with animation group, and electronic storybooks without animation group; between the electronic storybooks with animation and the traditional print storybook (Table 4-4).
- Analysis of retelling data revealed that electronic storybooks with animation helped struggling readers to better comprehend the story characters (item #2, #3) plot episode (item #6), resolution (item #7, #8), and sequence (item #9) (Table 4-11).
- Another finding of the study is that there was a significant difference between the electronic storybooks with animation, and the traditionally printed storybooks (Table 4-6).
- According to the second storybooks retelling scores, the electronic storybook with animation group ranked highest, the electronic storybooks without animation group ranked second, and the traditional print storybook group ranked lowest on plot episodes of the story (items #6), and resolution of the story (item #8) (Table 4-16).

Additional data analysis such as field notes from observations of struggling readers showed that their reading of electronic versions of stories took longer time than the printed

version of stories. Scoresby (1996) also found that animation-available groups spent the most time engaged in reading CD-ROM books. In addition, with the struggling readers, who read electronic storybooks, the retellings were longer than with the other groups of students.

The results of the student survey showed that computer technology is widely available for struggling readers. Seventy-one students (92.2%) either have a computer at home or get to use a computer outside of school. However, only eleven students (14.3%) reported they use computer for reading purposes outside of school (Table 4-28). About half of the participants (50.6%) reported having read a storybook on computer before the beginning of study. A total of sixty-two of the respondents (80.5%) stated that they use a computer at home.

Discussion

This study found that electronic storybooks on CD-ROM 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 CD-ROM storybooks is inconsistent with the findings of this study (De Jong & Bus 2002; Labbo & Kuhn, 2000; Maitland & Trushell, 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 study 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 CD-ROM books diverted from reading rather than improved it and the animation slowed down recall of textual information.

Another result of this study 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 CD-ROM storybooks than with static visualizations available in electronic storybook and printed storybooks. The result of the study found that the advantages of animation in improving story comprehension and in supporting struggling readers' ability to make inferences about story events. The subjects reading electronic storybooks with animation received higher scores on both text-explicit and text-implicit questions than the other two groups. These advantages emerge relative to the capacity of the

multimedia version of the story increase and enrich representation of texts that are necessary to understanding deeper layers of the story.

This study 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 study struggling readers reached more complex levels of story understanding with multimedia storybooks. Additionally, it is clear that the CD-ROM 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 study 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 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.

Implications

Quantitative results from the present investigation show that the use of electronic CD-ROM storybooks improved comprehension of struggling readers. The use of animation features of electronic storybooks could be beneficial for struggling readers. Doty (1999) suggests that the use of CD-ROM books in classroom, “particularly for students reading below grade level” (p.63). The study findings might be useful for teachers and educators.

New literacy technologies bring new approaches into the classroom (Leu, 2000). Many states, policy makers, national educational initiatives have supported technology reform efforts in many schools and have urged the importance of technology (Chiappone, 2003). Teachers play an important role these technology reform efforts because finally they decide and use technology in the classroom. Teachers may add and use electronic storybooks in their instruction. However, first of all, teachers must gain knowledge and about effective use of electronic technology for literacy instruction (Coiro, 2003; Labbo et al., 2003). They need to help students overcome their challenges and problems with the technology. It also requires that teacher education programs instruct teachers on how to effectively integrate technologies into their classrooms (Leu, 2000), and how to use these technologies to introduce students to the strategies and skills necessary for interacting with the new literacy (Coiro, 2003).

In today, many storybooks are available in educational markets. The teachers must evaluate and make choices about which CD-ROM are appropriate for children (Shamir & Korat,

2006) as the CD-ROM storybooks' design characteristics are important for a child's literacy development. Labbo et al. (2003) believed that using CD-ROM storybooks for instruction will provide opportunities to develop higher-level reasoning and problem solving skills. Teachers must also model effective use strategies to solve various comprehension tasks (Coiro, 2003), in addition to assisting students with new digital text reading strategies.

Very few contemporary, well-established authors of children literature publish in electronic formats. A small number of successful picture books appeared in CD-ROM format (Unsworth, 2001). There is a need to extend variability of these stories and more sophisticated designed software to provide a rich resource of children's narratives.

Recommendations for Further Research

The goal of this study was to compare and explore the effects of the medium of storybook presentations on struggling readers' reading comprehension. Three different presentations of electronic storybooks, with animation, without animation format, and traditional paper based format were compared with respect to reading comprehension as measured by multiple-choice comprehension test and retelling assessment.

The results of this study provide some encouraging results relevant to those interested in the use of new digital technology to improve struggling readers' reading comprehension at the elementary school level but also lead to new questions. Based on limitations and findings for this study, the following are suggestions for future research.

There is need for further research in this area. It would be beneficial to further study motivational value of electronic storybooks, issues of engagement, comprehension strategies, and metacognitive performances (Dalton & Strangman, 2006, Moran et al., 2008).

Multiple-choice test and retelling formats were used in this study to assess students' reading comprehension performance. The researcher developed comprehension measures, and

additional comprehension measures such as open-ended questions, miscue analysis, response logs, written retellings and observations might provide more information on student comprehension (Pearman, 2003).

Literature review for this study found that most of the studies have been focused on younger readers. Future research needs to be done for upper grades, older readers, and even adult readers.

In the present study, narrative storybooks were used for reading comprehension. The results may have been different if expository text available on CD-ROM and web based online reading texts had been used. Hence, future research is needed also on the effects of electronic storybooks on comprehension of expository texts.

Future studies should concentrate on understanding of electronic storybooks use in the classroom, relating their use with other instructional resources, and applying them to learning settings, evaluating limitations and managing these limitations of electronic storybooks (Chen et al., 2003).

Future researchers may want to look at the effects of multimedia storybooks on disadvantaged children from immigrant families or English as second language learners who might have reading comprehension difficulties. The electronic storybooks could be beneficial for them.

This study electronic CD-ROM storybooks software were used. Future researchers may want to use online storybooks because the Internet has become more popular day after day and provides more choice in stories. Dalton and Strangman (2006) pointed out that “there is very little research on struggling readers’ comprehension on the Internet” (p. 89). Conducting the

research on online storybooks and analyses of these results might assist in determining the most appropriate instructional practices and strategies to use with struggling readers.

Limitations

1. Participants were fourth-grade students from the same school district in the Northern Florida. As a result, generalizations of the findings are limited with this population.
2. In the study, subjects' range of ages represents fourth-grade students in Florida. Some of the subjects of the study might hold back and repeat the third grade because of Florida's retention policy. Fourth-grade students' range of ages and the retention policy can vary from state to state.
3. Another limitation for this study was that two identical storybooks were available in this study. The researcher was concerned about matching reading difficulty level of stories and matching paper based stories and electronic version of stories as closely as possible. This was accomplished by using the same texts and illustrations in the electronic versions and paper versions.
4. Each group of students read two different storybooks either electronic or print based. A study of more storybook titles could provide more definitive results.
5. Multiple-choice questions and retelling were used to assess students' reading comprehension. Additional qualitative and quantitative measure of comprehension could be used to provide triangulation of data.
6. The reliability of the instruments (retelling and comprehension test) was not as high because of low numbers of items.

Conclusion

This study investigated the effects of electronic CD-ROM 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 showed that comprehension scores of the fourth-grade struggling readers were significantly higher than those of students reading printed storybooks and electronic storybooks without animation. Both retelling and comprehension test 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. 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 CD-ROM storybooks caused this result because their formats are more engaging, interesting, and thus, more motivating to readers (Pearman & Lefever-Davis, 2006).

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 study found that electronic storybooks might be beneficial in helping struggling readers better understand the narratives and animation feature of electronic CD-ROM storybooks which has the potential to improve struggling reader comprehension.

APPENDIX A
THE DATABASES AND KEYWORDS

The key databases used in collecting supporting literature for this study included:

Academic Search Premier (EBSCO)
Dissertations and Theses: Full Text (ProQuest)
University of Florida Electronic Theses & Dissertations
WorldCat Dissertations and Theses
Education Full Text (1983 to date)
ERIC
JSTOR
NetLibrary
Professional Development Collection (EBSCO)

Key words used for searches included:

#1 Electronic storybooks or
#2 CD-ROM storybooks or
#3 Electronic texts
#4 Digital literacy
#5 Electronic books
#6 (#1 or #2 or #3)

And

#7 Reading or
#8 Comprehension or
#9 Effects
#10 Influence
#11 Impact
#12 Interactive
#13 Animation
#14 Struggling reader or
#15 Low reading ability
#16 Reading difficulty
#17 Retelling
#18 (#7 or #8 or #9)
#19 (#14 or #15 or 16)

APPENDIX B
STUDENT SURVEY

Name _____ :

Group Number: _____

1. Are you Male or Female?

_____ Male _____ Female

2. What is your age?

_____ 9 _____ 10 _____ 11 _____ 12 _____ other

3. What is your race?

_____ White _____ White. Non-Hispanic _____ African-American _____ Hispanic _____
Asian-Pacific Islander _____ Native American _____ other

4. Have you ever read and/or seen on Video/TV/DVD/CD Arthur's Teacher Trouble and/or Sheila Rae, The Brave?

_____ Yes _____ No

5. Have you read a storybook on computer?

_____ Yes _____ No

6. Do you have a computer at home or get to use a computer outside of school?

_____ Yes _____ No

7. How many days of the week do you use a computer?

Home

_____ 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ None

School

_____ 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ None

8. What do you do on the computer outside of school?

_____ play games

_____ write

_____ email

_____ Internet

_____ read books

_____ lessons

_____ other Explain: _____

(Survey questions #6, #7, and #8 are based on a modified version of the "Computer Use Survey" originally developed by Cathy J. Pearman).

Pearman, C. (2003). *Effects of electronic texts on the independent reading comprehension of second grade students*. Unpublished doctoral dissertation, University of Arkansas.

APPENDIX C
STORY RETELLING ANALYSIS: MORROW'S 10-POINT SCALE

Name: _____ Date: _____

Title of Story: _____

General Directions: Place a 1 next to each element if the student includes it in his or her presentation. Credit gist as well as obvious recall.

Characters and Setting (4 points)

- a. Begins the story with an introduction _____
- b. Names the main character(s) _____
- c. Number of other characters named _____
- d. Actual number of other characters _____
- e. Score for "other characters" (c/d) _____
- f. Includes statement about time or place _____

Theme (1 point)

Refers to main character's primary goal
Or problem to be solved _____

Plot episodes (1 point)

- a. Number of episodes recalled _____
- b. Number of episodes in story _____
- c. Score for "plot episodes" (a/b) _____

Resolution (2 points)

- a. Names the problem solution/goal attainment _____
- b. Ends story _____

Sequence (2 points)

Retells story in structural order: setting, theme
Plot episodes, resolution. (Score 2 for proper,
1 for partial, 0 for no response) _____

Highest score possible: (10)

Child's score: _____

Comments:

Morrow, L.M. (1986). Effects of structural guidance in story retelling on children's dictation of original stories. *Journal of Reading Behavior*, 18(2), 135-152.

APPENDIX D
COMPREHENSION TESTS

Questions for Arthur's Teacher Trouble

Name :

Group Number :

Now I'm going to ask you some questions about the story you read. Each question is a multiple-choice question with four answer choices. Please read each question carefully and choose the ONE best answer. Just do your best, and don't worry if you don't know an answer.

1) What was the name of Arthur's teacher?

- Ratburn
- Fink
- Sweetwater
- Prunella

2) What did Arthur's mother think his map of Africa looked like?

- Canada
- Pizza
- Hawaii
- Florida

3) When was the spelling bee?

- At the end of the school year
- The first week of school
- The day before spring break
- About a month after the first day of school

4) When Mr. Ratburn announced a spelling test, why did Buster look pale?

- He loves spelling test
- He is white rabbit
- He was afraid
- He had a bad lunch

5) Where did Mrs. Fink's class go during Mr. Ratburn's spelling test?

- Auditorium
- Gym
- Aquarium
- Fishing

6) Arthur's family asked him if he had finished his chores and made his bed by spelling out the words because;

- They were animation a trick on Arthur
- They wanted to help him spell
- They were making fun of Arthur
- They did not think Arthur could hear them

7) During Mr. Ratburn's spelling test, what was Miss Sweetwater's class doing?

- Popping corn
- Reading
- Taking exam
- Taking a field trip

8) Who wears a good-luck charm?

- Brain
- D.W.
- Arthur
- Buster

9) What did they call the building where the Spellathon was held?

- Fraser Hall
- Auditorium
- Library
- Main office

10) What word did The Brain miss at the Spellathon?

- Preparation
- Convince
- Fear
- Chores

11) Who had first turn at the Spellathon?

- Buster
- Arthur
- Brain
- Prunella

12) Who was in charge at the Spellathon?

- Mrs. Fink
- Mr. Ratburn
- Ms. Meeker
- Principal

13) At the end of spelling bee D.W. has a surprising bad news...

- Ms. Meeker will be teaching kindergarten
- Mr. Ratburn will NOT be teaching third grade
- Arthur lost spelling bee
- There will NOT ever be another spelling bee

The questions for Arthur's Teacher Trouble are based on a modified version of the "Recall Questions" originally developed by Scoresby, Kevin J.).

Scoresby, K. J. (1996). *The effects of electronic storybook animations on third graders' story recall*. Unpublished doctoral dissertation, Brigham Young University.

Questions for Sheila Rae, the Brave

Name :

Group Number :

Now I'm going to ask you some questions about the story you read. Each question is a multiple-choice question with four answer choices. Please read each question carefully and choose the ONE best answer. Just do your best, and don't worry if you don't know an answer.

1) Sheila Rae was afraid of_____.

- The dark
- Thunder and lightning
- The big black dog
- Nothing

2) Sheila Rae thought _____ looked like the eyes of dead bears at dinner.

- Olives
- Beans
- Cherries
- Raisins

3) "Sheila Rae grabbed Louise and dashed up the street." What does the word "dashed" mean on the sentence?

- Move quickly
- Rescue
- Disappear
- Fighting

4) When her classmate stole her jump rope during recess, _____.

- Sheila Rae attacked him
- Sheila Rae tied him up
- Sheila Rae giggled
- Sheila Rae yelled angrily

5) What did she call Louise?

- Scaredy-cat
- Fearless
- Coward
- Brave

6) Why did Sheila Rae cry?

- Because she suffered an arm injury
- Because she lost
- Because she was sad
- Because she missed her parents

7) When Sheila Rae was afraid, where was Louis?

- At home
- At school
- Following Sheila Rae
- Riding her bicycle

8) Sheila Rae can BEST be described as_____?

- Busy
- Angry
- Fair
- Fearless

9) What is the thing Sheila Rae does in the story?

- She goes to outside to play
- She collects rocks
- She decides to walk home from school a new way
- She goes to soccer practice

10) Sheila Rae became afraid because nothing looked familiar. What does “familiar” mean in the sentence?

- Recognizable
- Unknown
- Strange
- Foreign

11) Sheila Rae pretended that the trees were_____?

- Cars
- Her friends
- Houses
- Evil creatures

12) When Louise and Sheila Rae walked home at the end of the story, who was fearless?

- Sheila Rae
- Laura
- Louise
- Wendell

13) What do the sisters learn in this story?

- Having to share is good in some ways
- It's good to have different toys
- Do not be too brave
- When you make a mess, you have to clean it up

APPENDIX E
STORYBOOK LIST

TRADITIONAL:

Brown, M. (1986). *Arthur's Teacher Trouble*. Boston: Little, Brown, and Company.

Henkes, K. (1987). *Sheila Rae, the Brave*. New York: Greenwillow Books.

ELECTRONIC:

Brown, M. (1994). *Arthur's Teacher Trouble* [CD-ROM]. Novato, CA: Living Books.

Henkes, K. (1996). *Sheila Rae, the Brave* [CD-ROM]. Novato, CA: Living Books.

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BIOGRAPHICAL SKETCH

Ihsan Seyit Ertem was born in Yesilhisar, Turkey. The youngest of three children, he grew up mostly in Yesilhisar, graduating from Yesilhisar High School in 1988. He earned his two-year college degree from Ankara University Kirikkale Technical Vocational School of Higher Education in 1990, with a major in Business. He also received his B.A. degree in curriculum and instruction at Ankara University in July, 1994. Ihsan worked for several years as an elementary school teacher in Turkey. During his teaching career, he has taught the span of second graders to fifth graders, as well as counseling students. In 1997, he started to work as a Curriculum Development Specialist at the National Ministry of Education of Turkey, in Ankara/Turkey. In 1999, he was awarded a scholarship from Ministry of Education of Turkey to pursue his Master and Ph.D. degrees in the United States of America. Ihsan received his M.Ed. degree in May, 2002 from University of Missouri-Columbia with major in Elementary Education and his Doctor of Philosophy (Ph.D.) degree from College of Education, at the University of Florida. His current research interests include the integration of technology and literacy, personalization of electronic texts and using assistive technology to support struggling readers. After graduation, Ihsan Seyit Ertem will start teaching in the College of Education, Ankara, Turkey.