

THE EFFECT OF EMBEDDED TEXT-TO-SPEECH AND VOCABULARY EBOOK SCAFFOLDS ON THE COMPREHENSION OF STUDENTS WITH READING DISABILITIES

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Limited research exists concerning the effect of interactive electronic texts or eBooks on the reading comprehension of students with reading disabilities. The purpose of this study was to determine if there was a significant difference in oral retelling and comprehension performance on multiple-choice questions when 17 students with reading disabilities in third (n = 10) and fourth (n = 7) grade read eBooks under three different book formats. Participants read text presented in 3 formats with varying levels of built-in scaffolds including text-to-speech and vocabulary supports. Results of a Friedman's Test revealed a significant effect of the different book formats on comprehension measured by oral retelling, but not for comprehension measured by multiple-choice questions.

The fundamental goal of reading is to efficiently decode and comprehend the printed word (Hall, Hughes, & Filbert, 2000). Most often classroom reading instruction focuses on improving students' decoding and comprehension skills. However, educators today are faced with an increasing number of students who are not successfully learning these key skills (Hall et al., 2000). Approximately, only 31% of the nation's fourth graders performed at or above proficiency levels in reading with 36% scoring at or below the basic level (National Assessment of Educational Progress [NAEP], 2005). These statistics are a concern for educators who worry that deficiencies in reading may lead to negative outcomes in adulthood. For instance, struggling readers may not be prepared to be successful adults especially in the areas of secure employment and personal autonomy (Calhoun, 2005). Also, students continuing to struggle in school and reading in the upper grades are more likely to drop out, be unemployed, have a lower income, and have poor health (National Center for Educational Statistics [NCES], 2004 2006).

One specific group of students that significantly struggle with reading difficulties are those with documented learning disabilities (Stetter & Hughes, 2010). Nearly half of students receiving special education services under the Individuals with Disability Education Act (IDEA) do so under the Learning Disability category (Wanzek, Otaiba, & Petscher, 2014). Approximately 80% of these students with a learning disability are identified as having a reading disability (Hudson, High, & Otaiba, 2007). Difficulties in the reading process may be contributed to a number of factors such as cognitive factors like errors in written spelling or syntax (Aaron, Phillips, & Larsen, 1998; Wright, Fugett, & Caputa, 2013), non-cognitive factors like poor motivation or inadequate schooling, or neurobiological factors located physically in the brain (Hudson et al., 2007). Reading difficulties have also been connected with phonological processing problems (Ritchey, 2011). No matter the cause of reading deficiencies, students who consistently struggle to read and comprehend text exhibit specific characteristics and weaknesses in the key areas of reading. For example, students with reading disabilities have problems with fluent word recognition, decoding difficulties, and difficulty in using letter/sound relationships in combination with context to identify unknown words (Chard, Ketterlin-Geller, Baker, Doabler, & Apichatabutra, 2009; Hudson, High, & Otaiba, 2007). These reading problems can lead to poor fluency, which in turn may result in poor comprehension (Pikulski & Chard, 2005; Sze, 2009) and decreased reading independence (Adams, 1990).

It would seem sensible and logical for students with reading disabilities to be provided with increased intensive reading instruction and guided reading practice to help remediate their reading deficiencies. However, in reality, students with reading disabilities often spend little time actually engaged in the task of reading (Swanson, 2008). Simply, students with reading disabilities do not practice the task of reading

enough (Hall et al., 2000) and are often being instructed by educators who lack sufficient and accurate knowledge to teach this population of struggling readers (Washburn, Joshi, & Cantrell, 2011). It is clear that more intensive and high quality instructional time is needed for students with reading disabilities, but according to Hall et al. (2000) increased instructional time is not easily accomplished because of teacher shortages, financial limitations, and time factors. Educators understand and recognize the need and importance of improving reading comprehension and achievement in students with reading disabilities especially because of mandates of the No Child Left Behind Act (NCLB) of 2001, which dictates that all students, including those with disabilities, reach grade level performance targets by 2014. One promising supplemental instructional tool that may help in addressing these limitations is computer-assisted instruction.

Literature Review

Computer-Assisted Instruction

Computer-assisted instruction is one method that educators rely on to help remediate reading deficiencies. Computer-assisted instruction is mediated learning that includes online and/or automated applications (Johnson & Johnson, 2006) that is used as a supplement for traditional teacher instruction (Lowe, 2001). In addition, computer-assisted instruction entails the use of software, the Internet, or CD-ROM on a computer to reach or help teach instructional goals (Johnson & Johnson, 2006; Lowe, 2001). Computer-assisted instruction may have the potential to promote reading skills for students at risk for reading failure (National Reading Panel, 2000) and may help decrease the achievement gap in reading (Jimenez, 2003). It may also hold promise for those students with reading disabilities because this technology can help improve and develop their reading skills (Hall et al., 2000; MacArthur, Ferretti, Okolo, & Cavalier, 2001; Zascavage & Winterman, 2009) as well as improve students' attention within the classroom (Rabiner, Murray, Skinner, & Malone, 2009). Finally, according to Hall et al. (2000), computer-assisted instruction can provide the needed extra time, guided practice, and supplemental instruction that students with reading disabilities require to be more successful in the reading process and perhaps at the same time decrease the achievement gap that exists between those without disabilities.

eBooks

One specific example of computer-assisted instruction that holds promise in remediating reading difficulties is electronic reading environments, which consist of computer-based texts and multimedia supports. Electronic reading environments are most often referred to as electronic books or eBooks. eBooks can be defined as a form of an interactive story which includes multimedia effects such as written text, music, sound effects, animations (Shamir & Korat, 2007). eBooks typically have electronic text that is presented to the reader visually. However, the delivery method of the eBook is not important (Anderson-Inman & Horney, 1997). For example, some eBooks are on a CD-ROM, imbedded into the desktop or laptop computer, retrieved from the Internet, and most recently found on handheld tablets or in applications. Also, eBooks have the look and feel of more traditional books (Anderson-Inman & Horney, 1999). This means that the eBook still maintains the feel of a traditional book by having pages and allowing the reader to add a bookmark or make notes within the eBook. An additional common feature of eBooks is multimedia effects such as animation, music, sound effects, highlighted text, dictionaries, and modeled fluent reading to enhance and aid the reading experience and process (Korat, 2006; Labbo, 2000). Many eBooks contain interactive hotspots that when activated leads to elaboration on pictures or texts and in some cases an animation of the text. eBooks that include these multimedia effects are considered supported texts (Matthew, 1997; Moody, Justice, & Cabell, 2010).

Scaffolds and eBooks

The features found in the eBooks provide scaffolds to assist in the reading process and can be linked to Vygotsky's theory of scaffolding and zone of proximal development (ZPD). The concepts of the zone of proximal development (Vygotsky, 1978) and scaffolding (Vygotsky, 1978; Wood, Bruner, & Ross, 1976) are closely interconnected being that the term scaffolding was developed from Vygotsky's (1978) work concerning the ZPD. ZPD is defined as *The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers* (Vygotsky, 1978, p. 86). In other words, the ZPD is the difference between what a child can do without help from an adult or more capable peer and what that child can do with help from an adult. In order to provide adequate instruction in the ZPD, teachers must provide necessary supports, which Wood et al. (1976) referred to as scaffolds.

Scaffolds are defined as a support *that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts* (Wood et al., 1976, p. 90). Scaffolds are the appropriate assistance provided for students in order for them to achieve or accomplish something that normally would be too difficult for them to do independently without these supports. Environments that provide scaffolds for learning are effective because they allow novice learners to solve problems, complete tasks or accomplish goals that they normally could not do independently (Stone, 2002). Scaffolds can also be considered *one of the most recommended, versatile, and powerful instructional techniques* in education today (Clark & Graves, 2005, p. 570) allowing students to work in their ZPD.

Both the concepts of ZPD and scaffolding can be applied to the eBooks used in this study. Instead of an adult or a more capable peer providing scaffolds for a child to work in his or her ZPD, the embedded supports found in the interactive eBooks provided these scaffolds. Likewise, according to Englert, Zhao, Dunsmore, Collings, and Wolbers (2007), *technologies like eBooks can be designed to offer scaffolds that lead cognitive functions that are newly emerging, and to prompt routines and processes in a timely way just like a tutor might prompt* (p. 11). In other words, eBooks can aid and scaffold new mental processes in the same way that a teacher or tutor would. Specific features in eBooks such as text-to-speech (TSS), embedded vocabulary supports, and animated graphics serve as scaffolds for readers, which have all been utilized with practical benefits for many years (Englert, Wu, & Zhao, 2005; Larson, 2010). The embedded supports can also assist in the development of various reading skills (Pearman & Lefever-Davis, 2006; Quintana, Zhang, & Krajcik, 2005). These scaffolds can support reading, help students with reading disabilities feel confident in using technology to support their reading (Rhodes & Milby, 2007) and at the same time help them master reading tasks that they may not have been able to do on their own. Often scaffolds available in eBooks allow for students to read books that they may not have been able to read independently with the absence of the supports. These scaffolds present in eBooks allow students to work in their ZPD, which is where the most effective learning occurs (Vygotsky, 1978).

Limitations of eBooks

Yet, some researchers claim that the use of eBooks can also hinder the reading process. For instance, the multimedia enhancements (animations, sound effects, pronunciation of words, etc.) in eBooks may be distractions for some students (Lefever-Davis & Pearman, 2005; Schugar, Smith, & Schugar, 2013) and readers may focus on the extraneous features of the eBooks rather than the key points of the text. In addition, eBooks can take longer to read than traditional books (Grimshaw et al., 2007). Longer reading time may be due to the fact that eBooks limit the ability for readers to manually track text with a finger or bookmark or that readers spend increased time exploring the supports and hotspots eBooks offer. Another possible limitation to eBooks is that they may contribute to learned helplessness in some students (Lefever-Davis & Pearman, 2005). In other words, students may become dependent on the pronunciation tools embedded in the books and not try to decode the words on their own; thus, becoming passive rather than active readers.

Reading Achievement and eBooks

Research on the use of eBooks has indicated that they benefit the reading process in areas such as reading comprehension (Doty, Popplewell, & Byers, 2001; Matthew, 1997; Pearman, 2008), fluency (Oakley, 2003), reading engagement (Clyde, 2005; Labbo, 2000) and simply can make reading easier (Bus, de Jong & Verhallen, 2006; Labbo, 2006) by reducing the burden of decoding. Specifically, the impact of eBooks on student reading comprehension is a key research agenda for researchers and most studies resulted in positive outcomes. For instance, Greenlee-Moore and Smith (1994) found that electronic books with difficult text resulted in significantly higher comprehension scores, while no difference was found in text that was easier and shorter. In a second study, Matthew (1997) concluded that students' comprehension scores on a written retelling were significantly higher for those students reading eBooks than those reading traditional books. Doty et al. (2001) study results concluded that scores on comprehension questions were significantly higher for students reading eBooks in comparison to students reading traditional books. Lastly, Pearman (2008) found that reading eBooks resulted in significantly higher retelling scores. Further information and conclusions regarding the above studies as well as additional eBook studies can be found in Table 1.

Overall, positive outcomes on student comprehension were found in most studies concerning the efficacy of eBooks on student comprehension. However, after the examination of the few available studies, it is evident that gaps still exist in the research base concerning eBooks and student comprehension. This gap is especially significant in the area regarding students with reading disabilities. At the time of the

literature review, limited to no research was located concerning this population, reading comprehension, and eBooks. There is clearly a need for improved research in special education in the area of technology and reading (MacArthur et al., 2001). Specifically, research needs to be conducted using students with disabilities in reading to help educators and researchers understand how eBooks may impact their comprehension. Most of the research reviewed involved the comparison of two reading environments, one of those environments being traditional text and the other eBooks. No research was located that specifically compared the impact of different levels of support (Full TSS, vocabulary, pronunciation, etc.) found in eBooks on student comprehension. Therefore, the current study attempted to address the gaps concerning participants and book format.

Table 1. Studies Investigating eBooks and Comprehension

Authors	Participants	Results
Greenlee-Moore and Smith (1994)	Fourth graders (<i>N</i> = 31)	eBooks with difficult text resulted in significantly higher comprehension question scores. No significant difference was found between formats when simple text was used.
Matthew (1997) Study 1	Third graders (<i>N</i> = 74)	eBooks resulted in significantly higher retelling scores, but not on comprehension questions.
Matthew (1997) Study 2	Third graders (<i>N</i> = 30)	eBooks resulted in significantly higher retelling scores.
Doty et al. (2001)	Second graders (<i>N</i> = 39)	eBooks resulted in significantly higher scores on comprehension questions, but not on retellings.
Trushell et al. (2003)	8-9 year olds (<i>N</i> = 36)	The <i>Read to me</i> mode resulted in better recall of event story structure.
Pearman (2008)	Second graders (<i>N</i> = 54)	eBooks resulted in significantly higher retelling scores.

Purpose

The purpose of the study was to determine if there was a significant difference in oral retelling and comprehension performance on multiple-choice questions when students with reading disabilities in third and fourth grade read eBooks under three different book formats. Participants were exposed to all three book formats in a repeated measures study design, which helped control for the possibility of a confounding test order effect and/or testing effect. Participants did not read more than one book format in a week and were randomly assigned to each book order. The three book formats are briefly described below.

Format 1 (F1):

eBooks with an embedded text-to-speech (TSS) tool. The TTS tool reads entire text. Words are highlighted red while the tool reads the text. Reader reads text simultaneously with tool.

Format 2 (F2):

eBooks with vocabulary and pronunciation supports provided for select words. Vocabulary support consisted of definitions of key vocabulary in the text, and pronunciation supports entailed the TTS tool reading select words. Participants were required to activate all supports during this format by clicking with a mouse on these words in the text.

Format 3 (F3):

Traditional print format books with no added supports. These books were paper printed documents that consisted of paper bound between two covers.

Method

Participants and Setting

Participants were drawn from a suburban elementary school in a Mid Atlantic state. A total of 489 students in grades kindergarten through fourth grade attend this school where the demographic make-up is 4.1% Asian, 3.3% Black, 14.3% Hispanic, and 78.3% White. In the selected elementary school, there were 13 students in third grade and 10 students in fourth grade with documented reading disabilities, which resulted in a sampling pool of 23. A convenience sample was drawn from this pool and all the students who submitted consent forms were selected to participate. At the conclusion of the sampling procedures, study participants totaled 17 third ($n = 10$) and fourth ($n = 7$) grade students identified as having reading disabilities. Further details concerning the demographics of the study participants can be found in Table 2.

All participants had an Individualized Education Plan (IEP) and received reading instruction in either a resource center classroom or self-contained classroom from a certified special education teacher. Students in the self-contained classroom were considered to have more significant reading disabilities than those students in the resource center. Specific details regarding the extent of the participants' reading disabilities were not available to the researcher. However, in order for the participants to be labeled with a disability in reading in the selected school district a significant discrepancy was required between measured I.Q. (Wechsler Intelligence Scale for Children IV) and reading achievement scores (Woodcock Johnson Test of Achievement). All participants were reading at least one year below grade level with reading levels varying from first to third grade. A summary of participant reading level variance can be found in Table 2. The study occurred during an after school reading program.

Table 2. Demographics of Study Participants

Demographic	Grade 3	Grade 4	Total
Students with RD	10	7	17
Sex			
Male	6	6	12
Female	4	1	5
Ethnicity			
Asian	0	1	1
Hispanic	3	1	4
White	7	5	12
Reading Levels			
Grade 1	6	0	6
Grade 2	4	3	7
Grade 3	0	4	4

Materials: eBooks

The eBooks used for this study were obtained from an Internet based website designed to supply educators with an on-line leveled library for children in grades K-6 to supplement reading curriculum. Numerous books were available across reading levels and grades, as well as across topics in nonfiction and fiction. Every book found in the on-line library can be accessed in three different formats or varying levels of support. For instance, students can read along with books using TTS tools, practice reading with only pronunciation and vocabulary supports, and/or read books with no supports. The traditional print books were obtained through a similar website. The website was selected because the characteristics of the books were similar to the eBooks in areas including reading levels, story type and organization, word counts, and illustrations. The selected books were downloaded, printed, and assembled to resemble traditional print books. Participants were assigned books based on their instructional reading levels as measured by the Developmental Reading Assessment (DRA Beaver, 2005). Participants read three books for each book format, which included two narrative texts and one expository text. Books were classified as narrative if they included the story grammar elements of setting, characters, plot, conflict, and resolution. On the other hand, books were identified as expository if they included text structures such as description, sequence, compare/contrast, cause/effect, or problem solution.

Instruments

Comprehension was measured through both oral retellings and multiple-choice questions. Oral retelling can be defined as the oral post reading recalls during which children relate what they remember from reading or listening to a particular text. Oral retellings obtained from the narrative texts were scored using Morrow's (1985) 10-Point Scale and retellings from the expository text were scored using the

Expository Retelling Analysis Scale (Gonzalez, 2010). Copies of both scales can be found in the Appendix. Morrow's (1985) 10-Point Scale scores narrative retellings based on the inclusion of the following story elements: (a) characters and setting, (b) theme, (c) plot episodes, (d) resolution, and (e) sequence. Morrow (1986) determined the overall mean inter-rater reliability coefficient of the scale as 0.90, which can be interpreted as a high correlation.

Comprehension scores based on the oral retelling of expository text came from the Expository Retelling Analysis Scale. Each expository retelling was scored for the inclusion of the following elements: (a) topic-states what the story is about (b) main idea(s)-names the main ideas from the book, (c) details-names the supporting details of each main idea, (d) vocabulary-uses vocabulary from the story, and (e) accuracy-retells facts accurately. During a pilot study of this scale (Gonzalez, 2010), two raters independently scored 12 different expository retellings. An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency between the two raters. The overall inter-rater reliability was determined to be $Kappa = 0.68$ ($p < 0.001$), which can be interpreted as a substantial correlation (Landis & Koch, 1977).

During the current study, two raters independently scored all the oral retellings to establish inter-rater reliability. Inter-rater reliability was determined through the Cohen's Kappa procedure and was found to be $Kappa = 0.777$ ($p < 0.001$), which can be interpreted as a substantial correlation (Landis & Koch, 1977). Lastly, the oral retelling comprehension scores for all three books under each book format were averaged to obtain a mean score, which was used in the data analysis (Friedman's Test).

Comprehension scores were also collected using multiple-choice comprehension questions. The comprehension questions utilized were obtained through the creator of both the eBooks and traditional print books. The comprehension questions included factual, vocabulary, and inferential type questions. For every question there was a choice of three to four possible answers. The number of multiple-choice questions varied by reading level and ranged from five to twelve questions. Because the total question numbers were not equal for each book, the raw scores were converted into percent correct. The percent correct scores for all three books under each book format were averaged to obtain a mean percent correct score, which was used in the data analysis (Friedman's Test).

Data Collection Procedures

eBooks

During each book format session, the participants read three books, which included two narrative books and one expository book. Both expository text and narrative text were selected because the use of both narrative and expository text is consistent with the current focus on reading demands for students in third and fourth grades. Multiple books helped to control for the differential background knowledge of the participants concerning the selected texts. The order of the books was also randomized for each participant, which helped control for factors such as reading fatigue, background knowledge, and a possible testing effect.

Before Reading

Before reading the books in each format, the title was read to and discussed with each participant. Questions were asked to prompt discussion. These questions included, *What do you think this book is about?* or *Make a prediction about what you think is going to happen in this story.* For expository books, the participants were asked, *What do you think this book is about?* and *What do you know about this topic?* When reading the eBooks, participants were shown how to turn the pages, activate vocabulary and pronunciation supports with a click of the mouse. Participants read each book independently and received no help in the reading or defining any unknown words. Participants were given the option of reading the texts silently or aloud.

Post Reading

After reading each text, the participants completed an oral retelling and answered multiple-choice questions. Before each retelling each book, participants were prompted with *Tell me about the story you just read* or *Can you tell me about the story that you just read?* If the participants read the story aloud, they were prompted with *Pretend that you are telling this story to a friend who never heard it before, what will you tell them?* The rationale for a different prompt when text was read aloud was due to the idea that they may retell less due to the fact they knew that the research assistant just heard the story (Leslie, 1993). If the participants stopped during the retelling, they were prompted with the questions,

Can you tell me more? or What happened next? No prompts were given to the participants that may have helped with content.

The comprehension questions and multiple-choice answers were all read orally to the participants. Questions and answer choices were read to participants to insure that the comprehension of the questions did not impact with the comprehension of the text. Participants pointed to their selected answer and the research assistants marked the identified answer. Questions and the multiple-choice answers were reread only if participants requested that they be reread. Questions were not rephrased to help with understanding.

Research Assistants

Multiple research assistants ($N = 13$) were recruited and trained to help implement the study. Each assistant was trained in the data collection procedures prior to the start of the study and given a detailed script to follow to help standardize the interventions. A fidelity check was completed using a checklist for each research assistant in order to check the assistants' compliance to research protocol. One research session was video recorded for each research assistant and the sessions' fidelity was found to be at 96 %.

Results

A Friedman's Test was conducted to evaluate differences in medians for both the oral retelling scores and the multiple-choice question scores when students with reading disabilities read text on their instructional level presented in the three different book formats. The mean comprehension score for each book format was used in the statistical analysis. Table 3 summarizes the descriptive statistics.

Table 3. Descriptive Statistics for Comprehension Measures

Book Format	Measure	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>N</i>
Format 1: eBooks with full TTS narration	Oral Retell	5.210	5.270	1.418	17
	Multiple-choice	72.829	76.70	18.050	17
Format 2: eBooks with select vocabulary and TTS support	Oral Retell	4.046	4.450	1.761	17
	Multiple-choice	66.565	70.00	16.745	17
Format 3: Traditional print books with no added supports	Oral Retell	3.723	4.128	1.777	17
	Multiple-choice	68.018	66.70	14.595	17

The results of the Friedman's Test were mixed. Results indicated that the multiple-choice comprehension scores did not significantly change across book formats, $\chi^2(2, N = 17) = 5.903, p = 0.052$. However, results indicated that there was a significant difference in oral retelling scores across book formats, $\chi^2(2, N = 17) = 11.412, p = 0.003$. These results imply that the participants comprehended differently during each book format as measured through oral retellings, but they did not comprehend differently during each format as measured through multiple-choice questions.

Further statistical analysis was utilized to determine if there was any significant difference between oral retelling scores and book format. Therefore, a *post hoc* analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $p < 0.017$. Bonferroni corrected *post hoc* tests showed that F1 oral retelling scores were significantly higher than both F2 oral retelling ($z = -2.485, p = .013, r = -.348$) and F3 oral retelling ($z = -2.911, p = .004, r = -.408$) and that F2 and F3 did not significantly differ ($z = -1.207, p = .227, r = -.169$).

Results suggested that the participants had higher oral retelling scores when they read eBooks with full TTS narration when compared to reading eBooks with vocabulary and TTS support on select words and reading traditional print text with no supports. These results imply that the added full TTS support positively affected the reading achievement of the participants when compared to text that did not have this full support.

Discussion

The purpose of the study was to determine if there was a significant difference in oral retelling and comprehension performance on multiple-choice questions when students with reading disabilities in third and fourth grade read eBooks under three different book formats. The following discussion will examine the impact of eBooks on both oral retelling and comprehension performance on multiple-choice questions. The current study results will be compared to other eBook studies previously conducted. Analyses of study results will also be conducted in order to provide a rationale for study outcomes.

Impact of eBooks on Oral Retelling

Study findings indicated that the full TTS narration scaffolds found in the eBooks helped the participants' comprehension when measured through oral retellings. More specifically, findings showed that eBooks with full TTS narration (F1) significantly impacted reading achievement of students with reading disabilities when compared to eBooks that only had some TTS and vocabulary support (F2) or traditional text with no support (F3). In addition, the results implied that eBooks with some TTS and vocabulary support (F2) do not enhance comprehension when compared to traditional text with no added supports (F3). Therefore, it can be concluded that the full TTS supports in the eBooks helped the participants' comprehension when measured through oral retellings. These results can support the concept that TTS tools may be considered a scaffold for those with reading disabilities allowing these individuals to more effectively work in their zones of proximal development (ZPD; Vygotsky, 1978) and perform at a higher level than without these supports.

The study results can be compared with other studies investigating the impact of eBooks on reading comprehension. For instance, these results are in agreement with earlier findings by Matthew (1997) and Pearman (2008) who both found that reading eBooks resulted in significantly higher comprehension scores when measured through retelling. In contrast, the results were inconsistent with a study conducted by Doty et al. (2001) who determined that eBooks did not result in significantly higher comprehension scores when measured through retelling. Differences between the current study and the Doty et al. study, such as study design, participant type, and data collection procedures, may all help explain these inconsistent results.

More specifically, Doty et al. (2001) implemented an experimental and control group design, in which different participants read the traditional text and the electronic text when the current study used a repeated measures design. The use of the same participants for each book format may have helped reduce the confounding variable of participant differences. A second difference was the participants used in each study. The current study used participants with reading disabilities, while Doty et al. used students without disabilities. Characteristics of each group clearly could have impacted results. A third significant difference was that participants in the Doty et al. study were allowed to ask for help and clarification if needed during reading, which was not a condition in the current study. This extra help may have had an effect on the participants' comprehension.

The current study also resulted in contradictory or surprising results. For instance, study results indicated that there was no difference in oral retelling scores when participants read eBooks with TTS and vocabulary support on select words when compared to traditional text with no added supports. This conclusion was somewhat surprising because it was expected that by providing TTS and vocabulary support on select words comprehension would be enhanced in comparison to traditional text without these supports. A possible explanation for these findings may be contributed to the careful match between text difficulty and reader ability. The study participants were reading text on their instructional level, which may have caused the text not to be difficult enough to see a possible benefit of the extra supports on comprehension. Text on a more difficult level, such as participants' frustration level, may have yielded different results.

A second possible reason for the results was that the participants did not have a choice as to what words would be read by the TTS tool or to what words would be provided with definitions. The words in the eBooks with these scaffolds were predetermined by the book creators allowing the participants not to have full control over the scaffolds needed for successful reading. During informal field observations, it was noted that many of the preselected words were known words to the participants and at times clicking onto the words seemed to slow down the reading process and proved to be a distraction. These informal observations were consistent to ones made by Lefever-Davis and Pearman (2005) who also noted that some of the features of the eBooks used in their study proved to be distractions for some students and that most of the distractions were the result of the pronunciation of words.

Additional informal field observations further revealed there were many unknown words to the participants that did not have either the vocabulary or TTS scaffolds. No logical pattern or explanation could be found as to why some words were given scaffolds and others were not in the eBooks. This characteristic of the eBooks used in the current study should warn educators and researchers to carefully examine electronic text to ensure that is a good match for the reader and contains appropriate supports. eBooks where participants have more control over the built-in scaffolds may produce different results

and assist researchers in understanding how readers use scaffolds to aid in the reading process and to enhance reading comprehension.

Impact of eBooks on Multiple Choice Questions

The study results also showed that the participants did not comprehend differently during each book format when measured through multiple-choice questions. Therefore, results indicated that the built-in scaffolds in the eBooks did not impact comprehension when measured through multiple-choice questions. Results can be compared to other studies investigating the impact of eBooks on multiple-choice questions. For instance, these results were consistent with both Matthew (1997) and Greenlee-Moore and Smith (1994) who also found electronic books did not result in significantly higher multiple-choice question scores. On the other hand, study results were inconsistent with a study conducted by Doty et al. (2001) who found eBooks had a significant impact on participants' scores on comprehension questions. However, significant differences exist between the Doty et al. study and the present study, which may account for the inconsistent results. For example, Doty et al. measured comprehension through open-ended questions rather than multiple-choice questions. Also, a control group experimental group design was utilized rather than a repeated measure design that can help control for participant differences. Unlike in the present study where readers independently read the text, participants in the Doty et al. study were allowed to ask for clarification and help during reading the text. Lastly, the study sample consisted of average readers in second grade instead of third- and fourth-grade students with reading disabilities

Reading Comprehension Measures

Furthermore, the current study finding of no significant effect of book formats on the multiple-choice question scores contradicts the positive results of the scaffolds on the oral retelling scores. A possible contribution to the conflicting results may be attributed to the selected reading comprehension measures, oral retellings and multiple-choice questions. This is supported too by research that has illustrated that comprehension is dependent on the format of the assessment (Cutting & Scarborough, 2006). Oral retellings are simply the verbal reconstruction of text and they allow the reader to restructure the text in a more holistic manner in comparison to other comprehension measures (Gambrell, Koskinen, & Kapinus, 1991) and many researchers argue that retellings are valid tools to use in assessing children's true comprehension of text (Morrow, 1993; Doty et al., 2001). On the other hand, multiple-choice questions involve different thought processes and are considered to have many flaws or weaknesses (Dillon, 2006). For instance, multiple-choice questions have an unnatural format and require a higher level of self-restraint when selecting an answer choice (Schutz et al., 2008). Often impulsivity provides the student with an easy escape from a challenging or frustrating question (Schutz et al., 2008). In other words, instead of thoughtfully considering each answer choice on a challenging question some students tend to guess at the best answer.

In addition, multiple-choice questions require readers to use different cognitive processes than retellings. During retellings readers sequentially retell the story in their own words including all essential story elements (characters, problem, events, conclusion, etc.). In multiple-choice questions, different answer choices have to be compared to select an appropriate answer, which requires higher processing demands than other comprehension measures (Cain & Oakhill, 2006). Students with reading disabilities often exhibit information-processing difficulties (Swanson & Siegle, 2001), which may limit their success on these types of questions.

Only sophisticated test takers realize that multiple-choice questions require a comparison of the answer choices (Schutz et al., 2008) and generally students with reading disabilities are not labeled as sophisticated test takers. In order for students with reading disabilities to be successful on multiple-choice questions, they require extensive practice and feedback (Schutz et al., 2008). Also, answering multiple-choice questions accurately requires a strong working memory and skills in semantics (Schutz et al., 2008). However, students with reading disabilities are deficient in the skills of working memory (Cain, 2006; Swanson & Howard, 2005) and semantics (Snowling & Hulme, 2006). Therefore, these weaknesses may correlate with poor performance on multiple-choice questions.

It is difficult to conclude that the study outcome of no effect of book format on the multiple-choice question scores was a result of the book formats or just the nature of the multiple-choice questions. Results may just be contributed to idea that the participants were poor multiple-choice test takers due to weaknesses in processing and working memory. These weaknesses too may override the possible benefits of the scaffolds found in the eBooks. The use of other comprehension measures, such as cloze passages, open ended questions, and response logs, may provide evidence that a measured effect was not

necessarily due to the nature of a specific comprehension measure and may help researchers better understand how eBooks facilitate comprehension.

Recommendations for Action

eBooks can easily be used within a classroom or school to help facilitate the comprehension of students with reading disabilities. For instance, educators can be encouraged to use eBooks as a literacy center or for independent reading time, which may increase the time spent on reading. Increased reading time may help overcome the Matthew effect (Stanovich, 1986), which states that students with reading disabilities receive less reading time than their peers. eBooks are also ideal for independent reading time because the text-to-speech (TTS) tools found in most eBooks helps students work independently and limits the need of the teacher to help decode words. In many instances, students become embarrassed if they need to constantly ask for help to read unknown words. At the same time, the TTS tools found in eBooks decrease or eliminate the need for students to focus on decoding the text, which allows them to focus on comprehending the text instead (Pearman, 2008).

Additionally, educators can use eBooks as a link with reading practice at home. Many eBooks are available on-line, as were the eBooks used in the current study. Teachers can easily assign eBooks to read for homework and not worry about an adequate number of book copies or getting books to return to school as they do with traditional text. Moreover, educators can use eBooks to scaffold books for individual students in the classroom. For instance, students can independently preview a book that will be read in their guided reading group or a book that will be read with the whole class. This may help foster students' comprehension and boost their confidence when the time comes to read a particular book with the whole class or small reading group. It may too help increase engagement and motivation to read because eBooks allow for students to have access to texts that are on their grade level.

Lastly, eBooks can possibly be used to facilitate fluency. Improved fluency can lead to improved comprehension (Daane, Campbell, Grigg, Goodman, & Oranje, 2005). This is true because more fluent readers use fewer cognitive skills to decode text, which allows for more cognitive skills to be used to comprehend the text leading to improved comprehension (Rasinski, 2012). Also, the TTS capability in eBooks allows students to hear fluent readers. Many eBooks have a setting where the entire book can be read to an individual through the TTS tool. These TTS narrators then become effective reading models for students. Students can choose to read along with the narration as well. Many eBook programs, like the one used in the current study, permit students to record their oral reading. The use of both the TTS narration and recording capabilities in eBooks allow for educators to use the strategy of repeated reading, which is simply reading a text more than once. The use of the repeated reading strategy can lead to improved comprehension (Staudt, 2009). However, further research is needed to make a direct connection between the use of eBooks and improved fluency for students with reading disabilities.

Conclusion

The purpose of the study was to determine if there was a significant difference in oral retelling and comprehension performance on multiple-choice questions when students with reading disabilities in third and fourth grade read eBooks under three different book formats. Prior to this study, researchers were interested only in the impact of eBooks on the comprehension of average readers. Limited research exists that directly investigated the effect of eBooks on the comprehension of students with reading disabilities. Therefore, results of the current study made a unique contribution to research concerning eBooks and this at-risk population.

It is difficult to conclude that findings from this study indicate that eBooks can enhance reading comprehension in students with reading disabilities mainly due to the mixed results and limitations of the study. Further investigation is recommended to extend the results. A larger sample that is randomly selected and consists of a sole grade level is evidently needed. A larger sample size would eliminate the need to use a non-parametric statistical analysis, as was the case in the current study. A parametric statistical analysis could possibly lead to more powerful results. A single grade level would eliminate the possibility that grade level influenced results. The possibility of using a single grade level and larger sample could lead to more conclusive results concerning the impact of eBook supports on the comprehension of students with reading disabilities.

One specific area of interest concerns how readers utilize the built-in scaffolds found in eBooks. It is recommended that researchers investigate how readers access these scaffolds. Researchers should investigate whether readers access the scaffolds independently or need training and prompts, as well as if

there is any correlation between the number and type of scaffolds accessed and comprehension scores. Lastly, research can be extended to average readers, English language learners, and/or students with sensory impairments. The extension of the research to other populations will possibly provide greater insight into how eBook supports impact the comprehension of other readers not just those who struggle in the reading process.

In conclusion, according to the literature the features of eBooks may have benefits for students. The features in eBooks can make reading enjoyable for students and eBooks can help decrease the decoding burden for struggling readers (Pearman & Lefever-Davis, 2006). Also, they help increase and assist comprehension in struggling readers (Izzo, Yurick, & McArrell, 2009). Additionally, eBooks can provide scaffolds or supports to help students read books that they may normally have difficulty reading without these supports (Rhodes & Milby, 2007). Scaffolds can be considered *one of the most recommended, versatile, and powerful instructional techniques* in education today (Clark & Graves, 2005, p. 570). Scaffolds such as TTS narration can reduce the load on the readers' working memory (Grimshaw et al. 2008), which has been found to be one important aspect of successful comprehension (Oakhill, Cain, & Bryant, 2003). Using eBooks in the classroom as part of the reading curriculum, a learning center, or homework extension may be beneficial to readers. eBooks have the potential to assist educators in meeting the various reading needs in a single classroom and at the same time provide supplemental reading instruction for those students most at risk for reading failure.

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Appendix

Morrow's 10-Point Scale: Story Retelling Analysis

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

Characters and Setting

- A. Begins story with an introduction _____
- B. Names 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 and/or place _____

Theme

- Refers to main character's primary goal or problem to be resolved _____

Plot Episodes

- A. Number of episodes recalled _____
- B. Number of episodes in story _____
- C. Score for plot episodes (A/B) _____

Resolution

- A. Names the problem solution/goal attainment _____
- B. Ends story _____

Sequence

Retells story in structural order: setting, theme, plot, episodes, resolutions.
(Score 2 for correct order, 1 for partial, 0 for none.) _____

Highest Score Possible (10)

Child's Score _____

Comments:

Expository Retelling Analysis: 10-Point Scale

Directions: Place score next to each element. A scoring rubric can be found under each element.

Topic

States what the books is about _____

Score **0** for not included, **.5** for partial (does not specifically state, but gets the *gist* of the topic through the nature of the retelling), **1** for complete/detailed (specifically states, *The topic of the book is about _____ or The book is about _____*)

Main Idea(s)

Names the main ideas from the book _____

Score **0** for not included or not naming any, **1** for fragmentary or naming a few, **2** for partial or naming most, **3** for complete/detailed or naming all

Details

Names the supporting details _____

Score **0** for not included or not naming any, **1** for fragmentary or naming a few, **2** for partial or naming some, **3** for the gist or naming most, **4** for complete/detailed or naming all

Vocabulary

Uses vocabulary from the story _____

Score **0** for not included or uses none, **.5** for partial or uses some vocabulary words, **1** for complete/detailed or uses most key vocabulary words

Accuracy

Retells facts accurately _____

Only examine the facts used in the retelling. Do not score for the facts that were omitted in the retelling.

Score **0** for not included or none of the facts are accurate, **.5** for partial or most/some facts are accurate, **1** for complete/detailed or all facts are accurate

Highest Score Possible (10)

Child's Score _____

Comments: