Volume 14, Number 2: October 2013
ISSN: 1535-0975

Effects of Reading Formats on the Comprehension of New Independent Readers

M. Christina Roberts, M.Ed., MLIS
Kejabri-Roberts, LLC.
robertmc@stthom.edu

Dr. Catherine R. Barber, Ph.D.
University of St. Thomas
barbercr@stthom.edu

Volume 14, Number 2: October 2013
ISSN: 1535-0975

Abstract

This research study was conducted to determine whether book format (print or electronic) influenced newly independent students' reading comprehension. Thirty second grade students were randomly assigned to read a print or electronic version of a pre-selected book using a crossover study design to allow measurement using a sequenced treatment method. A multiple choice quiz was used to measure comprehension. The time spent to complete reading was recorded to allow investigation of this variable. The data analysis examined the relationship between the dependent variables of reading comprehension and time spent to complete reading combined with the independent variables of book format, treatment sequence, and reading proficiency level. The results showed a statistically significant relationship existed between book format and comprehension scores as well as book format and time spent to complete reading ($p < .05$). A qualitative survey determined preferences for reading format and content based upon ease of use of format as well as the content appeal.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

The importance of learning to read cannot be overlooked, as reading is a skill that allows individuals to acquire knowledge in all subject areas. In 2000, the National Reading Panel (NRP) Report identified several areas of research related to computers and reading. The Panel recommended further study of the use of computers for selected instructional tasks, teaching the reading/writing component, utilizing multimedia software, providing motivational reading, and introducing hypertext applications (National Institute of Child Health and Human Development [NICHD], 2000). In the decade following the NRP report, additional research (Grimshaw, Dungworth, McKnight, & Morris, 2007; Korat & Shamir, 2008; Lefever-Davis & Pearman, 2005; Pearman, 2008; Shamir, 2009) concerning the impact of reading materials in the form of print books, e-books, or interactive electronic books continued to provide information on the effectiveness of these formats for increasing student engagement and reading comprehension. However, there is still much to learn about issues surrounding the evolution of reading formats, the use of these formats to motivate readers, and the design of best practices to promote their use.

Reading advocates such as the American Association of School Librarians (AASL), a division of the American Library Association (ALA), understand that readers in the 21st century must be able to comprehend, analyze, and evaluate text in both print and digital formats (AASL, 2009). The National Education Technology Plan released in 2010 has provided a vision for all educators and students to have wireless internet access devices for research, communication, and multimedia resources (U.S. Department of Education, 2010). However, the incorporation of technology-driven reading platforms increases the need for additional research on students' use of electronic and print resources and its potential impact on reading comprehension. With this information, educators can make educated choices regarding the correct resources as well as

Volume 14, Number 2: October 2013
ISSN: 1535-0975

technologies to support student reading comprehension for all readers particularly those students in need of reading intervention.

Even before the addition of an electronic format, students' reading comprehension has been found to be influenced by factors such as a language mismatch between the reader/author, an inability to fully integrate the information presented, a misunderstood text organization, and/or an unengaged reader (Barr, 2007). Educators want students to become life-long learners and readers as students who have reading success will comprehend what they read, enjoy the experience of reading, and apply the information gained from reading (Graves, Juel, & Graves, 2007). If the additional features in interactive electronic books are determined to increase enthusiasm and engagement in reading, then student comprehension may increase as well (Grimshaw et al., 2007). Similarly, the choice of reading the same book title in either a print or electronic format could negatively influence student engagement.

Previous investigations have been conducted to establish whether reading comprehension gains could be measured for students who used electronic systems for reading; however, the results have been contradictory and therefore inconclusive (e.g., Doty, Popplewell, & Byers, 2001; Underwood, 2000). Research concerning the impact of book format on reading comprehension has often generated results that indicated no significant differences across formats (e.g., Grimshaw, Dungworth, McKnight, & Morris, 2007; Korat, & Shamir, 2008). Earlier studies of the CD-ROM electronic book format highlighted problems with interpreting the results due to the varied multimedia components contained in different products, such as sound, music, and animation (Shamir & Korat, 2006). For example, Pearman (2008) investigated whether the choice of CD-ROM or print formats would provide better comprehension scores for

Volume 14, Number 2: October 2013
ISSN: 1535-0975

54 second grade students. Pearman found that CD-ROM storybooks minimized the time students spend on decoding so they can focus more on reading comprehension.

Some researchers have suggested that the addition of animated components to the text has actually distracted young children rather than support their literacy (Shamir & Korat, 2006; Shamir, 2009). In a similar vein, Trushell, Burrell, and Maitland (2001) found that the interactive components of electronic storybooks on Year 5 students' reading comprehension negatively influenced these students' reading comprehension. Likewise, Lefever-Davis and Pearman (2005) noted that the overuse of electronic features for decoding and word meaning may cause young first grade readers to not fully develop skills necessary for reading comprehension. In contrast, Ricci and Beal (2002) found that the interactive elements of electronic multimedia storybooks did not hinder first grade students' recall of the story. Larson (2010) presented a case study that showed how e-readers can be used to encourage fifth grade reader's engagement and interaction with the text. Similarly, in the realm of orally read material, de Jong and Bus (2004) determined that kindergarten students' story comprehension was the same regardless of whether the story was narrated electronically or read by an adult. Pearman and Chang (2010) noted that when the additional features of electronic books support the story, reader comprehension may be enhanced, but supplemental features such as hotspots, highlighted text, and sound effects could also be "distracters" that could impair reading comprehension. Larson found that interactive elements such as note-taking and highlighting have the potential to increase 6-7 year-old students' engagement as well as text comprehension (Larson, 2009). In 2010, Sharmir and Korat designed e-books labeled "considerate" that were created with hotspots directly linked to the storyline to help reduce problems associated with electronic hotspots and story understanding.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

The researchers determined positive reading gains for students who utilized these "considerate" e-books.

Given the mixed evidence regarding the benefits and drawbacks of electronic book formats for reading comprehension, educators may wonder whether technology-driven reading formats are perhaps more useful for their ability to motivate students (Block & Parris, 2008). Unfortunately, the literature regarding the impact of electronic books and reading motivation is similarly sparse and mixed. Grimshaw et al. (2007) found that the type of book format did not notably affect 9-10 year-old children's reading satisfaction with either a print or electronic storybook. In comparison, Korat (2010) found that e-books designed with electronic features such as narration, animated illustrations, and dictionary features directly related to the storyline all positively stimulated emergent readers' literacy development. Similarly, research by Larson (2009) indicates those interactive elements such as note-taking and highlighting have the potential to increase fifth grade students' engagement as well as text comprehension. Segal-Drori, Klein, Korat, and Shamir (2009) discovered that the design and use of e-books can be enjoyable as well as beneficial but adult interaction with students is still a necessary component for emergent readers' success. Likewise, a study by Jones and Brown (2011) determined that third grade students are highly motivated to read e-books and remain engaged in the reading process when allowed to freely choose the type of book to read.

The development of new literacy forms including digital texts and internet resources increases the need for new research to determine the "best practices" for effective comprehension instruction with digital reading. In a previous study, Dalton and Rose (2008) recognize that "the primary goal of scaffolded digital reading environments is to develop

Volume 14, Number 2: October 2013
ISSN: 1535-0975

engaged, active, and strategic readers who are able to understand both print and digital multimedia text" (p. 352). Likewise in a review conducted by Moody (2010), key considerations for selection and use of both print and e-books include selection of developmentally appropriate materials, inclusion of adult support, and the removal of extraneous features that create distractions. With the knowledge gained from current research, educators are provided with information to help develop strategies to achieve reading comprehension goals when using digital formats. The design of best practices for the use of digital reading formats will allow students to become successful readers well into the future.

The current study seeks to provide additional data pertaining to the differences in students' reading comprehension depending on the book format (electronic vs. print) and whether such differences were associated with proficiency levels of newly independent readers grouped as advanced or proficient. By utilizing electronic book designs that exclude elements such as animation, sound, music, and narration that could increase reader distractibility, the results of this study provided information to allow educators to determine whether the various book formats without electronic features such as narration and animated illustrations can positively influence new independent readers' comprehension. In this study, 30 second grade students were identified as advanced or proficient readers and randomly assigned to read a print or electronic reading format of a researcher-selected book. Each reading group read a new book title using both types of book formats during a two week data collection period. The dependent variables were reading comprehension and time spent to fully complete reading each book. The independent variables included format type (print and electronic), reading proficiency level (advanced vs. proficient), and treatment sequence (electronic-print vs. print-electronic). The

Volume 14, Number 2: October 2013
ISSN: 1535-0975

hypothesis was that there would be significant differences in the reading comprehension for newly independent second grade students when the students read different book formats.

Method

Participants and Setting

The sample included 30 second grade students, ages eight to nine years old, selected from two second grade classrooms at a private school in Houston, Texas. The combined study group was composed of 20 females and 10 males, with English being their first language. Each classroom had one teacher who taught core subjects to students in a self-contained classroom. Students were instructed weekly in the use of technology resources beginning in kindergarten. Both classrooms contained SMART boards and desktop computers that were regularly accessed by both the teacher and students during classroom instruction.

Participants had a lexile score in one of two ranges, 265 to 599 (proficient) and 600 to 953 (advanced). The placement of students into two leveled reading groups allowed reading materials to be matched to the average range of reading levels to facilitate improved data reliability. Matching books to student reading ability adjusted for performance factors that allowed comparison of comprehension scores recorded using print or electronic books regardless of an individual student's reading proficiency (MetaMetrics, 2008).

Measures

The instrument used to determine each student's reading comprehension was a five question multiple-choice quiz designed for use in a lexile-based independent reading program

Volume 14, Number 2: October 2013
ISSN: 1535-0975

(SRC, 2006). Numerous studies (e.g., Doty et. al, 2001; Grimshaw et. al, 2007; Trushell et.al, 2001) have found the use of comprehension quizzes to be a valid measure for the assessment of a student's reading comprehension. All students received a paper copy of the quiz produced for their book immediately upon completion of reading their assigned book. Students were seated at tables adjacent to one another for reading as well as test administration. Cardboard study corrals separated students to minimize distraction during reading and assessment. Each comprehension quiz contained identical questions that were randomly ordered by the researcher. Each study participant also completed a qualitative survey during the third week of the study to facilitate assessment of student preferences for either reading formats based on ease of use as well as reading enjoyment.

Design

The experimental crossover design of this study provided a method to quantitatively measure the effect of the independent variables of print and electronic reading formats on the sample participants' reading comprehension. During the initial week of data collection, students were randomly assigned to read a print or electronic version of the initial book title matched to their reading level. The same student read the second book title in the alternate format the following week. The ability to match participants based on their assessed reading ability allowed treatment conditions to be controlled so that the study results could be reasonably applied to the general population of students.

One of the study design concerns was controlling for the variations in the participants' reading ability. For this study, the variations in student reading levels were controlled by matching participants to reading materials based on students' previous reading assessment

Volume 14, Number 2: October 2013
ISSN: 1535-0975

scores. After analyzing data generated from a current Scholastic Reading Inventory (SRI) assessment, the student sample was divided into two homogeneous groups based on their lexile levels. The SRI assessment identified a range of 265-599 as proficient and 600-953 as advanced. The proficient group had an average lexile level of 423. To enable matching of book resources, the lexile level translates to a reading level (RL) of approximately 2.37 based on a correlational chart available from Follett Corporation (Follett, 2011). The advanced group had an average lexile level of 738. For this group, the lexile level of 738 corresponds to a reading level (RL) of 3.72. The students were grouped according to average lexile levels to allow matching of reading materials corresponding to each of the leveled groups. Those students from both of the second grade classrooms falling below the lexile level of 265 participated in the reading activity and assessment but were excluded from the sample group results.

Procedure

Prior to the data collection, each student was assigned an identification number. The identification numbers were used to label the paperback books as well as the laptop computers used to access the electronic books. Approximately 50% of each leveled reading group was randomly selected to read a print version of the book while the other remaining 50% of each leveled reading group was assigned to read the electronic version of the book. The electronic books were accessed from the online reading website *Big Universe Learning* (http://www.biguniverse.com). Big Universe Learning provides published electronic books through a fee based subscription service. The publisher books contained on this site closely replicate traditional print books with features such as two-page spreads, the ability to turn pages with a mouse click and static print/images. The e-books did not contain narration, highlighted

Volume 14, Number 2: October 2013
ISSN: 1535-0975

text, hotspots, or dictionaries, which allowed accurate comparison of student reading using both book formats. Wireless laptops were used to access the electronic books read by students assigned this format. Although tablet readers such as *Nook, Kindle* or *iPad* provide a newer technology for delivery of e-books, many schools transitioning to digital formats have limited funds to purchase these devices for wide-scale use. For this reason, the use of laptops was considered a reasonable way to replicate the hardware delivery method utilized by a large sector of the population.

During data collection, each classroom visited the library at their regularly scheduled weekly time. The researcher provided an overview of the research to students including: 1) each student would read a print or electronic book chosen by the researcher, 2) each student would complete a five question comprehension quiz after reading the first book, 3) each student would read a second book in the alternate format the next week, and 4) each student would complete a comprehension quiz on the second book. Students read their print or electronic book while sitting at the tables in the library. During the first week of data collection, the proficient group read the book *First Day Jitters* by Julie Danneburg (2.6 RL), and the advanced group read the book *The Hockey Card* by Jack Siemiatycki (3.8 RL). In the second week, proficient group students read book *My Even Day* by Doris Fisher (2.4 RL), and advanced group read the book *Sack Full of Feathers* by Debby Waldman (3.7 RL). All students received a paper copy of the quiz produced for their book upon completion of reading their selected book. The researcher collected all quizzes for scoring and data analysis. The collected data were filed and locked in the library office.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

The qualitative survey was provided to students the week following data collection. The researcher gave each student a paper copy of the survey. The five survey questions were written to include the book titles read by the individual to increase the accuracy of each student's response. The multiple choice style questions were designed so that each student could circle the answer that best represented their views about both the book content and format. After completing the survey, each student returned the survey to the researcher for analysis.

Results

Quantitative Data Analysis

The data analysis examined the relationship between the dependent variables of reading comprehension and time spent to complete reading combined with the independent variables of book format, treatment sequence, and reading level of each student. The crossover study design allowed measurement of the dependent variables using a sequenced treatment method for all students. Students were randomly assigned to read a print or electronic version of a researcher selected book the first week and an alternate format of a different book the following week. During both weeks of data collection, the time spent to completely finish reading each book was recorded for all students.

Comprehension score analysis. The initial analysis of the data generated the means and standard deviations for reading comprehension scores associated with each book format and reading level (see Table 1). A three-way analysis of variance (ANOVA) was conducted to determine whether there was an interaction among book format, student reading level, and the treatment sequence. The interaction of these three combined variables was determined to be

Volume 14, Number 2: October 2013
ISSN: 1535-0975

statistically significant, F (1, 26) = 7.94, p = .01. The main effect of book format and the interaction of format and reading level or treatment sequence did not yield statistically significant results (ps > .05).

Table 1 *Means (M) and Standard Deviations (SD) for Comprehension Scores*

	Reading Level	Reading Sequence	*M*	*SD*	*N*
E-book score	Advanced	E-book-Print	94.29	9.76	7
		Print-E-book	84.00	20.66	10
		Total	88.24	17.41	17
	Proficient	E-book-Print	86.67	16.33	6
		Print-E-book	94.29	9.76	7
		Total	90.77	13.21	13
	Total	E-book-Print	90.77	13.21	13
		Print-E-book	88.24	17.41	17
		Total	89.93	15.52	30
Print book score	Advanced	E-book-Print	80.00	20.00	7
		Print-E-book	96.00	8.43	10
		Total	89.41	16.00	17

Proficient	E-book-Print	100.00	0.00	6
	Print-E-book	97.14	7.56	7
	Total	98.46	5.55	13
Total	E-book-Print	89.23	17.54	13
	Print-E-book	96.47	7.86	17
	Total	93.33	13.22	30

A split of the data based on student reading level (advanced/proficient) revealed a statistically significant two-way interaction between book format and treatment sequence for the advanced reading group, F (1, 15) = 7.72, p = .01. Additional data analysis was conducted to consider the relationship of book format and reading level for the advanced group using a paired *t* test analysis. The e-book and print book scores were determined to be significantly different for the advanced reading group who read the e-book first, t (6) = 2.5, p = .05. For the advanced group, students who read the e-book first scored higher on the e-book comprehension quiz compared to the comprehension scores reported after reading the print book during week two. Although the difference in reading comprehension across formats was not significant for those participants who read the print book first t (9) = -1.77, p = .11, comprehension scores were marginally higher for the print book format than for the e-book format. In short, advanced readers generally scored marginally to significantly better the first week than the second week, though the difference between formats was more pronounced among students who read the e-

Volume 14, Number 2: October 2013
ISSN: 1535-0975

book first. In contrast, for the proficient group, the ANOVA identified a marginally significant main effect of reading format, F (1, 13), p = .08, such that proficient students scored marginally better when reading the print book format than when reading the e-book format (see Table 1), regardless of treatment sequence.

Time spent to complete reading analysis. The time spent to finish reading each book format was analyzed to determine the relationship between book format, reading level, and treatment sequence. Data analysis was conducted to determine the means and standard deviations for time spent to complete reading related to each book format and reading level (see Table 2). A three-way analysis of variance (ANOVA) determined that there was an interaction among book format, student reading level, and the treatment sequence, F (1,26) = 95.13, p < .001. The two-way analyses of variances (ANOVAs) of book format and treatment sequence found a statistically significant interaction for both reading levels: advanced group, F (1, 15) = 106.83, p < .001; and proficient group, F (1, 11) = 11.56, p = .01.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

Table 2 *Means (M) and Standard Deviations (SD) for Time Spent to Complete Reading*

Sequence Read	Reading Format	Reading Level	*M* (minutes)	*SD*	*N*
E-book-	E-book	Advanced	7.14	.69	7
Print book		Proficient	8.33	2.58	6
		Total	7.69	1.84	13
	Print book	Advanced	11.71	2.81	6
		Proficient	6.67	3.39	7
		Total	9.38	3.95	13
Print book-	E-book	Advanced	17.60	3.98	10
E-book		Proficient	5.86	2.61	7
		Total	12.76	6.85	17
	Print book	Advanced	8.00	1.89	10
		Proficient	7.86	1.35	7
		Total	7.94	1.64	17

Two paired *t* tests were performed to determine differences between book formats and treatment sequence for each leveled reading group. A statistically significant difference between formats was found for the advanced reading group using both treatment sequences. Advanced

group students who read the e-book first spent 61% less time (4.57 minutes) to complete reading the e-book as compared to the time spent to finish reading the print book format in week two, e-book-print book, t (6) = -3.83, p = .01. In addition, advanced group students who initially read the print book spent 46% less time (9.60 minutes) to complete reading than when reading the e-book in week two, t (9) = 12.13, p < .001 (see Figure 1).

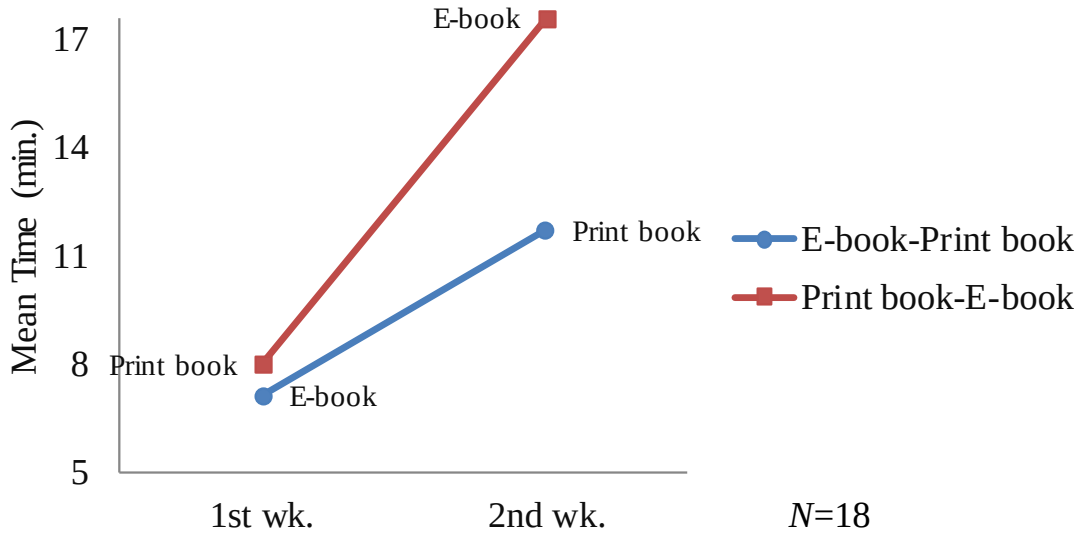

Figure 1. Mean time spent to complete reading for advanced students in each treatment sequence.

Among proficient readers, the t test analysis yielded statistically significant results for the print book-e-book sequence, t (6) = -2.65, p = .04. Proficient students who read the print book first read more slowly than students who read the e-book. These students spent 34% more time (2.00 minutes) to finish reading the print book as compared to their average time to complete the e-book during week one. In addition, the treatment sequence of e-book-print book for proficient students demonstrated marginally significant differences between time spent to complete reading the e-book and time spent to finish reading the print book, t (5) = 2.19, p = .08. Students in the

proficient group who read the e-book first read slower than students who read the print book. These students spent 25% more time (1.70 minutes) to complete reading the e-book in the first week one than to finish reading the print book during week two (see Figure 2). In summary, regardless of book format, advanced reading group students spent more time to complete reading in week two, while proficient reading group students generally spent less time to finish reading in week two.

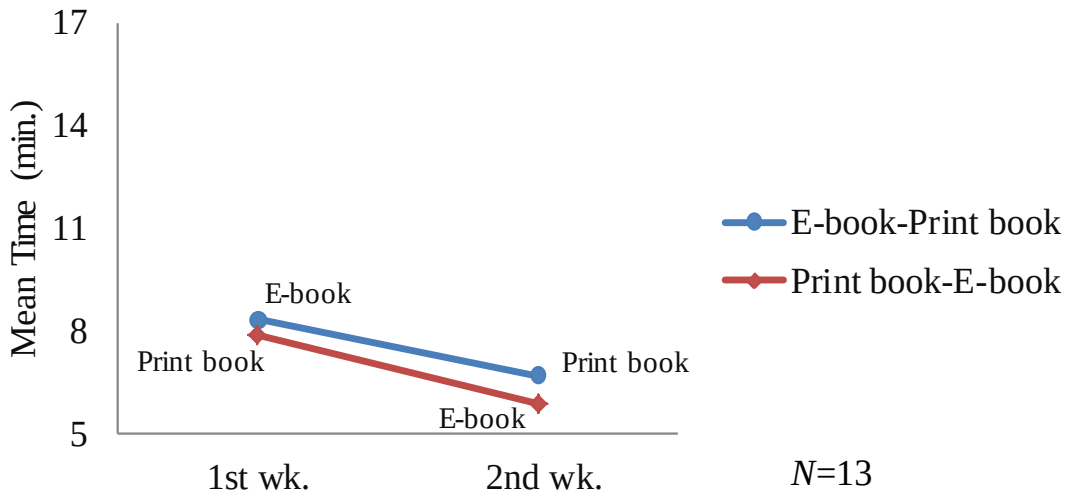

Figure 2. Mean time spent to complete reading for proficient students in each treatment sequence.

Qualitative Data Analysis

During the third week of the data collection, each study participant completed a qualitative survey to allow collection of students' preferences for reading format and content based on each book format's ease of use as well as the book content appeal. Students were asked to provide a response of e-book or print book for two questions related to book format. Responses were analyzed for each reading group. The majority of students in both reading groups reported a preference for reading the e-book as compared to the print book. Responses to

the question regarding usability of book formats indicated that students in both reading groups were equally divided in their preference for e-book or print book (see Table 3).

Table 3: *Analysis of Student Perceptions of Book Format Reported by Reading Level*

	Book Format				
Reading Level	Appeal		Usability		*N*
Advanced	E-book	71%	E-book	50%	17
	Print book	29%	Print book	50%	
Proficient	E-book	85%	E-book	46%	13
	Print book	15%	Print book	54%	

Table 4 *Analysis of Student Perceptions of Book Content Reported by Reading Level*

	Book Content				
	Appeal				
Reading Level	Week 1		Week 2		*N*
Advanced	I liked it a lot.	47%	I liked it a lot.	47%	17
	Okay or didn't like it.	53%	Okay or didn't like it.	53%	
Proficient	I liked it a lot.	92%	I liked it a lot.	85%	13
	Okay or didn't like it.		Okay or didn't like it.		

	8%	15%	
Fishers Exact test $p = .011$		Fishers Exact test $p = .040$	

Two additional survey questions answered by students were designed to consider student interest in each book's content regardless of book format for both week one and two of the data collection period. Survey analysis determined the advanced students to be evenly split regarding their enjoyment of the book content. In comparison, the proficient group reported a high enjoyment level of the book content for both weeks (see Table 4). These observed differences between advanced and proficient readers in terms of enjoyment of the books were significantly different, as evidenced by chi-square analyses using Fisher's Exact test. The groups differed in terms of the percentage of students who enjoyed the books during both week one ($p = .01$) and week two ($p = .04$), indicating that overall the proficient group had greater enjoyment of each book's content compared to the advanced group, regardless of the book format. Analysis of students' perceptions about book format as well as content provided additional data to determine motivational factors that could be related to reading performance.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

Discussion

The primary hypothesis stated that there would be significant differences in the reading comprehension of newly independent second grade students when the students read different book formats. The results of our investigation were unable to clearly support our hypothesis. After analyzing the data, it appears that the reading comprehension scores of students in the advanced group appeared to be heavily influenced the sequencing of reading formats. In the first week, advanced students who read the e-book scored higher on the comprehension quiz compared to the scores reported after reading the print book during week two. Similarly, the advanced students who read the print book in week one also scored higher than after reading the e-book in week two. The advanced group's reading mastery combined with the novelty of participation in the study may explain the higher scores in the first week regardless of book format. In week two, the significantly lower comprehension scores recorded for advanced students regardless of format could have been attributed to the students' lack of interest in the book content. The self-selection of reading materials has been linked to student interest in the reading material and could possibly lead to gains in students' comprehension scores. A recent study conducted by Jones and Brown (2011) determined that third grade students are highly motivated to read and remain engaged in the reading process when allowed to freely choose the type of book to read.

In contrast, the scores of proficient students were marginally influenced by format. The proficient group of students had higher comprehension scores after reading the print book than after reading the e-book regardless of their treatment sequence. For the proficient group, a

Volume 14, Number 2: October 2013
ISSN: 1535-0975

reduced mastery of reading combined with the familiarity of print books may have contributed to a trend towards higher scores using a print format.

The study design included e-books with a linear text design and no additional animation such as highlighted words, sound effects, or hypertext features such as dictionaries. Exclusion of these elements minimized possible distractions and enabled the researcher to decrease the effect of book format on reading comprehension. Student engagement with the e-books involved using the touchpad on the laptop to flip the electronic page whereas individuals utilizing the print book flipped the pages with their fingers. The majority of the students were unaffected by the different methods used to advance the pages of the book formats. However, the researcher noted that two proficient students experienced difficulty reading their e-book due to the use of finger tracking. Finger tracking is generally discouraged as students move from emergent to independent reading (Pinnell & Scharer, 2003). Previous literature (Grimshaw et al., 2007; Lefever-Davis & Pearman, 2005; Pearman & Chang, 2010, Trushell et. al., 2001) reported that e-books that included non-linear text components could adversely affect elementary school age students' reading and/or the amount of time spent to complete reading the text. In this study, the use of an electronic book format with a linear text design eliminated these extraneous multimedia components and allowed comparison of reading comprehension related to factors such as book content and ease of use.

To promote individual engagement with each book, all students were allowed to spend an unlimited amount of time to complete reading their randomly assigned book. The research indicated that advanced students spent more time to finish reading their assigned book in week two than in week one regardless of reading format. The advanced readers' interest in the books'

Volume 14, Number 2: October 2013
ISSN: 1535-0975

content as well as the novelty of participation in a research study may explain the decreased time needed to complete reading both book formats during the first week of data collection.

Similarly, format was not consistently associated with length of time spent to finish reading for the proficient group. Proficient students spent more time to complete reading during the first week than they spent during the second week, regardless of format. This is inconsistent with Grimshaw et al. (2007), who found that although book format did not notably affect the 9-10 year-old children's reading satisfaction of either storybook, students took more time to finish reading the electronic version of the book. Perhaps proficient students needed more time to adjust to the experimental situation and to the new material, resulting in more time spent to complete reading in week one. The variations in the time spent to finish reading different formats for the reading groups was an interesting discovery that would require additional research to fully determine the effect of book format on time spent to complete reading each type of book.

In this study, a qualitative survey indicated that the majority of students in both reading groups reported a preference for reading the e-book as compared to the print book. Responses to the question regarding usability of book formats indicated that students in both reading groups were equally divided in their preference for e-book or print book (see Table 3). Survey analysis determined the advanced students to be evenly split regarding their enjoyment of the book content. In comparison, the proficient group reported a high enjoyment level of the book content for both weeks (see Table 4).

The qualitative survey completed by students following data collection provided information to help evaluate possible relationships between motivational factors and reading performance. Past studies have noted key elements such as motivation and engagement that are

Volume 14, Number 2: October 2013
ISSN: 1535-0975

directly linked to reading comprehension. A RAND study listed three main factors linked to reading comprehension: 1) the text, 2) the act of reading, and 3) the reader (Snow, 2002). Each of these three items is intertwined so that all elements are necessary for successful reading comprehension. Dalton and Rose (2008) noted that the ability of technology-driven reading formats to motivate students and positively impact reading comprehension is an emerging area of research.

Strengths and Limitations

The crossover design of the study allowed each student to read both book formats and provided data related to treatment sequence, reading level, and book format. The ability to analyze multiple independent variables allowed the variables of reading level, reading sequence, or book format to be tested individually or combined to more effectively determine any interaction on student's reading comprehension or time spent to complete reading. In an effort to reduce the effect of differences in participant reading abilities, the students were grouped utilizing the Scholastic Reading Inventory (SRI) assessment results. A limiting factor when utilizing matching was the reliability of the data used for placement of students into their respective groups. Matching the reading levels of the books to the two reading levels increased the accuracy of the comprehension scores determined for each student participant. However, the accuracy of the identified lexile level and/or reading level of the book selected for student reading was not guaranteed. Although multiple resources were referenced to verify the accuracy of the lexile and reading level of the books, some variations were found.

In addition to limiting power to detect significant differences, the small sample size (n = 30) limited the ability to generalize the effects of reading formats on reading comprehension for

Volume 14, Number 2: October 2013
ISSN: 1535-0975

the general population of second grade readers. The ability to generalize the measurement of statistically significant variances in both the advanced and proficient students' time to complete reading the book was also limited by the small sample size. In addition, the study group contained a disproportionately high number of female participants (20) compared to male participants (10). However, the leveled reading groups, proficient and advanced, had similar gender distribution.

Although the study provided an opportunity for each student to participate twice using both types of reading formats, the ability to locate reading materials at the correct reading level in both a print and electronic format hindered the ability to conduct the research for a longer period of time. Allowing students to self-select books within their independent reading level would eliminate any negative motivational factors created due to lack of interest in the researcher selected books.

Electronic books were not formally utilized at the school where the students attend. Although some students may have utilized electronic book formats outside of school, the researcher was unaware of any participant's use of electronic books available through the *Big Universe* website, which provided the electronic book format used in this study. For this experiment, books were selected that were not available in the school library. Second grade students were individually surveyed by their teachers to determine if anyone had previously read the researcher selected books. Although students indicated no awareness of the titles, the ability to limit previous exposure to the reading material by one or more students prior to the study was not guaranteed. A final limitation was that the open environment of the library that created a setting where outside factors could have created interference during data collection. Every effort

Volume 14, Number 2: October 2013
ISSN: 1535-0975

was made to reduce the distractions that could have affected student participation, but perfect control was not possible.

Recommendations and Action Planning

The results of the study are inconclusive but indicate that students who are advanced readers master reading comprehension regardless of the book format. Although the investigation yielded small variations in comprehension and time spent to complete reading, it is important to remember that even minor gains or decreases can be important in certain educational situations, such as student evaluation and testing.

Furthermore, the use of an e-book format by advanced readers during week one allowed higher comprehension scores than week two lending modest support to the use of the e-book format. However, these results could be linked to the treatment sequence, increased motivation stemming from e-book use, or the appeal of the book content. In contrast, the proficient students seemed to score better using the more familiar print book format, whereas the unfamiliarity of the e-book seemed to modestly decrease student comprehension scores. For proficient readers, the combination of new reading material and a new reading format may have contributed to the lower comprehension scores for e-book readers in both weeks. Introduction of linear style e-books using e-readers would allow students to develop proficiency with using the products prior to evaluation of student comprehension.

Of particular interest in this study is the time spent to complete reading the two book formats. The advanced group had statistically significant differences between book formats for each week. As a whole, the advanced group spent less time to finish reading the book in week

Volume 14, Number 2: October 2013
ISSN: 1535-0975

one regardless of format than reading the book in week two. In addition, the advanced group's comprehension scores during week two were lower for both reading formats. The results indicate that the book content as well as the book format ultimately impacts the amount of time spent to complete reading a book. The ability to self-select books for each student's independent reading level may increase student engagement leading to improved comprehension and a reduction in the time spent to finish reading. Another concern was the controlled setting used to facilitate data collection, as it did not replicate the typical reading environment of student readers. Allowing students to read a linear designed e-book on an e-reader device rather than a lap-top would likely eliminate differences in reading environment that could impact comprehension scores. Although the small sample size limits the ability to make generalizations, the survey data collected in the current study suggest that the inclusion of e-books could be a motivational device used to increase student reading overall.

In this study, the time spent to complete reading appeared to be influenced more by book content rather than book format. Educators should be cognizant of the role that students' reading interests play in reading comprehension regardless of the book format utilized for delivery of the information. Further research needs to be conducted to determine if students who exclusively self-select linear designed e-books compared to students who self-select traditional print books will show reading comprehension gains over a longer period of time based on their assessment scores. The use of a handheld e-reader for e-books could further enhance future studies, as use of an e-reader would more closely mimic the portability of a traditional print book.

The qualitative component of this research study indicates that students appear to be motivated to read e-books regardless of the ease or difficulty of use. The limited duration of the

Volume 14, Number 2: October 2013
ISSN: 1535-0975

study hinders the ability to directly link e-books to reading motivation but suggests the novelty of their use is very appealing. Both proficient and advanced readers were equally divided regarding the usability of print books as opposed to e-books. With repeated use of an e-book format, problems associated with usability would most likely diminish over time. Based on the study findings, the introduction of linear designed e-books in addition to traditional print books could be beneficial, as their use could provide additional reading motivation particularly for lower level readers. Adequate training in the use of the e-books would help to alleviate issues that increase time spent reading as well as decrease reading comprehension scores, allowing students to fully benefit from use of this book format.

Volume 14, Number 2: October 2013
ISSN: 1535-0975

References

American Library Association. (2009). School librarian's role in reading (Report No: 534779). Retrieved from http://www.ala.org/ala/mgrps/divs/aasl/aaslissues/positionstatements/roleinreading.cfm.

Barr, R., Bates A., Blachowicz, C. L., Katz, C., & Kaufman, B. (2007). Reading comprehension: its nature and development. In A. Ramos (Ed.), *Reading diagnosis for teachers: An instructional approach* (5th ed., pp. 168-207). Boston, MA: Pearson Education.

Dalton, B. & Rose, D. Scaffolding digital comprehension. (2008). In C. C. Block & S. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 347-357). New York: Guilford Press.

de Jong, M. T., & Bus, A. G. (2004). The efficacy of electronic books in fostering kindergarten children's emergent story understanding. *Reading Research Quarterly*, *39*(4), 378-393).

Doty, D. E., Popplewell, S. R., & Byers, G. O. (2001). Interactive CD-ROM storybooks and young readers' reading comprehension. *Journal of Research on Technology in Education*, *33*(4).

Follett Library Resources. (2011). Reading levels correlation chart. Retrieved from http://www.flr.follett.com/intro/pdfs/products/ec-readingchart.pdf.

Graves, M., Juel, C., & Graves, B. (2007). Motivation and engagement. In A. Ramos (Ed.), *Teaching reading in the 21st Century* (4th ed., pp. 56-57). Boston, MA: Pearson Education.

Grimshaw, S., Dungworth, N., McKnight, C. and Morris, A. (2007). Electronic books: children's reading and comprehension. *British Journal of Educational Technology*, *38*, 583–599. doi: 10.1111/j.1467-8535.2006.00640.x

Jones, T., & Brown, C. (2011). Reading engagement: A comparison between e-books and traditional print books in an elementary classroom. *International Journal of Instruction*. *4*(2), 5-22.

Korat, O., & Shamir, A. (2008). The educational electronic book as a tool for supporting children's emergent literacy in low versus middle SES groups. *Computers & Education*, *50*(1), 110-124. doi:10.1016/j.compedu.2006.04.002

Korat, O. (2010). Reading electronic books as a support for vocabulary, story comprehension and word reading in kindergarten and first grade. *Computers & Education*, *55*(1), 24-31. doi:10.1016/j.compedu.2009.11.014

Larson, L.C. (2009). E-reading and e-responding: New tools for the next generation of readers. *Journal of Adolescent & Adult Literacy*, *53*(3), 255-258.

Larson, L. C. (2010). Digital Readers: The next chapter in e-book reading and response. *Reading Teacher*, *64*(1), 15-22.

Lefever-Davis, S., & Pearman, C. (2005). Early readers and electronic texts: CD-ROM storybook features that influence reading behaviors. *Reading Teacher*, *58*(5), 446-454.

MetaMetrics, Inc. (2008). *Lexiles: A system for measuring reader ability and text difficulty: A guide for educators*. New York, NY: Scholastic Corporation. Retrieved from http://teacher.scholastic.com/products/sri_reading_assessment/pdfs/SRI_ProfPaper

_Lexiles.pdf.

Moody, A. (2010). Using electronic books in the classroom to enhance emergent literacy skills in young children. *Journal of Literacy and Technology, 22*(11), 23-52.

National Institute of Child Health and Human Development. (2000). Report of the national reading panel teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769). Washington, DC: U.S. Government Printing Office.

Pearman, C. J., & Chang, C. (2010). Scaffolding or distracting: CD-ROM storybooks and young readers. *TechTrends: Linking Research and Practice to Improve Learning, 54*(4), 52-57.

Pearman, C. J. (2008). Independent reading of CD-ROM storybooks: Measuring comprehension with oral retellings. *Reading Teacher, 61*(8), 594-602.

Pinnell, G. S., & Scharer, P. L. (2003). Teaching for phrasing and fluency: Connections to comprehension. In Kay Mallett & Anjanette Brush (Eds.), *Teaching for comprehension in reading, grades k-2, strategies for helping children with ease, confidence, and understanding* (p. 155). New York, NY: Scholastic Teaching Resources.

Ricci, C. M., & Beal, C. R. (2002). The effect of interactive media on children's story memory. *Journal of Educational Psychology, 94*(1), 138-44. Retrieved from EBSCOhost.

Segal-Drori, O., Klein, P., Korat, O. & Shamir, A. (2009). Reading electronic and printed books with and without adult instruction: effects on emergent reading. *Reading and Writing, 23* (8), 913-930.

Shamir, A. (2009). Processes and outcomes of joint activity with e-books for promoting kindergarteners' emergent literacy. *Educational Media International*, 46(1), 81-96. doi:10.1080/09523980902781295

Shamir, A., & Korat, O. (2006). How to select CD-ROM storybooks for young children: The teacher's role. *The Reading Teacher, 59*(6), 532-543. Retrieved from http://www.jstor.org/stable/20204386.

Snow, C. (2002). Reading for understanding: Toward an R&D program in reading comprehension. Santa Monica, CA: RAND Corporation. Retrieved from http://www.rand.org/pubs/monograph_reports/MR1465.

SRC. (2006). Scholastic reading counts enterprise edition overview. Retrieved from http://teacher.scholastic.com/products/independent_reading/scholastic_reading_counts/pdfs/SRC_EE_ProdOver_Fall_06.pdf

Trushell, J., Burrell, C., & Maitland, A. (2001). Year 5 pupils reading an "interactive storybook" on CD-ROM: Losing the Plot? *British Journal of Educational Technology, 32*(4), 389-401.

Underwood, J. (2000). A comparison of two types of computer support for reading development. *Journal of Research in Reading, 23*(2), 136-48.

U.S. Department of Education, Office of Educational Technology. (2010). Transforming American education: Learning powered by technology, Washington, D.C: Education Publication Center. Retrieved from http://www.ed.gov/about/offices/list/opepd/ppss/reports.html.