The effect of electronic book use on reading enjoyment and comprehension in 4th grade students at an inner-city public school

Jennifer D. Burke

Kennesaw State University

EDRS 8900

Spring 2014

Introduction

Electronic books for children are now not only widely available but also being touted as a silver bullet to increase reading comprehension. Furthermore, literacy skills today have evolved from reading and writing to include interaction with numerous modes of communications, mostly online. Today's students will need to successfully navigate a wide range of formats and text in order to compete for education and jobs with students from all over the world. Indeed, children have become so accustomed to accessing information in snippets that the concept of book as aesthetic object may be changing (Woods, Lushington & Chrichton, 2007). However, not all kinds of books can be translated into electronic format with full functionality with the same success as traditional print books. Only a small percentage of books, especially reference materials and textbooks, are actually sold in electronic format (Crestiani, Landoni & Melucci, 2005). The emerging ebook business is more about delivery than format, and the quantity of electronic books available for children are still relatively limited. At the same time, nearly two-thirds of fourth grade students in the United States are not reading at grade level, and there are significant gaps in reading ability among Hispanic and African-American children (Guernsey, 2011). Electronic books have been seen as a tool that can help close the gap for these students.

In many schools, many students are reading below grade level. This is partly due to lack of concerted instruction, but it may also be because they have not been sufficiently exposed to entertaining books that capture their attention and motivate them to read more for pleasure, which would improve their reading skills through practice. Students often do not see the importance of reading for fun, partly because most of their reading focuses on learning and assignments. They may not live in a household where reading is enjoyed and encouraged. Even among households with computers, including tablets and smart phones, technology is used

largely for entertainment. If more youngsters had easy access to high-quality electronic books they may be more likely to read for enjoyment, which would strengthen their reading skills, improving their confidence and interest in reading.

The question of how ebooks impact student learning has a very practical application for media specialists. Reading comprehension is critical for student learning across the curriculum and in all grades. If it can be demonstrated through action research specifically how ebooks impact learning, increase student motivation, and encourage reading for pleasure, additional expenditures can be justified to add to an ebook collection and ensure books are being purchased that incorporate the features that are most effective for learning and provide topical coverage in depth to support the curriculum.

The purpose of this research was to determine in what ways reading electronic books affects students' reading comprehension and vocabulary. Most experimental research in this area has been conducted with kindergarten and first grade students and indicates that giving students time to explore and read a considerate electronic book several times improves both their word-reading ability and vocabulary. Research conducted with older students has been focused on what factors influence their choice of electronic books. An examination of how motivation and engagement with electronic books affects reading comprehension would yield significant benefit to reading instructors and others seeking to understand best practices for implementing the use of electronic books into classroom instruction. However, little research appears to be available on what effect reading electronic books has on upper elementary students.

In many schools' instructional plans, improvement in reading comprehension and vocabulary has been targeted across all grades and in all subjects. Because ebooks can be used in

several classrooms simultaneously across grades, they support consistency in classroom instruction by allowing teachers to share the same texts, but with technological features that support learning and reading comprehension. Practical research could yield insights into the best ways to further incorporate ebooks into classroom instruction, and could help media specialists in make purchasing decisions as the results of this research are disseminated.

This research seeks to address the following questions: Are students more motivated to read electronic books than print books? How does reading electronic books affect elementary students' reading comprehension and vocabulary? This research design uses quantitative research to address both questions: student motivation relative to reading electronic books, and the effect of reading electronic books on comprehension.

Key terms used in this study:

- E-book (eBook) – commercially available electronic book available through online purchase or lending (as at a library), that can be read using a computer, tablet, or a specialized reading device.
- Considerate electronic book – electronic book with five to nineteen "hotspots" on a page that supports story content
- Notation – feature of electronic books that allows the reader to to make notes about the text that supports their understanding of and reactions to the story.
- Hotspots – hidden icons that relate to the story that appear when the user mouses over them.
- Highlighting – feature of electronic books that allows the reader to highlight text
- Bookmarking - feature of electronic books that allows the reader to return to a specific area to resume reading at that point
- Multimedia ebook – electronic book that includes text, video, activities, audio, pictures, notation and highlighting features.

The majority of currently available online books generally consist of digitized books whose copyright has expired. The best representation of the ebook metaphor in this case is the portable document format (PDF) which is an inexpensive, stable form at that can be viewed on any computer or device (Crestiani, Landoni, & Melucci, 2005, P194). These often include

notations, bookmarking features, and a table of contents that allows reader to skip to the desired page, but limit copy and paste features which preserve text integrity.

Literature Review

One challenge in reviewing literature on this topic is found in the variety of terminology used. Electronic books can include any type of text accessible with a computer or electronic reading device. These might be digital picture books, as in the case of the International Children's Digital Library, or they could be CD-ROM stand-alone electronic multimedia books. E-reading devices, iPad, Nook, Kindle, e-book, e-reader, e-text, and tablet are used interchangeably and without definition throughout the literature and in promotional materials. Electronic books might incorporate a variety of features such as animations, narration, a dictionary, or pictures, designed to make the story more accessible to young children. Sometimes electronic books are more entertainment than education, and incorporate animation, video and games that distract children from the story (deJong and Bus, 2004). At the other extreme, the majority of electronic books now available in the public domain are simply digitized text, sometimes with illustrations, that can be read online but offer no additional supporting features beneficial to children, especially those who are beginning readers, are at risk of learning disabilities, or are learning to read in a second language.

This variety in format can lead to disparity of access, when students lacking e-reading devices or internet access cannot read the same e-text as classmates or students in other schools. At the same time, cash-strapped schools need to be able to provide access to lower income students, for whom the school environment provides the best support for acquiring literacy skills. Access to electronic books can also be problematic for students at risk of learning disabilities, or

those who are visually impaired, especially when each different e-book might require a different process for turning pages, listening to narration, or accessing dictionary features (Baird & Henninger, 2011). Libraries must be especially vigilant in regards to purchasing electronic books to ensure quality materials that are accessible to the widest number of readers. Teachers are advised to be deliberate in their use of electronic books with young children, as developmentally appropriate practice in the use of technology with young children advises careful monitoring and instructional support.

Demands of technology use require expanded literacies including higher level conceptual skills; gaps are widening due to educational levels and income. In this review of literature authors found that technology can build knowledge and support higher level reading strategies and behaviors (Biancarosa & Griffiths, 2012). Technology can be a tool for mitigating literacy challenges, especially among low income students or those at risk of learning disabilities. Students need more than access to technology. Biancarrosa and Griffiths (2012) offered four policy recommendations for implementing the use of electronic books in instruction: insist on using e-reading technology that incorporates Universal Design for Learning, choose evidence-based electronic tools, make use of data provided about the devices as well as student use of the materials, and provide teachers with systemic support for technology use. Baird and Henninger (2011) found similar challenges in their evaluation of ten interactive eBook applications developed for Apple iTunes. They note that electronic books available for this platform are applications developed by 3rd party designers, which leads to inconsistency in design and incompatibility in basic functionality. Guidelines for designers and developers are essential, similar to those ones applied for CD-ROM products. Their analysis pointed out that most recent studies have addressed the extent to which digital resources are used and how they affect sighted

children's reading and understanding. Little attention has been paid to the use of commercially available electronic books by individuals with disabilities.

Researchers take widely disparate approaches to investigations into ways these products should be used. Additional research into this field is important both to inform teaching strategies that incorporate electronic books as well as provide insight into optimal development of ebooks. There is a significant body of research over the past 10 years that focuses on young children's comprehension and literacy development. These studies have been quite small and incorporated only one or two electronic books, and provided students with support from adults to ensure they can use the texts correctly.

In Israel, several studies have focused primarily on children's early reading ability (Korat & Shamir, 2007). In this widely cited research, researchers studied 128 Israeli kindergarten children randomly chosen from eight kindergartens: four from lower socioeconomic status neighborhoods and four from middle socioeconomic status neighborhoods. The students were then randomly placed into three different groups: one third of students read an ebook independently, one third of students were read to by an adult, and the third group received no special reading intervention outside of their normal kindergarten instruction. Pre- and post-assessments were used to determine students' emergent literacy levels in vocabulary, word recognition and phonological awareness. For this study, the researchers created their own e-book corresponding to an already-published story. The ebook incorporated what they felt represented the best features of e-books: the option to read the story only, read the story with a dictionary feature for twelve difficult words, read the story and play supporting activities, and printing the story. Findings indicated that students who interacted with this carefully designed electronic book performed as well as students who worked with an adult on the same book. However

carefully designed, this study did not consider the effects of commercially available, and therefore more widely used electronic books.

Studies of Dutch kindergarten students noted several positive developments in components vital to development of reading skills. These studies focused on children in low income neighborhoods whose first language was not Dutch. In one study, researchers found significant improvement in story understanding after four encounters with multimedia books. In particular, vocabulary increased as did children's understanding of implied story elements, which had been reinforced by multimedia components and animations but not reflected in the text (Verhallen, Bus & deJong, 2006). This study also noted that children with more improved language skills did not benefit from repeated exposure to multimedia text. Other than during focused research, children rarely read electronic books the same way each time unlike the normal manner in which adults read the same story multiple times, allowing children to benefit from the repetition. A study by Segers and Verhoeven (2003) focusing on vocabulary training by computer, which is a component often built into electronic books, can have positive effects in developing young children's word recognition skills. The Dutch studies used familiar children's books currently available in print and electronic format, more consistent with the learning environment in schools, rather than developing an electronic book specifically for the research study.

A similar study in Great Britain used two commercially available electronic books to again measure student comprehension. Grimshaw studied 132 British children aged 9-11 reading extracts of two storybooks in print and electronic formats: *Magicians of Caprona* and *The Little Prince*. In this case, numerous other electronic stories were considered but these two stories were selected primarily because of their availability. This study supported previous findings indicating

that text accompanied by animation and narration, with an age-appropriate glossary, improves reading comprehension. Students were more engaged and motivated using electronic books. (Grimshaw et al, 2007. p.598). Meanwhile, Donatich posited in his essay Why Books Still Matter (2009) that although research focuses on ways students learn from electronic books, comparisons between use of ebooks and print books indicate no significant difference in comprehension. He also points out that current reports about the demise of book reading assume nearly universal access to computers and ebooks, which is not accurate.

Lotta C. Larson has written extensively about student interaction with electronic texts and ways to incorporate these into classrooms. She believes reading instruction is undergoing transformation as new technology demands new literacy skills, and concurs with other researchers that traditional definitions of reading and writing are insufficient in today's world (Larson, 2010 p.16). Students today have a keen understanding of the possibility of combining modes and media to create knowledge, and teachers must seek alternative text sources including digital text and electronic books to support classroom curriculum needs. In one qualitative study, Larson observed the reading habits and interactions of two second grade girls in Iowa as they read the same story on two Kindle readers. The girls received detailed instructions for using the optional features of the devices, and they both often used highlighting, note taking and the dictionary function. Her observations suggest that electronic book reading supports comprehension and efferent reader response, as young readers respond to digital text in distinctively personal ways. (Larson, 2010). Prior to studying these girls she observed individual interactions with electronic books by observing ten 5th grade students reading electronic versions of *Bud, not Buddy* and *Watsons go to Birmingham.* None of the students had read electronic books prior to this. These older students made ample use of the note-taking features for

highlighting and annotating their copies. They did not concern themselves with writing conventions but focused on content to record their thoughts quickly. She found the electronic books encouraged students to interact with text and make their own meaning of passages (Larson, 2009).

Other research referred to the effect of electronic books on motivation and engagement of students. One study of 199 Texas middle school students in a reading improvement program found significant increases for boys on the value of reading (Miranda, et al, 2011). Engagement in reading is critical to successful reading, yet older students are frequently uninterested in reading, partly because many are reading below grade level and have difficulty completing a text. Students involved in the study completed the Motivation to Read Protocol (Gambrell, et al, 1998) before and after using Kindle e-readers provided by the school. Student reported positive responses to using e-readers that were unrelated to reading instruction; one student reported it was nice to use the e-reader because the book he wanted was always available. The researchers noted they faced a number of technological challenges with this project, and that further research is necessary to understand the gender differences that presented, as well as the effect of e-readers on comprehension. Estonian researchers had earlier documented gender differences in the way secondary students approach not only reading but the way they interact with technology (Mikk & Luik, 2005), which implies that the structure and format of electronic books is as important for older students as the subjects being addressed.

In their article about today's new breed of readers, Lamb and Johnson (2011) explained that careful consideration should be given to selection of appropriate electronic texts since there is such a variety currently available in numerous formats. The authors describe issues for consideration when selecting text and technology access, including format, platform, and

subscriptions. Publishers and producers are beginning to predictably conduct their own research into the efficacy of their products. Librarians need to provide access to a wide variety of both digital and traditional texts to encourage deep reading. Licensing concerns and subscriptions can be significant challenges. Meanwhile, they note that although reading linear text will continue to be the foundation for learning reading, students require new skills to navigate new literacies, although taking time for deep reading is counter to interacting with multimedia and animation.

Researchers in Maryland took a different approach to the use of electronic books. Few studies have investigated children's responses to literature from an aesthetic perspective, although one identified the relationship that culture and environment have on children's reading habits. Additionally, many studies have examined school achievement and compared reading comprehension among countries but have not examined recreational reading, which is a stronger predictor of future academic success. School and public librarians need to understand how children respond to literature in order to effectively define library services and plan programs. Therefore, these researchers undertook a longitudinal study of twelve children's responses to 241 self-selected electronic books found on the International Children's Digital Library, an internet-accessible library that is at once "everywhere and nowhere." Books in the ICDL are fiction and nonfiction, picture books and chapter books, representing literature and folk tales from around the world. Participants were selected from four schools in Germany, Honduras, New Zealand, and the United States and provided reviews of books using a response form that allowed ratings and comments. A major function of this research is to develop a greater understanding of children's recreational reading and attitudes relative to electronic books, which will help school and public librarians understand how children respond to electronic books so they can effectively define library services and plan programs.

Several conclusions about electronic books can be drawn from the literature. There are many different terms used to mean electronic books, but all descriptions refer to text that is accessible via computer or tablet. Studies of student use of electronic books support several generalizations. First, shared reading or partner interaction is important to student learning using both print and e-books, but there is no significant difference in reading comprehension between use of electronic books and adults reading aloud. Interaction is the critical factor, whether students are interacting with an electronic book or with an adult. Electronic books allow students to interact individually with a text, much as they might with an adult, and using electronic books supports students when individual interaction with an adult is not possible. Students using ebooks will use them repeatedly, such as for informational reference, rather than engage in general reading. Next, students tend to use the embedded dictionary function if available, either as a convenience or out of curiosity. Also, students from lower socioeconomic groups and students at risk of learning disabilities, or with lower literacy levels, can benefit more from use of ebooks that provide narration, supporting activities and the dictionary feature, which contributes to improved word recognition and vocabulary. Four areas of reading development have been shown to be supported by use of electronic books: engagement, concept about print, vocabulary, and story comprehension. Using electronic books helps build confidence and models fluency, offering students support for more effective word attack strategies than attempting to sound out each letter, which is a strategy often employed by students with low reading ability. When phonological awareness activities in electronic books are available for younger children, they are less important and less likely to be used than other features. Furthermore, books with activities and games not related directly to the story have a negative effect on story comprehension as they distract the child from story. Activities and pictures must support story content. Finally, the

format and design of the ebook is important. The best features of electronic books include a dictionary feature that has pictures and can be activated by children, a read-aloud feature with highlighted words, and an option that allows children to read on their own. For older students, the read-aloud feature with highlighted words continues to be important to reading comprehension and especially when supported by a note-taking function.

Methodology

This study was completed using quasi-experimental methodologies at Centennial Place Elementary School, a public elementary school in the Atlanta Public School district. Centennial Place enrolls approximately 520 students in kindergarten through 5th grade. Students at the school come from economically diverse backgrounds; about 58% are eligible for free or reduced price lunch, and nearly 60 students live in transitional housing for homeless families. The student population consists of 90% African-American students, 7% Caucasian, 2% Asian and 1% Hispanic. Approximately 52% of students are male, and nearly 70% of all families are female-headed households.

Purposeful sampling was used to identify study participants from among 74 4th grade students at Centennial Place Elementary School. Separate lists of 29 girls and 45 boys were compiled and numbered. Thirty students were then selected as possible participants using the sampling tool in Excel. From this group of comprised of seventeen boys and thirteen girls, seventeen students consented to participate in the research study, six girls and eleven boys, representing about 23% of the total 4th grade enrollment. One student participating in this study was Caucasian, three of the students were English language learners from Africa; the remaining thirteen students were African-American. Two students in the group have Individualized

Education Plans (IEP), indicating that they have some learning difficulties. Students were purposefully divided into two groups, control and intervention, each with a mixture of boys and girls that roughly approximates the gender makeup of 4th grade. Nine students comprised the intervention group who read an interactive electronic book, and the control group was comprised of seven students who read the print book.

Students met individually three times with the researcher over four weeks after lunch each day. Each student worked in a quiet location in the library. At the 1st session, about 15 minutes long, students completed the pre-tests on vocabulary and story elements and a survey to gauge motivation to read. In the second session, students in the control group read the print book while students in the intervention group read the ebook on the computer. At their 3rd sessions, each student read the book again in the same format and completed the post-tests. Students were permitted to take as long as they wanted to read the books.

At the beginning of the study participating students were asked to complete a questionnaire documenting their motivation for reading and engagement. This instrument was based on the *Motivation to Read Profile* (MRP) developed by Gambrell, et al. (1996). The researcher met with each student individually and read aloud each question in the *Motivation to Read Profile,* allowing time for the student to mark his or her answer choices for each question. This should have prevented students of lower reading ability being confused by the questions, which could have resulted in more capable readers being identified as more motivated. One student declined to participate further after completing the initial *Motivation to Read* survey.

Next, before reading the story, participating students completed pretests on both vocabulary and story elements. The vocabulary pretest consisted of a multiple-choice test on the

definitions and usage of ten words taken from the text. The pretest on story elements consisted of five multiple choice questions that can be answered with basic recall. Both vocabulary and story element tests were consistent in length and focus with *Accelerated Reader* online tests already familiar to students. *Accelerated Reader* is an online diagnostic and assessment tool developed by Renaissance Learning, Inc. that is widely used by elementary schools across the country. Using this style test alleviated confusion caused by students facing an unfamiliar testing environment. All survey instruments were created by the researcher specifically for this study. Students were assigned code numbers, and survey documents were coded with these numbers to maintain participant privacy while allowing distinctions between control and intervention groups.

Following pretests, students in the control group individually read a print book, *Crab Moon*, while students in the intervention group read the same text in using *Tumblebooks* electronic books. *Tumblebooks* is used in classrooms and for individual reading at this school, so students were already familiar with accessing the website. Participants read each book two times. Students reading the electronic book were allowed to choose the manner in which they interacted with the book at each session, either on their own or using the read-along feature of the book, in which text on the screen was highlighted while a narrator read aloud. Most participants in the intervention group chose to use the read-along feature for both readings.

After reading the books, each student completed vocabulary and story element comprehension post-tests to allow comparison of student comprehension and vocabulary pre- and post-condition. These tests consisted of the same vocabulary and story elements assessed during the pre-test, but the questions were presented in a different order to prevent students memorizing the short tests. Students again completed the *Motivation to Read Profile.* Finally,

after students had completed their reading and post-tests, students in the control group were shown how to access the ebook and given the opportunity to read the ebook if they wanted to.

For this study, it was important to use a book that is commonly found in school and public libraries, because these books have the widest availability to schoolchildren and families. Previous research used electronic versions of print books that were created specifically for the research study. Students participating in this study read one picture book, *Crab Moon*, by Ruth Horowitz (Candlewick Press, 2000). This book was selected because it is a readily available, well-reviewed children's picture book available in both print and electronic formats at no additional cost. The book was written for an audience in second through fifth grade, reading at the mid-fourth-grade level, and includes scientifically accurate informational vocabulary that is appropriately challenging for 4th grade students.

Results

Prior to beginning the reading intervention, seventeen 4th grade students were surveyed to gauge their motivation and interest in reading. The survey was scored with a Likert-type 4-point rating. Students with higher scores would be considered more motivated readers. The mean motivation score was 0.808, and the range between the less motivated students (0.575) and the more motivated students (0.925) was 0.35. The median score is 0.825 which indicates that half of students in our sample scored higher than the mean of 0.808.

Motivation prior to reading intervention

Mean	0.808333333
Standard Error	0.025781438
Median	0.825
Mode	0.825
Standard Deviation	0.09985108

Sample Variance	0.009970238
Kurtosis	0.890926538
Skewness	-1.105837403
Range	0.35
Minimum	0.575
Maximum	0.925
Sum	12.125
Count	17
Confidence Level (95.0%)	0.055295685

Prior to the intervention, students described their perception and motivation about reading by answering ten questions. They felt their friends describe them as "OK readers" (M=2.875, SD=0.806). Reading is something they sometimes like to do (M=3.125, SD=0.341). They felt that they read about the same as their friends (M=2.75, SD=0.856) and sometimes tell their friends about books they read (M=2.75, SD=0.930). When reading by themselves, they said they understand some of what they read (M=3.75, SD=0.447). They think reading is an interesting way to spend time (M=3, SD=0.894), but once in a while they worry about what other students think about their reading (M = 3.25, SD=1.064). They felt that reading is kind of easy for them (M=3.375, SD=0.885) and said that if someone gives them a book as a present they would feel sort of happy (M=3.437, SD=0.629). Finally, they said that knowing how to read well is important (M=3.813, SD=0.403).

Two sample independent t-tests assuming equal variances were then conducted on student scores for motivation, comprehension, and vocabulary to compare results of pre- and post-tests between the control and intervention groups.

First, the reading intervention was evaluated to determine whether reading an electronic book could contribute positively to 4th grade students' motivation to read. Survey scores of the students were compared before and after reading the electronic book. Following the reading

intervention, sixteen students again completed the *Motivation to Read* survey recording their motivation for reading, and results were scored using a Likert-type scale. Motivation scores of the two groups of students were compared for significant differences following reading intervention. The mean motivation score of students who read the interactive e-book was 0.791 as compared with the mean motivation score of students who read the print book (0.875). The independent sample t-test results indicated there was no significant difference between the two reading interventions in terms of motivation ($t=-1.02$, $df=14$, $p>.05$) among these groups of 4th grade students.

t-Test: Two-Sample Assuming Equal Variances

	Motivation and interest after intervention -ebook	Motivation and interest after reading - control group (print)
Mean	0.791666667	0.875
Variance	0.04109375	0.005625
Observations	9	7
Pooled Variance	0.025892857	
Hypothesized Mean Difference	0	
df	14	
t Stat	-1.027635384	
P(T<=t) one-tail	0.16077495	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.3215499	
t Critical two-tail	2.144786688	

There were slight increases in mean among student motivation measures for most questions. The increase was significant for only one indicator of motivation: when asked whether students considered themselves good readers, a paired t-test for means indicated the increase in self-perception was significant for all students ($t = -2.78$, $df =15$, $p<0.05$, one-tailed). The

motivation scores of the students in the intervention group were further analyzed to determine whether the intervention had a significant effect on motivation. Although slightly higher scores were observed after the treatment (mean = 0.778) than before the treatment (mean = 0.763), a paired t-test showed that the difference between the mean examination scores among the intervention group was not significant (t = -0.294, df =7, p>0.05, one-tailed) which suggests that reading electronic books has no significant effect on motivation to read among this group of 4th grade students.

t-Test: Paired Two Sample for Means
INTERVENTION GROUP

	Motivation before reading e-book	*Motivation after reading e-book*
Mean	0.7625	0.778125
Variance	0.012678571	0.045078125
Observations	9	9
Pearson Correlation	0.733882361	
Hypothesized Mean Difference	0	
df	7	
t Stat	-0.293537819	
P(T<=t) one-tail	0.38881154	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.77762308	
t Critical two-tail	2.364624252	

Reading Comprehension

The reading intervention was then evaluated to determine whether reading an interactive electronic book could contribute to higher reading comprehension. Prior to reading the book, sixteen students completed a pre-test consisting of five questions about events in the story. Following the reading intervention, participating students completed post-tests and results were scored. Scores on comprehension post-tests were compared using an independent sample t-test for students receiving the intervention reading the electronic book and students reading the same

book in print format. The mean reading comprehension score for nine students who read the interactive e-book was 4.33 as compared with the mean reading comprehension score for seven students who read the print book (3.71). Results indicate that there is no significant difference between the two reading interventions in terms of reading comprehension (t=0.87, df=14, p>.05).

t-Test: Two-Sample Assuming Equal Variances

	Comprehension after intervention -ebook	*Comprehension after reading - control group (print)*
Mean	4.333333333	3.714285714
Variance	1	3.238095238
Observations	9	7
Pooled Variance	1.959183673	
Hypothesized Mean Difference	0	
df	14	
t Stat	0.877600303	
P(T<=t) one-tail	0.197485972	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.394971945	
t Critical two-tail	2.144786688	

Next, comprehension scores for the invention group of nine students were compared before and after reading the electronic book. Higher scores in reading comprehension were observed after the treatment (mean = 4.333) than before the treatment (mean = 1.0). A paired t-test showed that the difference between the mean examination scores was significant (t = -7.55, df =8, p<0.05, one-tailed) suggests that reading electronic books may have an effect on reading comprehension among this group of 4th grade students.

t-Test: Paired Two Sample for Means – INTERVENTION GROUP

	Comprehension test before reading e-book	*Comprehension test after reading e-book*
Mean	1	4.333333333
Variance	0.75	1

Observations	9	9
Pearson Correlation	0	
Hypothesized Mean Difference	0	
df	8	
t Stat	-7.559289460	
P(T<=t) one-tail	0.000032753	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.000065507	
t Critical two-tail	2.306004135	

Although mean reading comprehension scores for students reading the print book were also significantly higher than before reading, the independent t-test indicates that there is no significant effect between reading an electronic book or reading a print book for this group of 4th grade students. The reading format did not affect the increase in comprehension scores.

Vocabulary

Vocabulary knowledge of sixteen students was compared before and after the reading intervention. Before the intervention, sixteen students completed a pre-test about the meanings of ten words critical to understanding the story. Following the reading intervention, students completed a post-test on these words. Test scores of two groups of students, intervention and control, were then compared for significant differences using an independent sample t-test with equal variance. The mean vocabulary score of students who read an interactive e-book was 5.66 as compared with the mean vocabulary score of students who read a print book (6.29). The independent sample t-test results indicated that there is no significant difference between the two reading interventions in terms of vocabulary knowledge (t=-.629, df=14, p>.05).

t-Test: Two-Sample Assuming Equal Variances

	Vocabulary scores after intervention - ebook	*Vocabulary scores after reading - control group (print)*

Mean	5.666666667	6.285714286
Variance	3	4.904761905
Observations	9	7
Pooled Variance	3.816326531	
Hypothesized Mean Difference	0	
df	14	
t Stat	-0.628798617	
P(T<=t) one-tail	0.269802742	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.539605483	
t Critical two-tail	2.144786688	

Among students reading the electronic book, slightly lower scores in vocabulary were observed after the treatment (mean = 0.567) than before the treatment (mean = 0.600). However a paired t-test of vocabulary post-test scores for the intervention group indicated that the difference between the mean examination scores was not significant (t = 0.755, df =8, p>0.05, one-tailed) which suggests that reading electronic books had no effect on vocabulary comprehension among this group of 4th grade students.

t-Test: Paired Two Sample for Means
INTERVENTION GROUP

	Vocabulary pre-test	*Vocabulary post-test*
Mean	6	5.666666667
Variance	2.5	3
Observations	9	9
Pearson Correlation	0.684653197	
Hypothesized Mean Difference	0	
df	8	
t Stat	0.755928946	
P(T<=t) one-tail	0.23568084	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.471361681	
t Critical two-tail	2.306004135	

Limitations

The validity of this research study was limited by several circumstances. The greatest limitation was due to sample size. Since this study involved a small number of participants, the

results cannot be generalized to a wider population. This study was also subject to a "research effect." Students' responses, particularly on the *Motivation to Read* survey could have been influenced by students' interest in and willingness to participate in the research study, particularly since they were acquainted with the researcher. Students participating in study were enthusiastic about participating and told their friends about the study. They were completely unconcerned about keeping their participation private. It was also noted that scores on motivation indicators actually declined slightly on several measures. Finally, it is possible that the text selected for this study was not interesting to students, and they might have been more motivated to read electronic books if they had the opportunity to choose reading material.

Conclusion and Recommendations

The purpose of this research study was to try to determine whether reading electronic books has an effect on student motivation to read as well as comprehension. To answer the first research question, "Are students more motivated to read electronic books than print books?" data analysis indicated that these 4th grade students were not more motivated to read by using electronic books. Anecdotally, 4th grade students actually seemed less motivated to read e-books on the computer. It is possible students felt they were tethered to the computer in this study, or were distracted by the animation. Additionally, students in this survey did not interact with the ebook in depth, but simply read through the story two times without otherwise engaging with the text or exploring beyond their initial instructions. Students reading print text made themselves comfortable and pored over pages, studying both text and illustrations, but the students reading e-books all used the read-aloud function of *Tumblebooks*.

The second research question, "How does reading electronic books affect elementary students' reading comprehension and vocabulary?" was also not completely answered by the

research. For this group of 4th grade students, there was no significant difference in reading comprehension or vocabulary knowledge between the intervention group that read the electronic book and the control group reading the printed book. Although reading comprehension and vocabulary scores improved following reading, the data did not indicate a significant effect from the format. Since none of the students could have scored high on the story comprehension test before reading the book, data indicates only that the act of reading in any format improves comprehension.

Independent t-tests for two samples assuming equal variance were conducted on test scores for motivation, vocabulary knowledge and story comprehension. The results of all these tests indicated that reading an electronic book has no significant effect on motivation to read, vocabulary knowledge, or reading comprehension among this group of students. Therefore, it can be concluded that reading e-books on a computer may not have a positive effect on African-American 4th grade students attending this urban public school.

Electronic text is used at this school, particularly for classroom instruction, and additional electronic materials will likely continue to be purchased to meet specific reading needs. Increases in reading comprehension and vocabulary scores were more noticeable for English language learners participating in the study, which indicates that more research is needed to determine how electronic books could be used to benefit this population. However, students with Individual Educational Plans who participated in this study did not score higher on either comprehension or vocabulary knowledge after reading the electronic book.

Electronic books may have the greatest effect in improving reading skills for younger children, but have less benefit to older students. Additionally, media and format may have an effect on reading motivation. This study required students to read an electronic book using a

desktop computer; reading motivation may be higher for students using tablet computers. Further research should be conducted with more participants in this age group to determine whether electronic books have a significant effect on reading comprehension or motivation to read.

Motivation to Read Survey

Student number _____ Date _____

For each question, choose the answer that best describes how you feel about reading.

1. My friends think I am _____
   - A very good reader
   - A good reader
   - An OK reader
   - A poor reader

2. Reading a book is something I like to do.
   - Never
   - Not very often
   - Sometimes
   - Often

3. I read _____
   - Not as well as my friends
   - About the same as my friends
   - A little better than my friends
   - A lot better than my friends

4. I tell my friends about books I read.
   - I never do this
   - I almost never do this
   - I sometimes do this
   - I do this a lot

5. When I am reading by myself, I understand
   - Almost everything I read
   - Some of what I read
   - Almost none of what I read
   - none of what I read

6. I think reading is _____
    - A boring way to spend time
    - An OK way to spend time
    - An interesting way to spend time
    - A great way to spend time

7. I worry about what other kids think about my reading _____
    - Every day
    - Almost every day
    - Once in a while
    - Never

8. Reading is _____
    - Very easy for me
    - Kind of easy for me
    - Kind of hard for me
    - Very hard for me

9. When someone gives me a book for a present, I feel _____
    - Very happy
    - Sort of happy
    - Sort of unhappy
    - Unhappy

10. Knowing how to read well is _____
    - Not very important
    - Sort of important
    - Important
    - Very important

Pre-test: Story Elements: *Crab Moon*

Student number _____ Date _____

1. Daniel's mother told him that horseshoe crabs were
   - As black as tar
   - More dangerous than jellyfish
   - Older than dinosaurs
   - As round as the full moon

2. What did Daniel and his mother have to do to see the crabs?
   - Ask Dad to take them to Horseshoe Beach
   - Row their tiny boat to Crab Island
   - Walk on the beach in the middle of the night
   - Ride their bikes to the beach at sunrise

3. What did Daniel's mother explain to him about the crabs?
   - The female crabs had one more pair of claws than males did
   - Only the female crabs came to the shore at night
   - The male crabs were twice as big as the females
   - The female crabs had smaller male crabs on their backs

4. When Daniel went to the beach in the morning, he found _____?
   - Two great blue herons "with legs long as stilts"
   - Black seaweed that looked like streamers left over from a party
   - Thousands of crabs bobbing on the waves like bathtub toys
   - Dozens of people picking up crab eggs as if they were seashells

5. What was wrong with the lone crab that Daniel had to rescue?
   - One of its claws was missing
   - A fishing line was snagged on its legs
   - It was trapped under a piece of driftwood
   - It was lying upside down

Vocabulary Pre-test: *Crab Moon*

Student number _____ Date _____

For each word, choose the word or phrase that is the BEST definition of each word.

1. Cottage
   - a small house with a single story
   - A tool shed with no windows
   - A building where farm animals are kept
   - A store where fishermen can buy bait

2. Path
   - a sidewalk
   - a route along which something travels
   - directions how to travel to a place
   - a plan to do something fun

3. Marooned
   - stranded
   - washed out to sea
   - hung up to dry
   - colored purple

4. Gentle
   - noisy and active
   - soft and mild
   - angry and loud
   - silent and still

5. Whisper
   - speak softly
   - cry
   - speak loudly
   - complain about the weather

6. Recede
   - chase after
   - pull back or move away or backward
   - follow
   - flow toward the beach

7. Arthropod
   - scorpions, spiders, insects and other joint-legged animals
   - a kind of fish
   - earthworms
   - a spiderweb

8. Wavered
   - blew in the breeze
   - waved slightly
   - flashed
   - moved rapidly back and worth

9. Snagged
   - caught on something
   - tangled up
   - folded up
   - rolled in a ball

10. Stilts
    - tree branches
    - tall poles for walking up high
    - boxes where toys are stored
    - a kind of boat

Vocabulary Post-test: *Crab Moon*

Student number _____ Date _____

For each word, choose the word or phrase that is the BEST definition of each word.

1. Wavered
   - blew in the breeze
   - waved slightly
   - flashed
   - moved rapidly back and worth

2. Marooned
   - stranded
   - washed out to sea
   - hung up to dry
   - colored purple

3. Recede
   - chase after
   - pull back or move away or backward
   - follow
   - flow toward the beach

4. Arthropod
   - scorpions, spiders, insects and other joint-legged animals
   - a kind of fish
   - earthworms
   - a spiderweb

5. Path
   - a sidewalk
   - a route along which something travels
   - directions how to travel to a place
   - a plan to do something fun

6. Cottage
   - a small house with a single story
   - A tool shed with no windows
   - A building where farm animals are kept
   - A store where fishermen can buy bait

7. Snagged
    - caught on something
    - tangled up
    - folded up
    - rolled in a ball

8. Gentle
    - noisy and active
    - soft and mild
    - angry and loud
    - silent and still

9. Whisper
    - speak softly
    - cry
    - speak loudly
    - complain about the weather

10. Stilts
    - tree branches
    - tall poles for walking up high
    - boxes where toys are stored
    - a kind of boat

Post-test: Story Elements: *Crab Moon*

Student number _____ Date _____

1. What did Daniel's mother explain to him about the crabs?
   - The female crabs had one more pair of claws than males did
   - Only the female crabs came to the shore at night
   - The male crabs were twice as big as the females
   - The female crabs had smaller male crabs on their backs

2. What was wrong with the lone crab that Daniel had to rescue?
   - One of its claws was missing
   - A fishing line was snagged on its legs
   - It was trapped under a piece of driftwood
   - It was lying upside down

3. When Daniel went to the beach in the morning, he found _____?
   - Two great blue herons "with legs long as stilts"
   - Black seaweed that looked like streamers left over from a party
   - Thousands of crabs bobbing on the waves like bathtub toys
   - Dozens of people picking up crab eggs as if they were seashells

4. What did Daniel and his mother have to do to see the crabs?
   - Ask Dad to take them to Horseshoe Beach
   - Row their tiny boat to Crab Island
   - Walk on the beach in the middle of the night
   - Ride their bikes to the beach at sunrise

5. Daniel's mother told him that horseshoe crabs were
   - As black as tar
   - More dangerous than jellyfish
   - Older than dinosaurs
   - As round as the full moon

References:

Biancarosa, G., & Griffiths, G.C. (2012). Technology tools to support reading in the Digital Age. *The Future of Children*, 22(2), 139-160.

Baird, C., & Henninger, M. (2011). Serious play, serious problems: issues with eBook applications. *Cosmopolitan Civil Societies: An Interdisciplinary Journal*, *3*(2), 1-17.

Balpe, J. (2004). Toward a diffracted literature. *Leonardo*, *37*(5), 385. doi:10.1162/0024094041956033

Clyde, L. A. (2005). Electronic books. *Teacher Librarian*, *32*(5), 45-47.

Crestani, F. (2006). Appearance and functionality of electronic books. *International Journal On Digital Libraries*, *6*(2), 192-209.

deJong, 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.

Donatich, J. (2009). Why books still matter. *Journal of Scholarly Publishing*, *40*(4), 329-342.

Fast, K. (2010). Interaction and the epistemic potential of digital libraries. *International Journal on Digital Libraries*, *11*(3), 169-207.

Friese, E. G. (2012). E-books, E-readers and the questions they Kindle. *Knowledge Quest*, *41*(1), 66-67.

Gambrell, L.B., Palmer, B.M., Codling, R.M., & Mazzoni, S.A. (1996). Assessing motivation to read. *The Reading Teacher*, 49(7), 518-533.

Grimshaw, S., Dungworth, N., McKnight, C., & Morris, A. (2007). Electronic books: children's reading and comprehension. *British Journal of Educational Technology*, *38*(4), 583-599. doi:10.1111/j.1467-8535.2006.00640.xt

Horowitz, Ruth. (2000). *Crab Moon*. Candlewick Press.

Houston, C. (2011). Digital books for digital natives: A tour of open access children's digital literature collections. *Children and Libraries*, Winter, 39-42.

Huang, Y. (2012). Empowering personalized learning with an interactive e-book learning system for elementary school students. *Educational Technology Research & Development*, *60*(4), 703-722.

Juan Pablo, H., Benjamin B., B., Allison, D., Anne, R., Allison, F., & Yoshifumi, T. (n.d). The International Children's Digital Library: viewing digital books online. *Interacting With*

Computers, *15*(Interaction Design and Children), 151-167. doi:10.1016/S0953-5438(03)00005-5

Killeen, E. (2011). Children and Reading. *Teacher Librarian*, *38*(4), 60-61.

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

Korat, O. A., & Shamir, A. (2007). Electronic books versus adult readers: effects on children's emergent literacy as a function of social class. *Journal of Computer Assisted Learning*, *23*(3), 248-259.

Lamb, A., & Johnson, L. (2011). Nurturing a new breed of reader. *Teacher Librarian*, *39*(1), 56-63.

Larson, L. C. (2008). Electronic reading workshop: Beyond books with new literacies and Instructional Technologies. *Journal Of Adolescent & Adult Literacy*, *52*(2), 121-131.

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. doi:10.1598/RT.64.1.2

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

Mardis, M., & Everhart, N. (2011). Digital Textbooks in Florida: Extending the Teacher-Librarians' Reach. *Teacher Librarian*, *38*(3), 8-11.

Massey, S., Weeks, A.C., & Druin, A. (2005) Initial findings from a three-year international case study exploring children's response to literature in a digital library. *Library Trends*, 54(2),245-265.

McClanahan, B., Williams, K., Kennedy, E., & Tate, S. (2012). A breakthrough for Josh: how use of an iPad facilitated reading Improvement. *Techtrends: Linking Research & Practice to Improve Learning*, *56*(4), 20-28. doi:10.1007/s11528-012-0572-6

Miranda, T., Williams-Rossi, D., Johnson, K.A., & McKenzie, N. (2011). Reluctant readers in middle school: Successful engagement with text using the e-reader. *International Journal of Applied Science and Technology*, 1(6), 81-91.

Mikk, J. (2005). Do girls and boys need different electronic books?. *Innovations In Education & Teaching International*, *42*(2), 167-180.

Moody, A.K. (2010). Using electronic books in the classroom to enhance emergent literacy skills in young children. *Journal of Literacy and Technology*, 11(4), 22-52.

Reuter, K. (2007). Assessing aesthetic relevance: Children's book selection in a digital library. Journal of the American Society for Information Science and Technology, 58(12), 1745-1763.

Segers, L., & Verhoeven, L. (2003). Effects of vocabulary training by computer in kindergarten. *Journal of Computer Assisted Learning*, 19, 557-566.

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

Shamir, A., & Baruch, D. (2012). Educational e-books: a support for vocabulary and early math for children at risk for learning disabilities. *Educational Media International*, *49*(1), 33-47. doi:10.1080/09523987.2012.662623

Shamir, A., & Shlafer, I. (2011). E-books effectiveness in promoting phonological awareness and concept about print: A comparison between children at risk for learning disabilities and typically developing kindergartners. *Computers and Education*, 57, 1989-1997.

Verhallen, M.J., Bus, A.G., & deJong, M.T. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology*, 98(2), 410-419.

Wessa, P. (2014), Free Statistics Software, Office for Research Development and Education, version 1.1.23-r7, URL http://www.wessa.net/. Accessed April 18, 2014.

Wood, C. (2005). Beginning readers' use of 'talking books' software can affect their reading strategies. *Journal of Research in Reading*, 28(2), 170-182.

Wood, C., Littleton, K., & Chera, P. (2005). Beginning readers' use of talking books: styles of working. *Literacy*, n.v. , 135-141.

Woods, C. A., Lushington, K., & Crichton, J. (2007). Readers' perceptions. *International Journal of the Book*, *4*(1), 51-67.

Wright, S., Fugett, A., & Caputa, F. (2013). Using e-readers and Internet resources to support comprehension. *Journal Of Educational Technology & Society*, *16*(1), 367-379.

Zucker, T. C. (2009). The effects of electronic books on pre-kindergarten-to-grade 5 students' literacy and language outcomes: A Research Synthesis. *Journal of Educational Computing Research*, *40*(1), 47-87.