

Using E-readers and Internet Resources to Support Comprehension

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ABSTRACT

The advancements of technology have led to the use of electronic reading systems for digital text. Research indicates similarities and differences in reading performance and comprehension in digital formats compared to paper formats. This study compared vocabulary understanding and reading comprehension scores from two reading sources (electronic story book and paper-based book). This study also evaluated the use of reading resources available (dictionary, thesaurus, word pronunciation) between the two reading methods. An AB experimental design consisting of three females currently enrolled in the second grade, between the ages 7 years 0 months to 8 years 11 months without an identified disability, was conducted between two reading methods (paper versus electronic book source) with the participants serving as their own control in both conditions. The results of this study conclude that although vocabulary and reading comprehension is consistent between the two reading methods, students are more likely to utilize reading resources when engaged with digital text. This article supports that comprehension of written materials remains unchanged for students regardless of presentation method (print versus digital). It also provides evidence that supports students who are typically developing demonstrate more willing to utilize reading resources when technological advancements are integrated into reading practices. Further research is needed in order to determine if this trend is consistent for children with a diagnosed receptive language or reading disorder.

Keywords

Literacy, Language, Technology, Digital Text, Reading Comprehension, Vocabulary

Introduction

The National Center for Education Statistics (NCES) showed that in 2003, 40% of fourth grade students in the United States scored below the basic level of reading expected for their age (Ogle, Sen, Pahlke, Jocelyn, Kastberg, Roey, & Williams, 2003). The impact of increasingly available electronic devices, and their use within society, could be a contributing factor to the decline of voluntary reading time for children. Children of the new generation are being referred to as digital natives (Prensky, 2006). Digital natives are born into an electronic world in which it seems their brains are immediately wired to acknowledge electronically operated devices, such as television remote controls, computers, and music players. Researchers claim that activities for children of this generation are more electronically driven than the activities of any other generation, and young children today are more intrigued by electronic devices than any other type of entertainment (Kinzer, 2003; Larson, 2009; Larson, 2008; Prensky, 2006). Digitally operated devices are thought to capture the interest of the American mind more than paper-based activities (Bennett, Maton, & Kerwin, 2008; Prensky, 2006; NEA, 2007). This transition is evidenced through the availability of electronic books (e-books). By altering the mode of reading material from traditional paper-based reading to electronic book (e-book) reading, interest in reading may increase, and thus be an effective solution to promote literacy activities both in and out of educational settings. Numerous studies illustrate the benefits of e-book reading as an effective means to improve the literacy skills of children, especially reading comprehension when assessed using multiple choice questions (Korat, 2009; de Jong & Bus 2002; Grimshaw, Dungworth, McKnight, & Morris, 2007).

Literacy is the key to success in a literate culture and an essential element to the educational development of students (Hay & Fielding-Barnsley, 2009; Moats, 2000; NEA, 2007; Strickland & Morrow, 1989). Well-developed reading and writing skills are associated with higher levels of academic achievement. Before a student can begin to develop literacy skills, several language structures must be developed in listening and speaking skills (McLaughlin, 2006). The development of literacy skills must exceed the production of pronouncing a printed word, or constructing letter sequences through writing, there must be a level a comprehension of the language embedded within these formats. This is why the development of grammar, semantics, metalinguistics, and pragmatics should be apparent in spoken language production and auditory understanding prior to the initiation of reading instruction. Reading and writing are complex processes that demand appropriate instruction for satisfactory acquisition of the skills necessary to

becoming a competent reader (Gleason, 2005; Moats, 2000; Strickland & Morrow, 1989). Learning to read is a complex process that is not easy to teach and consists of several components. The ability to read, and understand what is read, is directly impacted by a person's expressive and receptive language abilities. Spoken and written language skills are the ways in which someone expresses him- or herself, whereas listening and reading are means of receiving language. Developmentally, children first make gains in their listening skills that help generate new spoken vocabulary. Children must then take their spoken language knowledge and translate it into literacy development, specifically reading decoding and reading comprehension skills. The recognition of a word, and knowing that it has a function, stimulates the ability to understand the meaning of multiple words in the context of a sentence, which is called semantic knowledge (Gleason, 2005). At early literacy levels, a person is able to use prior knowledge to decode words, understand the parts of the word and how the word relates to surrounding words within the given context, and connect a meaning to the word based on its' context. Semantic knowledge opens the door to reading comprehension and interpretation of text. With the ability to connect meaning to print, a child is able to read stories more fluently and eventually read for educational purposes and learning new knowledge (Gleason, 2005). Direct instruction for reading usually starts during kindergarten and first grade; however, literacy learning is a lifelong process that begins indirectly during infancy and naturally continues throughout adulthood (Gleason, 2005). Prior to school enrollment, children's literacy skills begin to build through interactions with their environment. At home and in community settings, most children are surrounded by print material such as alphabet blocks, toys, newspapers, magazines, grocery lists, public signs, logos, and labels (Strickland & Morrow, 1989). Exposure to print, active engagement with literacy-rich activities, and facilitation by a caregiver are important experiences that prepare one for literacy development.

The five essential components of reading include phonemic awareness, phonics, comprehension, vocabulary, and fluency (Gleason, 2005; Hay & Fielding-Barnsley, 2009; Moats, 2000). When students in upper elementary and middle school grades demonstrate reading comprehension difficulties, the area of difficulty is typically weak phonological processing skills and the inability to decode words; skills they failed to master in their early years of literacy development (Moats, 2000). As a result, these students frequently skip over unrecognizable words, lack the ability to read fluently, and, therefore, struggle to comprehend age appropriate stories and educational material (Moats, 2000). Efficient reading skills do not develop easily for all children, and, within the school system, students often fail to receive special reading intervention when it is most needed. Children who experience numerous difficulties in reading may begin to associate negative feelings with reading activities. Children will frequently attribute their reading difficulties with low ability that can result in reduced self-esteem and therefore a lack of motivation to read (Kamhi & Catts, 1991). As a consequence of such deficits, a person who lacks motivation to engage in reading academic material activities may increasingly continue to fall behind in literacy skills and, thus, have difficulty advancing with higher educational knowledge. Reading intervention must be addressed aggressively. All children do not respond to repeated failure in the same manner, therefore alternate approaches to the teaching of reading skills should be utilized (Kamhi & Catts, 1991). Teachers and speech language pathologists need to focus on phonological skills, age-appropriate vocabulary, and comprehension strategies, while presenting instruction in an appealing manner that motivates the child to read (Gleason, 2005; Moats, 2000).

Technology is argued as a solution that will close the gap between teachers, and the traditional method of teaching, and students of the new generation. E-books provide an opportunity for teachers and children to connect and share knowledge, build relationships through literacy developing activities, and enhance stimulation in literacy enriched environments (Strickland & Morrow, 1989). Larson (2008) argues that altering traditional reading workshops to electronic reading workshops is crucial, as well as, educating teachers on how to implement technology and effectively use e-books within an elementary classroom. If e-reading workshops are not available for an educator, public librarians are a proficient resource for teaching adults, educators, and children digital literacy skills and showing educators how to best take advantage of literacy-learning options offered by e-books (Borawski, 2009). There is also concern regarding the distractibility of electronic sources used for e-books that may distract the reader's attention away from the text (de Jong & Bus, 2002). There are some concerns regarding the use of digital text, such as decreased reading speed, inability to accurately scan or notice details when screen reading, and distractibility from other available activities; however the benefit of readily available reading resources outweighs these concerns. Moreover, numerous studies illustrate the benefits of e-book reading as an effective means to improving the literacy skills of children, especially reading comprehension (Korat, 2009; de Jong & Bus, 2002; Grimshaw et al., 2007). Many teachers and researchers agree that e-books aid in the comprehension of reading and enhance literacy acquisition for typically developing children, as well as, children with learning disabilities of communication disorders (Black, 2010; de Jong & Bus, 2004; Korat, 2009; Shamir, 2009). Teachers help facilitate the development

of cognitive processes necessary for reading comprehension skills, especially for early readers. These cognitive processes are also developed through a variety of adult-child interactions. Unfortunately, some children lack, or have significantly reduced, adult-child literacy interactions in their home and school environments, thus inhibiting the acquisition of age-appropriate reading skills. Reading difficulties in children deprived of such reading interactions is frequently due to word-decoding failure, which can lead to poor vocabulary skills and thus difficulty with comprehension of higher-level reading materials. Adult-child interactions allow the child an opportunity to have instant oral-text narration, word-pronunciation, definitions and other useful literary information provided that are similarly available in e-book reading systems. These resources, as provided by electronic readers (e-readers), benefit emergent readers when parents or teachers are not readily available, as well as, late-developing older readers who desire privacy that prevent them from requesting help (Grimshaw et al., 2007). For struggling readers, and typically developing readers alike, e-book reading can provide a means for increased interest in literacy activities (Grimshaw et al., 2007).

Grimshaw and colleagues (2007) conducted a study that investigated reading comprehension and interest of reading of students based on the source of reading material (electronic versus paper-based). The research team analyzed two data sets. The first compared comprehension scores of two groups of students reading the same story through different sources. One group of students read the story digitally, while the other read a traditional paper-based book. Results illustrated no significant difference in overall reading comprehension abilities based on reading source. The second data set compared the comprehension scores and enjoyment level of three groups of students after reading the same reading passage either electronically without narration, electronically with oral-narration, or in a paper-based version. Results of a one-way analysis of variance (ANOVA) demonstrated that comprehension skills are significantly higher for electronic book (e-book) readers when the reader utilizes the available e-book resources, such as oral-narration. Based on student report using a 3-point Likert scale, the enjoyment level of reading was higher for the students reading the e-book with oral-narration versus those reading e-books without narration or those reading the printed version. The research team conducted their study with each participant individually, controlling for his or her reading level, book interest, age, gender, novelty of texts presented, and time given to complete the reading (Grimshaw et al., 2007). These results support that students' comprehension of text is unchanged when reading digital text compared to print. Although the time needed to complete the reading of digital text increased compared to print, students indicated a higher level of enjoyment while reading in this format.

De Jong and Bus (2002) compared children's attention to text based on the method of story narration (adult, e-book with games, e-book without games, audiotape) for 48 participants matched on age, socioeconomic status, reading level and absence of disability. The researchers provided an equal amount of time for reading in each of the conditions for the participants. The participants completed tasks related to the study individually, with only one examiner present to ensure that only the condition targeted was available to the participant (de Jong & Bus, 2002). Results from this study revealed that features offered through e-books distract the reader's attention away from the text, especially when games are not restricted on the e-book reader, but overall ability to recall the story was similar regardless of delivery method. However, Korat (2009) conducted a study that demonstrated significant benefits of e-book reading when word meaning and comprehension skills were evaluated using yes or no questions and compared to print-based book reading. Moreover, in another comparable study by Korat and Shamir (2007) results concluded that children receive similar literacy benefits when they read independently using an e-book reader and when an *adult* reads to them using a book in print. It is important to note that in both studies, Korat (2009) and Korat and Shamir (2007), children using the e-book were limited to the available resources on the e-book reader by omitting access to gaming programs or application options. Participants involved in these studies were all within the emergent literacy age-range; an age in which it is normal to receive outside support to interpret and comprehend text. These participants were asked to engage in the reading tasks, controlled for age of participant, reading ability and interest level of the participants, individually but while being in groups of three. These studies indicate the potential of digital text to enhance literacy development, especially those in kindergarten and first grade (Korat, 2009; Korat & Shamir, 2007).

The American Speech Language Hearing Association (ASHA) (2010) stated that an educational reform addressing literacy achievement within the schools is needed in response to the decline of academic scores and school drop-out rates over the past decade. To improve the overall academic success of America's current students, educators are encouraged to place direct attention on literacy achievement (ASHA, 2010). The demand to increase overall academic success within the schools is addressed through the emphasis of literacy acquisition activities, thus the role

of literacy intervention for speech language pathologists is escalating. Therefore, discovering an alternative means to story reading that enhances children's reading interest and comprehension skills is important to this field of study.

In order to meet the needs of literacy development for today's children, several researchers and educational authorities argue that traditional classroom teaching styles must be modified (Black, 2010, Kinzer, 2003; Larson, 2009; Larson, 2008; Prensky, 2006). Schools need to act on this notion and, instead of continuing traditional means of teaching, need to utilize technology within the classroom as a foundation to reinforce the interest and motivation of literacy engagement. Several teachers and researchers argue that by adopting technology into the classroom, educators will provide more efficient and relevant education to their students (Bennett et al., 2008; Kinzer, 2003; Larson, 2009; Larson, 2008; Prensky, 2006). Teachers are increasingly encouraged to use various forms of technology within the classroom which the newly revised NETS [National Educational Technology Standards] for teachers provide a framework for transitioning schools from industrial to digital places of learning (Larson, 2008). Such technologies include PowerPoint presentations, online communication systems, online research, electronic discussion boards, and multimedia teaching techniques within the classroom (Kinzer, 2003). Teachers are encouraged to download e-books, use digitally interactive reading activities, and learn to how to best utilize these sources for literacy development (Borowski, 2009; Larson, 2008).

E-books are available through the Internet or CD-ROMs. E-books available through the Internet are usually purchased through online bookstores or borrowed free from electronic libraries or other public resources (de Jong & Bus, 2002). CD-ROM books are purchased through local bookstores, toy stores, drug stores, catalogs, computer stores, or borrowed free from public resources. The system used for reading, a computer, tablet or palm-based device (e.g., Amazon Kindle, iPad, Sony's Reader Digital Book, or PDAs), determines the resource for locating electronic texts: Internet or CD-ROM. Most e-books include multimodal tools such as written text or oral narration, music, sound effects, dictionary, thesaurus, hotspots, and animation (Korat, 2009). Most e-books additionally have useful educational tools for highlighting, bookmarking, note making, search features and other valuable features for more advanced, educational reading (de Jong & Bus, 2002).

Although most schools currently do not have the financial means to purchase PDAs, tablets or other hand-held electronics, most schools offer computers that teachers may use for classroom lessons. Schools may either have a room or hallway designated for computers, or may only have computers within the school's library. Schools usually have access to enough computers for each student within a single class, or to share with a partner. Teachers can have students access e-books through an e-book website, or the educator could download a CD-ROM story onto the computer prior to the classroom session. Larson (2008) reported that it is the responsibility of educators to integrate the use of technology into literacy instruction and the entire language development curricula.

Purpose of the study

The purpose of this study was to determine whether children utilize readily available technology features available on e-book readers (i.e., animation, highlighting, dictionary, thesaurus, etc.) to support overall reading comprehension. This study did not intend to validate that e-books should replace paper-print books for children but simply to discover if e-books provide an alternative option to reading which may be more effective than the traditional method. This study intended to replicate the findings from previous research in regard to reading comprehension similarities regardless of reading format, but support that students may have greater independent learning through the use of embedded reading reference materials. For the purpose of this study, attention focused on the multimodal options offered by e-books that support early developing reading skills: thesaurus, dictionary, and text-to-speech capabilities. Such reading resources support comprehension of texts that are otherwise not easily accessible to children when reading traditional paper-based books. The interest and enjoyment in reading during the two reading methods (electronic versus paper) was also explored. It is hypothesized that with the integration of technology in reading instruction, participants will increase their overall reading comprehension.

Methodology

Participants were recruited through word-of-mouth through the Mary K. Chapman Center for Communicative Disorders on the University of Tulsa college campus. Eligibility was determined through completion of a parent questionnaire (See Appendix A), hearing screening, language assessment, and reading assessment. Students that

qualified based on the parent questionnaire were assessed using a reading screener (Slosson Oral Reading Test-Revised (SORT-R)), and standardized language assessment (Clinical Evaluation of Language Fundamentals-Revised (CELF-R)) at The University of Tulsa communicative disorder clinic by the researcher under the supervision of a certified and licensed speech-language pathologist. The participants were the first three students who met all eligibility criteria and agreed to participation in the study through parental informed consent and assent procedures.

Participants

This study consisted of three females currently enrolled in the second grade, between the ages 7 years 0 months to 8 years 11 months. All participants scored within normal limits for their age in language skills according to the CELF-R (Semel, Wiig, & Secord, 1995), and within normal limits for their age in reading skills according to the SORT-R (Slosson, 2003), as assessed by the researcher. Parent reports indicated that all participants had hearing and vision abilities within normal limit, and did not have any history of special education services or recommendations for special education services. Participants were all from middle socioeconomic status families and English was indicated as the primary spoken language in the home. All participants had access to computers and video gaming systems at home during participation in this study. According to parent report, none of the participants had previous exposure to the specific stories used for this study or history of using any type of e-reading system except for e-mail or Internet browsing. In order to insure protection of the participants this research was approved by the institutional review board at the University of Tulsa and employed both informed consent by the parents and assent of the participants. There were no expected risks to the participants in this study. Interestingly, participant's reported that their reading experience was enjoyable, particularly when reading electronically. A small sample size was collected in order to make a book club more feasible, and would be more prevalent in an applied setting.

Research design

An AB experimental design was conducted between two reading methods with the participants serving as their own control in both conditions. Each participant engaged in reading sessions that met four times over a three-week period for one and a half to two hours per session. During the reading sessions lead by the researcher at The University of Tulsa communicative disorder clinic, the participants read one story using a traditional paper-based book and one story using an electronic-based book. The stories were equally divided across the four reading sessions; the first and second reading session focused on the paper-based book and the third and fourth session focused on the electronic book. Each story was divided into four segments and the participants were required to read each segment during a time period. Prior to the first and third session, participants were given instructions on the use, and recording process of the available resources (dictionary, thesaurus, and word pronunciation) for each reading method. Participants read simultaneously, in the same room which was set up similar to a living room with chairs, tables, and couches, and in individually chosen "reading-spots." Variables that were considered to be influential in affecting outcomes were alertness level of participants, interaction of participants, and amount of time allotted for reading. The sessions were designed to occur on days in which the participants did not have to attend school in order to limit the amount of general fatigue from a long school day. The participants were not allowed to engage or interact with one another throughout the timed 15-minute silent reading period, or while completing the comprehension quizzes. The researcher designed "reading-spots" with props such as a beanbag chair and a blanket sprawled on the floor in order to give each participant his or her own space, and remove the possibility of interactions. The researcher remained in the room to monitor the participants throughout the independent reading time to ensure there were no interactions among them during the reading time or that the participants did not refer to the text while completing their comprehension quizzes. Participants independently completed comprehension quizzes in individually assigned areas within the same room. A description of each reading session is found in Appendix B. This method is similar to other studies whose aim was to assess text comprehension (Cross & Paris, 1988; Ray & Beldon, 2007; Senechal, 1997).

Instruments

Storybooks

A book via an e-reader, specifically the Apple iPad, and a book via paper-based print were used during this study. One story was chosen for each reading method. Both stories were matched equally in level of reading difficulty as

determined by *Scholastic*, reading interest based on gender and grade of participants, genre (fiction), and page length. According to *Scholastic's* reading level system, both stories qualified at the 2.3 reading difficulty level, pre-k to third grade reading interest level, categorized under the genre of mystery, and met the page-length between 50-65 pages.

Comprehension quizzes

A total of four reading comprehension quizzes were given to each participant during the study; two quizzes based off of the paper-based story and two quizzes based off the e-reader story. The researcher constructed the quizzes. Each quiz was equally matched in style and type of questions asked, and consisted of four multiple-choice questions; two term-defining questions, one implicit question, and one explicit question (See Appendix C).

Resources available for use

A paper-based dictionary, a thesaurus, and the option to ask the researcher questions were provided while the participants read the paper-based story. While reading via electronic source, participants had access to use the dictionary, thesaurus, and word pronunciation tools offered on the iPad. Prior to beginning the story on e-readers, all participants were instructed on how to utilize the technological resources for reading.

Data analyses

Data analyses consisted of collecting the number of times (frequency) resources (dictionary, thesaurus, and word pronunciation) were used while reading for each of the two reading methods, and assessment of overall comprehension (based on frequency of correct responses) of the read materials for each reading period. A self-reporting tally system was used to record the total use of reading resources by each participant. Video recordings were used for viewing after intervention as a reliability check by the researcher and a trained outside observer. A comprehension quiz was given to each participant after each reading session to measure reading comprehension. A χ^2 McNemar Test for significance of change is used for dependent sample designs and was calculated for each of the two hypotheses because of the small sample size, the AB design, and the collection of frequency data (Hinkle, Wiersma, & Jurs, 2003). Further, the print source was treated as a baseline of comparison to the electronic texts thus simulating a pretest-posttest design. It was felt that the χ^2 McNemar Test for significance of was the best fit for statistical analysis.

Results

Two sets of data were analyzed. The first data set was the number of times literacy resources were used by type of reading method. The second set of data was the overall reading comprehension of text-based quizzes by reading method. Resource use data was calculated using a tally system. Analyses determined how frequently the participants used available literacy resources per method of reading. The frequency of use between the two conditions, paper-based and electronic reading was then compared. As indicated by Figure 1, the participants utilized more literacy resources when reading in an electronic format.

Data regarding participant's reading comprehension was collected and analyzed using a point system with two, four-point quizzes per reading method. The quizzes for each method were combined for total of 8 possible points per method. As seen in Figure 2, the participants scored better on reading comprehension when reading through paper-based texts rather than on an e-reader system.

A χ^2 McNemar Test for significance of change was calculated for each of the two hypotheses. First, the number of times participants used reading resources with print materials and with electronic materials was analyzed. Results indicated that there was a significant difference between the number of reading resources reported for print and electronic sources, $\chi^2 (1, n = 3) = 7, p < .05$. More resources were used when participants were reading with the

electronic sources than when they were reading print materials even though the same kind of resources were made available for both conditions.

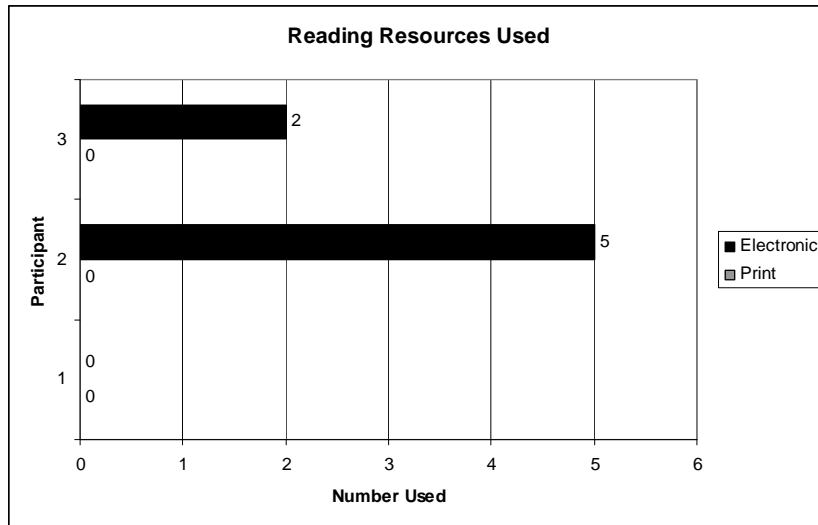


Figure 1. Comparison of resources used between the two reading methods

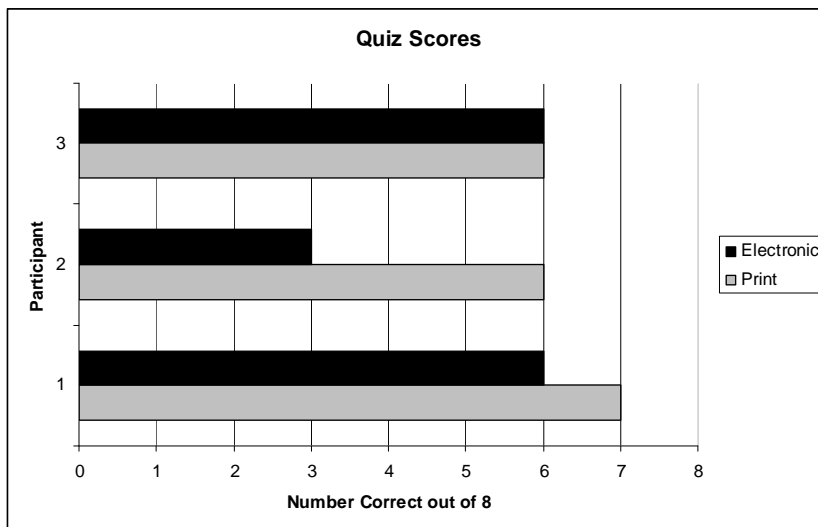


Figure 2. Comparison of vocabulary and comprehension quiz scores between the two methods of reading

Secondly, the frequency of the number of correct quiz responses for those using print books was compared to the number of correct quiz responses for those using electronic books. Results indicated that there was not a significant difference between the number of correct responses reported for print and electronic sources, $\chi^2 (1, n = 3) = .47, p > .05$. While there does seem to be variations in quiz scores, these differences are not significant. Similar to the findings of Grimshaw et al. (2007), these results do not indicate a change in comprehension based on reading source.

Conclusions and discussion

The results support the hypothesis that children accessed reading support resources (e.g., a dictionary) more frequently while using an electronic reader. However, the results do not reflect the hypothesis that an e-reading method increases children's reading comprehension.

The researcher noted that the participants' reading time was consistently longer when reading on the iPad compared to the print-source. This observation could either challenge the understanding that children born in the new generation are able to automatically adapt to electronic use, or arise multiple other explanations. It may also support that attempting to capture the detail available while screen reading slows down overall reading fluency. One cause could be supported by Grimshaw et al.'s (2007) study, saying that kids are distracted by technology. Another explanation may be that since this was the participants' first time utilizing the e-reader, the initial "getting comfortable" with a new device and playing with iPad's features (i.e., automatic page turning by the flicking one's finger over the page). On the other hand, it could be that the technology enhanced the children's engagement when reading due to the higher-grade images and electronic front, thus causing them to take longer to complete the required readings. The positive feelings associated with interacting with digital text may have increased the overall motivation to engage in the required readings.

This study differs from Grimshaw et al.'s (2007) study in that the participants of the present study were not able to refer back to the story when taking comprehension quizzes. Within Grimshaw et al.'s (2007) study it cannot be stated with any certainty whether the children were simply turning the pages during the reading time, or actually comprehending the story while reading. Allowing the child to refer back to the story while testing reading comprehension could contribute to the lack of significant differences found between reading books in paper versus electronic formats. For that reason, the present study was concerned with measuring reading comprehension absorbed by the reader while reading the story without the opportunity to refer back to the text.

Notably, each participant's reading experience was more enjoyable when reading via electronically verse paper print, as reported by the participants themselves. This data was gathered by asking the participants to provide feedback about their reading experiences using the two reading methods. They were asked to state which reading method they liked better, and then to write about why one method was preferred over the other. Each participant selected the iPad over the print book. The following reasons were a few among the responses provided by the participants: The iPad is easier to hold, liked the option to change the screen's contrast to lighter or darker, enjoyed turning the pages, liked using the electronic book-marker, could understand the story better, and liked the iPad better because the paper book hurts when trying to hold the pages.

Pedagogically, the logical conclusion is that the evidence from this research supports the use of e-texts in reading groups and in the classroom. This is particularly true for students who might not enjoy reading a typical paper-based book or in cases where it is advantageous for a student to access resources. While there is no improvement in comprehension scores, it is important to note that there is no reduction in scores. Further, participants do have an increased use of resources. This could be attributed to any number of items (such as ease of use, enjoyment of use, lack of peer involvement or input on the use of resources). Finally, the participants reported that reading on the iPad was more "fun."

A limitation of this study was the reduced number of participants. Further research is needed to investigate the effects of this study for students outside the particular eligibility criteria for this study. That is, students from different socioeconomic statuses, age range of students, and students with identified reading or communication delays or disorders.

Based upon the present study's findings, a question was raised as to why the participants reading comprehension scores did not remain consistent between the two reading sources and why more reading resources were accessed with digital texts. A further study comparing the reading comprehension of longer books which would require longer periods of interaction with the digital texts than this study would provide greater support for the influences of technology on the processes of reading comprehension. Special attention should be given to the manipulability and ease of technological resources available to support reading comprehension (e.g., thesaurus, dictionary, pronunciation) compared to traditional paper-based supports.

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Appendix A

Parent Questionnaire

Today's Date:

- | | | |
|--|-----------------|-------------|
| 1. age between 7.0 and 8.11 years: | Y N | birth date: |
| 2. gender: | M F | |
| 3. enrolled in second grade: | Y N | |
| 4. history of special services (speech therapy, use of resource classroom, learning disability): | N Y | |
| 5. recommended for special education: | N Y | |
| 6. visual impairment (or glasses): | N Y | |
| 7. socioeconomic status: | Low Middle High | |
| 8. English primary Language spoken at home: | Y N | |
| 9. access to computer at home: | Y N | |
| 10. access to video games at home: | Y N | |
| 11. read the story "Nate the Great and the Stolen Base" by Marjorie Sharma: | Y N | |
| 12. read stories from the "Nate the Great" book series: | Y N | |
| 13. read the story "Cam Jansen and the Mystery of the U. F. O." by David Adler: | Y N | |
| 14. read stories from the "Cam Jansen" book series: | Y N | |

Appendix B

Format of reading sessions: order and time span of each activity

<u>Activity</u>	<u>Time span measured by minute</u>
Print book: reading session I	
get-to-know each-other game	15
independent reading; pages 7-17	15
snack break	15
independent reading; pages 18-29	15
comprehension quiz	10
fun activity: make “octopus pops”	20
Print book: reading session II	
independent reading; pages 30-39	15
snack break	20
independent reading; pages 40-48	15
comprehension quiz	10
fun activity: scavenger hunt	30
E-book: reading session III	
independent reading; pages 13-28	15
snack break	20
independent reading; pages 29-41	15
comprehension quiz	10
fun activity: make alien goo	30
E-book: reading session IV	
independent reading; pages 42-55	15
snack break	20
independent reading; pages 56-65	15
comprehension quiz	10
reading method questionnaire	10
fun activity: create paper U. F. O.	30

Appendix C

Quiz #1

1. What does mascot mean? “They are the team’s mascots.”
 - a. a wild animal
 - b. a good luck charm
 - c. a Halloween costume
 - d. a type of food
2. What does sorted mean? “I, Nate the Great, moved things, plied things, and sorted things”
 - a. to put things in the right place
 - b. to make things messy
 - c. to throw away things
 - d. to tear things
3. Where is the first place Nate looked for the missing/stolen octopus?
 - a. In a tree
 - b. at the playground
 - c. In the Oliver’s trashcan
 - d. on Oliver’s bookshelf
4. Rosamond thinks her cats could find the octopus if it was **not** made of plastic. Why?
 - a. Her cats do not like plastic things
 - b. plastic octopuses are harder to find
 - c. a real one would smell like fish and cats eat fish
 - d. it would be easier to find swimming in the ocean

Quiz #2

1. What does snatch mean? “Did Oliver see the snatch?”
 - a. to hit a homerun
 - b. a kids t.v. show
 - c. to steal something
 - d. a type of insect
2. What does peered mean? “Then I peered behind the bookcase.”
 - a. to look closely
 - b. to walk slowly
 - c. to look quickly
 - d. to sit for a long time
3. Who did Nate think stole the base **first**?
 - a. Rosamond’s cats
 - b. an older kid at school
 - c. the other team
 - d. Annie’s dog, Fang
4. At the end of the story when Nate was up to bat, why did he hope to strike out?
 - a. He was scared of Fang, who was on the third base
 - b. He wanted to play with Fang and his bone instead
 - c. to look for another mystery to solve

- d. He did not want to lose the baseball after he hit it

Quiz #3

1. What does posed mean? “I can’t take a posed picture,” Eric told her.
 - a. to be famous
 - b. to pretend or be fake
 - c. to be old
 - d. to be creative
2. What does squaw mean? “We’ve seen a red-backed sandpiper, a bufflehead, an old-squaw, and now this.”
 - a. a Native American woman
 - b. a type of snake
 - c. a dinosaur fossil
 - d. a type of vegetable
3. Why did the reporter walk away before Cam finished talking to her?
 - a. U. F. O. stories scare the reporter
 - b. The reporter did not like the cat liking her
 - c. Cam was not telling the truth
 - d. The reporter saw a UFO in the sky
4. Why did they name the cat Neptune; an outer-space name?
 - a. the cat likes stars at night
 - b. the cat looks like a planet
 - c. they thought the cat came from the U.F.O.
 - d. they found the cat at the same time they saw the U. F. O.

Quiz #4

1. What does stroked mean in the sentence, “She stroked the back of her neck” ?
 - a. to hit something hard
 - b. to gently move your hand across something
 - c. to paint
 - d. to give a kiss
2. What does shield mean in the sentence, “Cam held her hand over her eyes to shield them” ?
 - a. a type of hat
 - b. a pair of glasses
 - c. a piece of armor carried on arm
 - d. a way to protect something
3. Why did Neptune move towards the end of the tree branch when she saw Cam?
 - a. Cam will give her food if Neptune shakes the branch
 - b. Neptune was scared
 - c. They were playing the game, hide-and-go-seek
 - d. Neptune lives in the tree
4. What did the kids use to make the UFOs?
 - a. Metal
 - b. Candy, tape, and paper plates
 - c. Balloons and flashlights
 - d. They were real UFOs from space