

THE IMPACT OF E-READERS ON THE DOMAINS OF READING COMPREHENSION IN
HIGH SCHOOL STUDENTS

by

Erika Margaret Zeidler

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Education

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ABSTRACT

In this quasi-experimental static comparison group design, a homogenous sample of 128 American Literature (high school juniors) students were placed in a comparison and treatment group to determine whether e-readers can improve decoding skills and language comprehension, the two main domains of reading comprehension. Both groups took a pre- and posttest that measured their reading comprehension skills in both areas. The comparison group read a class assigned novel in a traditional paperback version while the treatment group read the novel on either a Kindle or a Kindle app on his or her smart phone or device. The treatment group was given a tutorial on how to use the various tools contained within the e-reader the participant was using, and the participants were encouraged to utilize those tools. Upon analyzing the data, there was no significant difference in decoding rates; however, language comprehension was improved in the e-reader group. A possible explanation for the e-reading improvement is the use of the tools that allowed for improved vocabulary comprehension, expansion of prior knowledge, and encouragement of metacognition. Further studies with specialized and groups would help to validate the inclusion of e-reading technology into more schools. Also, more research among varied age groups would help to show if decoding rates could be improved using e-readers.

Table of Contents

ABSTRACT..... 3

CHAPTER ONE: INTRODUCTION..... 8

 Introduction 8

 Background 8

 Problem Statement 9

 Purpose Statement 10

 Significance of the Study 10

 Research Questions and Hypotheses 10

 Identification of Variables..... 11

 Definitions 11

CHAPTER TWO: LITERATURE REVIEW..... 13

 Introduction 13

 Theoretical Framework 16

 Reading Comprehension 20

 Reading Comprehension Strategies 28

 Digital Literacy 29

 E-Readers 31

 E-Readers and Education 35

 Studies of E-Readers 39

 Summary 49

CHAPTER THREE: METHODS..... 51

Design.....	51
Research Questions and Hypotheses.....	51
Participants and Setting.....	52
Instrumentation.....	54
Procedures.....	57
Data Analysis.....	58
CHAPTER 4: FINDINGS.....	64
Introduction.....	64
Research Questions and Hypotheses.....	64
Descriptive Statistics.....	65
Results.....	68
Summary.....	81
CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS.....	83
Overview.....	83
Summary of Findings.....	83
Discussion.....	84
Implications.....	94
Limitations.....	96
Recommendations for Future Research.....	97
Summary.....	98
APPENDIX A.....	106
APPENDIX B.....	110

List of Tables

Table 1	54
Table 2	56
Table 3	57
Table 4	66
Table 5	67
Table 6	68
Table 7	68
Table 8	69
Table 9	69
Table 10	70
Table 11	71
Table 12	71
Table 13	73
Table 14	73
Table 15	74
Table 16	74
Table 17	75
Table 18	75
Table 19	75
Table 20	76
Table 21	76
Table 22	77

Table 23	77
Table 24	78
Table 25	78
Table 26	79
Table 27	80
Table 28	81

CHAPTER ONE: INTRODUCTION

Introduction

Reading comprehension is a complex process that students must successfully work through to be successful in education. Reading creates the basis for all areas of the educational curriculum; therefore, research seeking improved strategies is necessary for continued student success (McCallum et al., 2011, p. 78). One strategy called into question is the use of e-readers in the classroom; however, there remains little research addressing the efficacy of these tools and their impact on reading comprehension.

Background

A major component skill required for successful reading comprehension to occur is the student's activation of his or her prior knowledge. Research consistently stated that prior knowledge is the most important skill required for students to engage successfully with a text. Based on Piaget's theories of Structuralism and schemes, extensive research has yielded numerous strategies to aid students in scheme creation to foster their reading comprehension abilities. The use of schemes in reading is complemented using metacognitive strategies. While students use schemes to activate their prior knowledge thus creating a context for the piece, metacognitive strategies allow for self-monitoring of comprehension (Miller, 2011, p. 34; Anderson, 2010, p. 594).

Another force upon education is the advent of technology. Students have been born into an era where they have always had access to the various forms of technology, and they incorporate it into everything they do. Educators are aware of the connection students have to technology; however, they often struggle with how to incorporate this emerging trend into the classroom truly to create deeper educational experiences (Bittman, 2011, p. 161). Many teachers

feel that technology integration in the classroom is nothing more than an overcomplicated version of the same message they can deliver through traditional means. This line of thinking is largely because there lacks an extensive body of research to validate technology integration in education (Honan, 2012, p. 83).

One piece of technology trying to find a place in education is the e-reader. An e-reader is an electronic book that has the same readability as paper and contains tools for note taking, highlighting, etc. Many schools are adding these devices to their libraries hoping the availability of e-readers will encourage students to read more and to read with more efficiency; however, until more research exists to validate or invalidate the effectiveness of e-readers, there will be a section of teachers who refuse to embrace this and other technologies on the horizon.

Problem Statement

Students arrive to the classroom with a set of skills related to technology they often do not get to use in school. This disconnect in education between the emerging technological skills of students, and the traditional approach of most educational institutions is causing students to become disengaged from their learning. Furthermore, many students feel their learning lacks efficiency when technology is not incorporated.

Also, schools are investing tremendous amounts of money to try to stay current with technological trends with little data to support the expense. Research, especially in the quantitative realm, is scant in concluding that the use of technology yields better student performance (Wright, Fugett, and Caputa, 2013, p. 371). Furthermore, even less data exist in regards to the use of e-readers. Policy makers and educators need to have more concrete evidence that true technological integration not only engages students, but also increases their authentic learning.

Purpose Statement

The purpose of this study is to discover whether there is a significant difference made in reading comprehension rates of students using e-readers compared to traditional texts within a secondary classroom . Students have increasing access to tools that complement their digital literacy skills, and this study seeks to determine if the use of electronic reading platforms, such as e-readers, makes a difference in the skill of reading comprehension.

Significance of the Study

The significance of this study is twofold. First, if students who use e-readers do show significant reading comprehension gains over students who do not, the teaching of reading can be shifted from traditional paper methods to e-readers. Secondly, if this study shows that significant difference, educators will have a reason to invest in the digital tools, such as e-readers, to help their students to better comprehend written word.

Research Questions and Hypotheses

RQ 1: Is there a difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text?

H₀1: There is no significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text.

RQ 2: Is there a difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text?

H₀2: There is no significant difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text

comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text.

Identification of Variables

In the case of this study, the primary independent variable is the e-reader the students are using to read the novel. The dependent variables will be the domains of reading comprehension that are assessed by TORC-4. The subtests are relational vocabulary, sentence completion, paragraph construction, text comprehension, and contextual fluency. The first domain of reading comprehension is how well the student decodes the text, and the second dependent variable is the student's language comprehension.

Definitions

Decoding: one of the two main elements of reading comprehension. Decoding is the reader's ability to recognize words in a text.

Digital Literacy: a term used to refer to the changing definition of literacy ushered in with the recent explosion of technology. Digital literacy implies that reading no longer only takes place on paper; reading now takes place in a variety of electronic formats and platforms.

E-ink: the style of print used by e-readers. E-ink allows the e-reader to create a reading plane that is the same as reading on paper; thus, eliminating any comprehension issues that have been previously caused by computer screen reading.

E-reader: an electronic reader or book. This device allows people to read texts in an electronic format while providing access to tools such as highlighting, definitions, annotating, etc. that allow for deeper engagement of the text.

Kindle: an e-reading platform offered by Amazon. A Kindle is a handheld device that uses e-ink and provides a comfortable reading experience for the reader. A Kindle also has built in tools

such as hyperlinks, dictionaries, and highlighting and note taking capability. There is also an app version of this platform that contains all of the same tools and functionality.

Language Comprehension: one of the two main elements of reading comprehension. Language comprehension is the reader's ability to understand the meaning of words in a text.

Metacognition: reflecting upon how one learns.

Metacognitive strategies: strategies readers can use to monitor their comprehension and thinking processes while reading a text.

Reading comprehension: the rate at which one reads and understands a text, whether written or digital.

Scheme: a learned pattern of behavior based on prior experience. Schemes create the foundation for prior knowledge.

TORC-4: An abbreviation for the Test of Reading Comprehension; the instrument used to assess reading comprehension skills in this study. The test is comprised of four subtests: relational vocabulary, sentence completion, paragraph construction, text comprehension, and contextual fluency.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Reading comprehension is one of the most important skills a student must acquire throughout their education. Out of the multiple areas of education, “reading has received the greatest amount of systematic attention by researchers and practitioners...because students require skills in reading comprehension to access information and concepts in various curriculum areas” (Hale et al., 2011, p. 4). Being able to read silently and comprehend a text “is essential for academic learning in the various subject areas and to professional success and lifelong learning” (Alkhaldeh, 2011, p. 454). Some researchers even go as far as to state, “Reading is regarded as one of the most significant skills language learners need to obtain” (Alkhaldeh, 2011, p. 454). Based on the necessity for students to be able to comprehend on higher levels as they progress through their education, many research studies have focused on methods and approaches seeking to improve reading comprehension skills for students at varying ages.

Reading comprehension is a multifaceted process that requires students to work through several cognitive processes simultaneously. Research has identified “component skills required for comprehension of text to occur. These include phonemic awareness, or the ability to detect and manipulate the sounds of language; the alphabetic principle, or the ability to directly link sounds to print; vocabulary, or word knowledge; and, general text comprehension strategies” (Schmitt et al., 2010, p. 37). Furthermore, reading is a process that is unique to the person doing it. This skill “is purposive and resides as much in the person reading as in the text to be read. Moreover, it is assumed that the reader brings to a text his or her expectations, prior knowledge of language structure and content, and cultural background to construct an interpretation of the written word as it is being read” (Hall, 1989, p. 157). The knowledge a reader brings to a text

also seems to be a huge component when striving to read for comprehension. Anmarkrud and Braten (2009) state that no other factor influences understanding more than prior knowledge (p. 253). William Hall (1989) also furthers the discussion about prior knowledge and reading comprehension. He notes that reading comprehension “is interactive as opposed to sequential. From this perspective, reading for comprehension is purposive and resides as much in the person reading as in the text to be read. Moreover, it is assumed that the reader brings to a text his or her expectations, prior knowledge of language structure and content, and cultural background to construct an interpretation of the written word as its being read” (Hall, 1989, p. 157). Overall, reading comprehension ability relies greatly on the skills and experiences of the reader more so than the text.

Compounding the quest to discover reading comprehension improvement strategies is the new concept of digital literacy. Traditionally, literacy “generally applies to reading and writing, speaking and listening” (Hobbs, 2011, p. 14). “Prior to the 21st century, literate defined a person’s ability to read and write” (Jones-Kavalier & Flannigan, 2008, p. 13); however, with the introduction of the digital age, that definition is rapidly expanding. A new term, digital literacy, is creating new ideas about what makes a person literate. Digital literacy is defined in a variety of ways including “the composition and reading of multimodal texts” (O’Brein & Scharber, 2008, p. 66) and “using technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in or to function in a knowledgeable society” (Borawski, 2009, p. 53). This new definition of literacy has been largely brought on by the advent of computers, the Internet, smart phones, and e-readers, and students must not only be able to read and comprehend printed text, they now must be able to discern the validity of digital text and make strides to read and understand what is on their screen. Modern students are being

called “native speakers of the digital language of computers, video games, and the internet. They are held to be active, experiential learners, natural multitaskers, using a range of digital devices and platforms simultaneously to drive their own information learning agendas” (Bittman et al., 2011, p. 161); thus, these students are driving the changing definition of literacy. On the other hand, teachers tend to be “digital immigrants” (Bittman et al., 2011, p. 161), and the lack of fluency teachers have with this technology is creating a disconnection in the learning process. Meagan Poore (2011) believes, “building digital literacy is thus essential in helping our young people – especially in those all-important middle years – attain their human potential” (p. 20). From this perspective, the digital literacy that students are forming is creating the basis for the next generation of students, and if schools do not find valid instructional methods to embrace this change, the students will be shortchanged and unengaged in their own education; thus, leading to an on overall decline in the quality of student produced in American schools.

One particular piece of technology that has come to the forefront of this debate is the e-reader. While the e-reader has been in existence since the 1990s, it is only with the recent releases of the Amazon Kindle and the Barnes and Noble Nook that this technology has become accessible to larger group of consumers and readers (Foasberg, 2011, p. 108). Not to be left out of the technology land grab, many proactive school librarians have begun to stock their shelves with e-readers that each contains access to several texts on a single device. The e-reader has many benefits over print books such as portability, adjustable text size, and their environmentally friendly paperless format (Foasberg, 2011, p. 110). While the e-readers provide easy access for recreational reading, there is little research in their potential role for educational purposes. E-readers have found a niche in the recreational reading market; however, they have been found “awkward for classroom use” (Foasberg, 2011, p. 110). Despite their lack of a simple

conversion to the classroom, the features e-readers offer may be worthwhile putting in the effort to get them in the hands of students.

Reading comprehension and technology have recently become intertwined with the explosion of portable technology devices such as Smartphones and e-readers. While many adults have come to integrate this new style of reading into their daily lives, most students have been born into this technology and know no other manner through which to read for knowledge and entertainment. Conversely, most educational institutions have been slow to adopt this new style of reading thus relegating students back to traditional forms of literacy such as paperback books and research materials.

To date, research in reference to the efficacy of these new technologies remains scarce. The only common conclusion the research indicates is that students tend to engage on a deeper level with texts when they are presented in digital form; however, little quantitative data in reference to reading comprehension gains were available for review. This dearth of quantitative studies may be part of the reason educational institutions, faced with down turning budgetary conditions, have hesitated to embrace the technological revolution.

Theoretical Framework

Reading and comprehending a text is a process that does not occur in a single step. Several researchers have defined multiple processes that occur when a reader engages with a text that can be placed into two categories: decoding printed text and understanding the language decoded in that text (Hogan et al., 2011, p. 1). Although Hogan (2011) relied heavily on decoding, there is another component that reading comprehension is hinged upon: the activation of prior knowledge, and “central to this theory is the interaction of the reader and the text as each reader breathes life into the text through personal meaning making and prior experiences”

(Larson, 2009b, p. 638). Piaget's theory of schemas and structuralism play into the way a reader takes in and comprehends a text based on his or her own prior knowledge. Piaget "proposed that a small set of mental operations (mental actions) forms a structure that underlies much of our thinking" (Miller, 2011, p. 34) and these schemes are created based on the reader's prior experiences. From that perspective, schemes that facilitate learning and comprehension are formed. A scheme "is an organized pattern of behavior; it reflects a particular way of interacting with the environment" (Miller, 2011, p. 34). Research clearly indicates, "A reader's prior knowledge is a significant factor in his or her comprehension of a text" (Hall, 1989, p. 159); therefore, appropriate schemes must be in place for the reader to engage fully in a text.

Because of their basis in prior knowledge, schemes play heavily into reading comprehension. To begin, "schema theory refers to how knowledge is stored in memory, to the ways this knowledge is used in comprehension, to the acquisition of new knowledge and to the recall of old knowledge" (Hall, 1989, p. 158). There are six functions of schemes:

1. They provide the basis for assimilating text information.
2. They allow the reader to create inferences in gaps of the texts.
3. They allow the reader to allocate attention to important components of the text.
4. They provide the reader a way to search his or her memory in an orderly fashion.
5. The reader may create summaries of the information using existing schemes.
6. Schemes enable the reader to reconstruct the information in the passages even though details may have been forgotten (Bransford, 2010, p. 608).

Richard Anderson (2010), further connected the scheme learning theory to reading comprehension with his theory that "a reader's schema, or organized knowledge of the world, provides much of the basis of for comprehending, learning, and remembering the ideas in stories

and texts” (p. 594). In this theory, comprehension is created through organized patterns of behavior that have been established from the reader’s prior experiences and knowledge. A reader must have an experience or knowledge base of a topic that exists in a text (a scheme) to fully engage with and understand that text. Anderson (2010) asserted, “In schema-theoretic theory terms, a reader comprehends a message when he is able to bring to mind a schema that gives a good account of the objects and events described in the message” (p. 594). When reading a text, “the schema that will be brought up will be brought to bear on a text depends on the reader’s age, sex, race, religion, nationality, occupation – in short, it depends on the reader’s culture” (p. 597). Most of the time, a reader’s interaction is automatic as the scheme is already in place; however, “conscious control is necessary only when the information in the text interferes with reader’s background knowledge or when the reader does not possess enough knowledge to form a mental representation of the text” (Pecjak, Podlesek, & Pirc, 2011, p. 54). Overall, a reader must have in place or be capable of creating a scheme, based on his or her background, to comprehend a text. In reference to education, children that lack an appropriate scheme related to the text “may appear to have poor comprehension and memory skills” (Bransford, 2010, p. 608). Anderson (2010) asserted the use of schemes in reading is innate and a necessity for any level of comprehension to occur. Educators must be aware of the necessity of scheme activation for engaged reading comprehension and provide tools for students to do so.

Another theory important in reading comprehension research is the theory of metacognition in the reader. Hall (1989) defined metacognition as “reflecting on one’s knowledge” (p. 158). According to Hacker (2010), “metacognitive experiences are concerned with one’s awareness of his or her cognitive or affective processes and whether progress is being made toward the goal of a current process” (p. 757). Overall, when a reader is engaging with a

text, if he or she is actively channeling strategies to be successful with the text, the goal has a higher likelihood of being met. “When reading for comprehension, effective readers actively apply strategies designed to monitor and enhance their comprehension” which is a metacognitive strategy (McCallum, 2011, p. 78). One aspect of metacognition is the concept of comprehension monitoring which is:

A multidimensional process that includes evaluation and regulation... evaluation involves monitoring of one’s understanding of text material, and regulation involves control of one’s reading to resolve problems and increase comprehension... good comprehension monitoring is demonstrated by those readers who detect and resolve all or most errors (Hacker, 2010, p. 755)

According to Hacker’s (2010) cognitive monitoring model, metacognition:

Occurs through the actions and interactions among four classes of phenomena: metacognitive knowledge, metacognitive experiences, goals, and experiences.

Metacognitive knowledge consists of a person’s stored world knowledge that has to do with the people their cognitive tasks, goals, and strategies for achieving them, actions, and experiences. Metacognitive experiences are concerned with one’s awareness of his or her cognitive or affective processes and whether progress is being made toward the goal of a current process (p. 757)

The implication for reading comprehension is that if the reader has a goal for comprehension in mind and engages these metacognitive processes, the goal of proficient reading comprehension has a higher likelihood of being met. The use of metacognitive strategies allows the reader “a way to lessen demands on the working memory” (Hacker, 2010, p. 760),

providing an opportunity for readers to evaluate their engagement and comprehension of a text.

Furthermore, Brown et al. (2010) identify six key metacognitive strategies for readers to employ:

1. Clarification of the purpose of the task
2. Activation of prior knowledge
3. Focused attention
4. Lining up the content to the activated prior knowledge
5. Ongoing comprehension monitoring activities
6. Creating and testing inferences (p.787-788)

Tasks such as these encourage students' metacognitive processes and foster deeper reading comprehension abilities.

Reading Comprehension

Reading comprehension is the most vital skill that students earn through their education; therefore, ample research is focused around this skill. Reading comprehension is so heavily examined and researched because “the capacity to read and write is casually associated with earning a living, achieving expanded horizons of personal enlightenment and enjoyment, maintaining a stable and democratic society, and historically, with the rise of civilization itself” (Richardson, 1998, p. 1). Hale et al. (2011) observed, “reading receives the greatest amount of attention because students require skills in reading comprehension to access information and concepts in various curriculum areas” (p. 4). When students have poor reading comprehension, their access to all curricular areas is limited and “these reading deficits likely contribute to unsuccessful outcomes for students, such as high dropout rates, grade retention, and overall poor achievement” (Hale et al., 2011, p. 4). Furthermore, the ability to read and comprehend is “essential for academic learning in the various subject areas and to the professional success and

lifelong learning” of the student (Alkhawaldeh, 2011, p. 454). Svetina, Gorin, and Tatsuoka (2011) agreed that because of the necessity to improve and monitor reading comprehension in students, it is “of the most commonly assessed constructs across all ages of education” (p. 1).

While reading comprehension may appear to be the simple task of observing and processing written words, there are several components involved in that process that must act in unison for true comprehension to occur. Reading comprehension is often in the forefront of educational research because “students require skills in reading to access information and concepts in various curriculum areas” (Hale et al., 2010, p. 4). Hogan et al. (2011) asserted that “reading comprehension involves two primary processes: (a) decoding printed text and (b) understanding language accessed through the process of decoding” (p. 1). Samuelsteun & Braten (2005) asserted, “many reading researches have focused their attention on word-level skills because of the assumption that word decoding is *the* bottleneck in the meaning-getting process” (p. 107); however, the current research is scant and conflicted as to the depth of impact decoding alone has on overall reading comprehension. On the one hand, “word recognition efficiency predicted reading comprehension in adult college students” (Samuelsteun & Braten, 2005, p. 108) indicating that decoding is a vital and necessary skill for any level of success in reading. However, other studies have indicated that many students can compensate for a lack of decoding skills “by developing particularly good text-processing strategies and effective use of prior knowledge” (Samuelsteun & Braten, 2005, p. 109).

To that end, Samuelsteun & Braten (2005) sought to understand the full impact of decoding on reading comprehension and understand if students who lack strong decoding ability could still be proficient readers. To assess this skill, the participants were administered a decoding test where 360 words were strung together without spaces and the reader had 180

seconds to separate as many of the words as possible leading to a mean score of 159.96. Upon analyzing the data, the researchers came to several conclusions. First, as expected, higher decoding rates were a predictor for higher reading comprehension. On the other hand, the data indicated that a student with low decoding had greater reading comprehension than a student with high decoding and low reading comprehension. Therefore, these data support the idea that a reader can successfully compensate for poor decoding capabilities.

Hall (1989) conducted a review of reading comprehension research based on the views of several different areas of study. He began by defining “skilled reading as text based and interactive as opposed to sequential. From this perspective, reading comprehension is purposive and resides as much in the person reading the text as in the text to be read” (Hall, 1989, p. 157). Hall (1989) believed that prior knowledge was one of the most important components in the reading comprehension process: “the reader brings to a text his or her expectations, prior knowledge of language structure and content, and cultural background to construct an interpretation of the written word being read” (p. 157); thus, he validates the scheme theory set forth by other researchers.

Hall (1989) began with the developments in reading comprehension from the perspective of psychology. He noted, “The shift from behaviorism to an information-processing perspective has had its impact on language theory” (Hall, 1989, p. 157). Through this lens, Hall (1989) shared several conclusions about reading comprehension:

1. The syntactic structure of a sentence imposes groupings that would govern the interactions between the meanings of the words in that sentence.
2. There is no limit to the number of sentences or the number of meanings that can be expressed.

3. A description of language and a description of language user must be kept distinct (p. 157)

McCallum et al. (2011) believed that “proficient reading is...a hierarchal process of skill development that includes phonemic awareness, phonics, fluency, vocabulary and comprehension” (p. 78). This sentiment is echoed by Schmitt et al. (2011) when they concluded that there are:

Component skills for reading comprehension to occur. These include phonemic awareness, or the ability to detect and manipulate the sounds of a language; the alphabetic principle, or the ability [to link directly] sounds to print; fluency, or the ability to read in a fluid manner; vocabulary, or word knowledge; and general text comprehension strategies (p. 37).

Several researchers, as cited by Samuelsteun & Braten (2005), have exhorted the idea that reading comprehension is a layered process. In their research, Samuelsteun & Braten (2005) validated that strong reading comprehension as a process that is deepened by strategies such as summarizing, creating mental images, extending the text, questioning while reading, and monitoring one’s own understanding through reflection upon strategies employed while reading.

In 2014, the Southwest Educational Development Laboratory (SEDL) created a report, “Cognitive elements of reading,” to support teachers in the endeavor to improve reading comprehension through teacher education and resources. Their model hinges upon one concise graphic they created that breaks reading comprehension into two domains: language comprehension and decoding. A graphic of the model can be found at:

<https://www.sedl.org/reading/framework/overview.html>.

The graphic is meant to show how the different domains blend together, as shown by each of the “legs”; they blend at the top where reading comprehension occurs. SEDL (2014) noted:

Both language comprehension and decoding are necessary for reading comprehension success. Neither is sufficient by itself. On the one hand, being fully competent in a language but having no ability to recognize its written words will not allow for successful reading comprehension. On the other hand, neither will have the ability to recognize the written words of a language but not having the ability to understand their meaning. In this view, the only route to successful reading comprehension is through success as both language comprehension and decoding (p. 13)

According to SEDL (2014), language comprehension means the “ability to construct the meaning of spoken language.” Language comprehension can also be broken into two types: formal and informal. Informal language is generally “context dependent; the conversations typically focus on information that is immediately relevant and often concrete” (SEDL, 2014). On the other hand, “formal language is often decontextualized and abstract” which is similar to the language that most students encounter in the classroom (SEDL, 2014). Furthermore, there are different levels to comprehension. The most basic level, explicit comprehension, deals with “merely understanding what is stated. The listener may not draw any inferences or elaborate” (SEDL, 2014). As language comprehension becomes more advanced, the listener “builds inferential knowledge on top of explicit comprehension” (SEDL, 2014). As language becomes more complex and abstract, the listener or reader must advance his or her language comprehension skills to understand the multiple levels of meaning within that specific text.

As seen in Figure 1, language comprehension is also contingent upon other abilities.

Linguistic knowledge creates the base for language comprehension. As SEDL (2014) explained:

Languages are composed of sounds that are assembled to form words, which are combined to form sentences, which are arranged to convey ideas. Each of these processes is constrained and governed by linguistic rules. An implicit knowledge of their structure and integration is essential to language comprehension. (SEDL, 2014)

Linguistic knowledge is then broken into phonology: knowledge of the sound of a language, semantics: understanding how language is broken into parts, and syntax: the rules of how language is structured (SEDL, 2014). Also included in the language comprehension side of reading comprehension is the background, or prior knowledge a reader brings to a text.

The other side of the chart deals with decoding which is “the ability to recognize and process written information” (SEDL, 2014). Since decoding is a skill that begins to be formed from a very early age, “in the early grades, reading comprehension is heavily dependent on emerging decoding skills” (Hogan et al., 2011, p. 2). Decoding often begins with a child’s acquisition of sight words. When a child is a pre-emergent reader, they “develop the ability to recognize certain high-frequency and familiar words” which are known as sight words (SEDL, 2014). While this is a basic decoding skill, children must evolve past memorizing words and acquire the ability to understand the sounds that form the words. This is when children begin to be able to sound out words, and with this generative approach, “there is no limit to the number of words that can be created or read by those with this ability” (SEDL, 2014). Decoding is based upon two foundational skills: cipher and lexical knowledge, both of which encompass units of spoken and written word as well as the exceptions (SEDL, 2014).

Cipher knowledge is one of the two equally important foundations to being able successfully to decode words. Cipher knowledge “refers to the underlying knowledge that allows children to read and pronounce regular words correctly... [and] is demonstrated when a person appropriately sounds out words she has never seen before” (SEDL, 2014). As children begin to obtain cipher knowledge, “they begin to understand that the English language writing system is, for the most part, regular and consistent” (SEDL, 2014). Once children begin to acquire ciphering skills, they can take the patterns they have observed in the language and apply them to unfamiliar words thus increasing their reading comprehension. In addition to cipher knowledge, lexical knowledge works hand in hand to allow readers to decode a text. While cipher knowledge lends to regular words, lexical knowledge allows readers to recognize and pronounce irregular words. When a reader encounters a regular word, he or she can rely on ciphering skills to disseminate the pattern and pronounce the word; however, no such pattern exists for irregular words. To apply lexical knowledge, “the child may need to mentally compare that word against other known words. To do this, the child needs an internal representation of all of the words she knows... this internal representation of all the words we know [is called] our ‘lexicon’” (SEDL, 2014). To use effectively lexical knowledge, a reader uses his or her existing knowledge of words to recognize and successfully pronounce new, irregular words. In support of cipher and lexical knowledge, SEDL (2014) asserted a reader must have phoneme awareness: an understanding that words are composed of individual sounds, knowledge of alphabetic principle: the idea that words are made of phonemes and each phoneme includes letters and letter knowledge: understanding and being familiar with the letters of the alphabet.

Hogan et al., (2011) commented on the relationship between decoding and language comprehension. While they are both integral for deep comprehension to occur, when children are

“in the early years of reading development, children’s ability to comprehend text is largely constrained by the individual difference in decoding text; however, once decoding becomes automatized, reading comprehension is largely dependent on one’s skills in language comprehension” (Hogan et al., 2011, p. 1). Both skills must be in place for comprehension to occur; however, language comprehension is a more developed and mature process when compared to decoding. Hogan et al. (2011) also noted that as decoding skills advance, “language abilities serve as a more critical determinant of one’s reading comprehension” (p. 2) continuing to lend to the idea that decoding and language comprehension vary in the times they develop and are dominant in the reading comprehension process.

Overall, reading comprehension is multifaceted and requires skills on top of skills for success. As a reader matures, “it should be expected that the relationship between decoding and reading comprehension will decrease... while the relationship between comprehension due to background knowledge and language comprehension will increase” (Samuelstuen & Braten, 2005, p. 113). Successful readers “go beyond single-word and sentence comprehension and the textbase; they construct a representation of the text’s meaning or state of affairs described by that text” (Hogan, 2011, p. 2). Neddenriep, Fritz, & Carrier (2011) observed that:

At an individual level, the relationship between reading fluently and understanding what one reads has been described theoretically. One such theory explains that, as students become more skilled in decoding and identifying words, their recognition of them becomes more automatic. This automaticity allows the reader to spend less time and effort sounding out words and to retain more cognitive resources for understanding what is being read (p. 15)

This implies that students need to be taught basic comprehension skills, such as word identification, so they may clear the way for higher level thinking skills to allow for deeper comprehension and engagement with a text.

Reading Comprehension Strategies

Reading comprehension is a skill that must be taught to students. Rather than providing each student a textbook and expecting that him or her will be able to understand it in its entirety, overt skills must be transferred to these learners. Richardson (1998) agreed, “Reading is a complex process. This means that simple approaches to teaching children will probably have little success... students need to be taught the technicalities of reading” (p. 13). Researchers suggested that:

Some of the research based comprehension strategies include teaching or prompting readers to (a) make connections to the text based on background knowledge, (b) make predictions about text, (c) visualize text content, (d) ask questions when confused or uncertain about content, (e) use strategies to summarize text, and (f) problem solve and clarify (McCallum et al., 2011, p. 78)

Using these strategies can lead to students to become more successful in their ability to read and comprehend, and once students reach that point they become “successful comprehenders that have a good knowledge of narrative structure... successful comprehenders monitor their understanding of a text, and, in doing so, realize the need to make an inference” (Hogan, 2011, p.

3). To become successful readers, students need to:

Learn how to engage with [written] texts in ways appropriate to the purposes they can serve... children need to see and hear enactments of those inner mental processes that are

the essence of literate behavior, so they can appropriate them and deploy them themselves (Richardson, 1998, p. 7)

The challenge faced by educators is how to teach students these skills, especially on a secondary educational level, while expanding the students' prior knowledge required creating appropriate schemes for the text at hand.

Brown et al. (2010) related teaching reading comprehension through the blended viewpoints of schemes and metacognition. They relate that good reading teachers model metacognition strategies by sharing a text with a class while simultaneously sharing their own comprehension monitoring strategies such as questioning, predicating, and creating conclusions about the text (Brown et al., 2010, p. 784). While modeling, these teachers “function as a model of comprehension-fostering and comprehension-monitoring activities largely by activating prior knowledge and questioning basic assumptions” (Brown, 2010, p. 785).

Digital Literacy

The way students learn and take in information has been revolutionized with the advent of modern technology. Our current learners “encounter a plethora of new literacies including digital texts and online communication experiences” (Larson, 2012, p. 281). In addition to constantly encountering digital reading, “digital technology has been completely normalized by the younger generation and is fully integrated in their daily lives” (Korat & Shamir, 2012, p. 137). Students today have been born into and raised in a society where technology and digital media are pervasive in all aspects of their lives. Lending to that idea, Lotta Larson and Teresa Northern Miller (2011) observed that:

As technology becomes more prevalent in today's society, students need an increased expertise in digital technologies (computers, electronic white boards, GPS, etc.). Of

greater importance is the need for students' ability to use technology to research, organize, evaluate, and communicate information (p. 122)

This increased need for technology in education presents the need to understand the changing definition of literacy. In the past, "traditional literacy has been associated with an individual's ability to read and write" (Richardson, 1998, p. 3). On the other hand, digital literacy is a term that has become in vogue since the advent of so much text becoming available through electronic platforms. Students and adults alike now have access to a variety of texts through the Internet, smart phones, iPods and iPads, and e-readers. Generally speaking, "digital literacy, a term that emerged with the explosion of digital information and multimedia technology, refers to basic competence in using digital technology" (Jun & Pow, 2011, p. 57). Digital literacy is new to adults; however, "children today are so accustomed to digital literacy that they think it is a part of the natural landscape" (Jun & Pow, 2011, p. 58). This disparity between children's learning and their innate use of technology can be bridged by expanding "the types of texts students are exposed to and engaged with at school by turning attention to electronic books" (Larson, 2009, p. 255). Based on this new digital literacy, reading comprehension rates and strategies are also undergoing changes.

Researchers agreed that as readers are exposed to different styles of text, research in the field needs to react to this trend largely because:

Reading skills and abilities have always been important in the educational context, especially nowadays, in the era of information society. These skills represent an effective means for acceptance, organization, and usage of information in different areas. Thus, reading skills and the ability to comprehend written material have become an important cross curriculum experience, which influences one's educational achievement, since the

vast majority of information in educational settings is transferred through written materials (Pecjak, Podlesek, & Pirc, 2011, p. 53)

Hogan et al. (2011) began the discussion with vocabulary and grammar, which are considered lower level skills because:

Lower level language skills serve as the foundation that supports what have been labeled higher level language skills, which are required to construct a mental model of a text's meaning...as children develop higher level language skills, their ability to create accurate mental models advances their vocabulary and grammar...however, higher level language skills are not exclusive to reading; children begin developing these skills before formal reading instruction. Because these skills are not reliant on word reading abilities, they can be stimulated across a child's educational career — preschool through high school (and beyond) – through different modalities (p. 3)

E-Readers

One way to access these lower level language skills is using e-readers. E-readers are electronic devices displaying texts such as books, portable document format files, word processing documents, and a variety of other text formats. Designed to make text readable over sustained periods of time... [they also use] e-Ink screens [that] emit no radiation and intend to achieve a level of text clarity and readability analogous to paper (Barron, 2011, p. 133).

Griffey (2012) asserted, “e-readers using E Ink technology were at the height of their hype in 2010” (p. 14). With the explosion of this new technology, the conversation of “what is a book” (Kircz, 2010, p. 107) has naturally arisen. Adding to this discussion, Wischenbart (2008), as cited by Kircz (2010), “posed the question ‘has digitization changed what’s really in the

book?” (p. 107). In response to this, Kircz (2010) defined a book as “a social invention for an authoritative exchange of ideas” and asserted that the digital revolution that e-readers have ushered in have wildly changed what is contained in a book.

Kircz (2010) examined the changes digital books have brought on from two perspectives. Both perspectives are hinged upon the idea that “a book is a communicative device [and] technology enables communication” (Kircz, 2010, p. 107). He asserted that technology and communication are linked and they can develop interdependently. His point is that communication desires a technological intervention for the sake of a transactional experience with the text. In this new age of technology:

We are now entering a new phase again: a phase where fixity and change can go hand-in-hand. As readers, receivers of a message, enter a mental state of contemplation, they feel the need for comment... This urge for digesting and contemplation of messages...demands technologies that allow the reader to mold the original into a personalized shape... Digital technology is enabling all kinds of text and picture manipulation (Kircz, 2010, p. 108).

Technology is creating effective ways for readers to interact with texts, and this interaction is making the reading experience a more personal one.

In her article “Digital literacies,” Lotta Larson (2009) explored the functionality of e-readers and defined many of the features that were alluded to by Kircz (2010). She clarified that:

Many e-books employ multimodal features – such as video, audio, and hyperlinks – as well as interactive tools. Such tools invite readers to physically interact with the text through inserting, deleting, or replacing text; marking passages by highlighting, underlining, or crossing out words; adding comments by inserting notes, attaching files,

or recording audio comments; and manipulating the page format, text size, and screen layout (Larson, 2009, p. 255).

Using the tools provided via e-readers, students have access to lower level skills, such as vocabulary, and they are then able to allow themselves to create higher-level comprehension with those obstacles eliminated. E-readers also facilitate the engagement of higher level thinking skills through their allowance of questioning and creating inferences, both of which are components of metacognition.

One aspect of digital literacy is the advent of the e-reader, and this device and others like it are changing the definition of what a text is. In the past, “text was seen as a passage of print or a slice of a speech, or an image” (Larson, 2010, p. 15). With the changing digital and technological landscape, e-readers have arrived to change that definition and how people engage with a text, and “texts are professed as much more than written words or images” (Larson, 2010, p. 15). With this changing landscape, “recent studies of e-book reading and response behaviors suggested that e-book reading may support comprehension and strengthen both aesthetic and efferent reader response” (Larson, 2010, p. 15). Reading is a skill many children may lack interest in and:

Because of the decreasing interest in reading and the growing appeal of computers, it has been suggested that the electronic environment is becoming more important to a growing number of children who do not respond well to traditional print media and who are reluctant to read. Electronic books (or e-books) can potentially bridge the gap between printed media and other, more interactive, forms of media. Recent research shows that books read on electronic devices, such as the Kindle and the iPad, satisfy users as much as printed books, despite reading speeds being generally slower (Maynard, 2010, p. 238) .

Despite reduced reading speeds, e-readers provide engagement, support, and advantages to readers that traditional texts do not allow for. Since so much of a reader's comprehension is reliant upon their prior knowledge and preexisting schemes, e-readers are a logical way to bridge the gap between the reader and the prior knowledge required truly to engage in full comprehension.

While the research into the efficacy of e-readers from an educational standpoint is currently in a fledgling phase, the prevalence of e-readers is growing. The Pew Research Center, “a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping America and the world [which] conducts public opinion polling, demographic research, media content analysis and other empirical social science research” (Pew Research Center, 2014), has been following the e-reader trend for the last several years. In a 2012 article, Rainie and Duggan noted, “the number of those who read e-readers increased from 16% of all American ages 16 and older to 23%. At the same time, the number of those who read printed book in the previous 12 months fell from 72% of the population ages 16 and older to 67%” (p. 1). E-reading has been trending upward for the last several years as exhibited by a survey conducted by the Pew Research project. A copy of their data can be found at:

<http://www.pewinternet.org/2014/01/16/e-reading-rises-as-device-ownership-jumps/e-readers1/>

Part of the reason e-reading is becoming more prevalent may be due to the rise in ownership of devices that support this reading style. Zickuhr and Rainie (2014) conducted a survey “among a nationally representative sample of 1,005 adults ages 18 and older living in the continental United States” (p. 3). The results can be found at the following site:

<http://www.pewinternet.org/2014/01/16/e-reading-rises-as-device-ownership-jumps/e-readers3/>

While people e-read for a variety of reasons, it is clear that e-reading across several platforms is trending upward, and the educational community could benefit from understanding and capitalizing on this trend.

E-Readers and Education

In the area of reading comprehension, technology and education are struggling to find a common ground. Lamb and Johnson (2011) acknowledged that “technology, both inside and outside of the school library, is changing the way children read, as well as our approach to teaching... this new breed of reader feels comfortable working with many devices” (pp. 1-2), and education is striving to find way to allow these readers access to these devices. One reason these new devices, such as e-readers, are useful to educators is because they have the potential to create a higher sense of engagement in students while they are reading. Creating engagement in reading is vital because “research shows that young people who enjoy reading do it more frequently and tend to become skilled at it, so schools have an important role to play in trying to encourage children to read for enjoyment” (Maynard, 2010, p. 237). There are those who believe that technology, such as e-readers, can create that level of engagement for the student readers. Furthermore, modern students have been raised with technology all around them; thus, “with technology making its mark on all areas of the age we are living in, it is now a necessity to utilize technology in the field of education, as well” (Sahin, 2011, p. 94), and it is possible e-readers could fill that gap.

Nancy Foasberg (2011) delved into the arena of e-readers and education to gain an insight of exactly how this technology is being used. Foasberg (2011) conducted a survey at a New York City college to understand how e-readers were being integrated into the lives of college students. In her results section, Foasberg reported that of the 1,705 respondents, 401 have

used e-readers (p. 111). Given all of the advantages e-readers provide, they are still slow to make an impact in the world of education.

Continuing the examination of e-readers among teenage students, Wendy Stephens (2012) noted that “e-book adoption among teens has been found to trail that of all other reader age groups... but, in recent months, an unprecedented number of young people at my high school have acquired e-readers, both dedicated devices and multifunction tablets” (p. 28). Stephens (2012) discussed the experiences of several students with their e-readers. Two students, Natasha and Emily, were both introduced to e-readers when they checked them out of the library (Stephens, 2012, p. 28). Upon the loan, both girls discovered a love of the reading platform for different reasons such as being more engaged with the text and the accessibility of the accessories that support reading comprehension. Natasha, one of the study participants “appreciates the ability to carry hundreds of books at once, collecting dozens of games and several dictionaries in addition to an extensive digital library” (Stephens, 2012, p. 28).

Stephens (2012) also commented on the functionality of e-readers. She observed that “hyperlinked definitions are invariably a function my teen readers describe as an advantage of electronic readers” (Stephens, 2012, p. 29). She continued with the functionality discussion when she observed “fewer students seemed to know about or have experimented with note-taking features, but those who had were enthusiastic... ‘I highlighted and took notes on *Macbeth*, using different colors to show my thought process,’ said Natasha” (Stephens, 2012, p. 30). Stephens’s (2012) observations lend to the idea that e-readers create a more engaging reading experience based on their supportive and interactive features. Furthermore, “use of e-readers has been shown to produce a more positive attitude toward the reading experience among middle school boys” (Stephens, 2012, p. 29), a typically less engaged demographic of readers, indicating that

there is something about the platform that is engaging, and further research to identify that component is necessary.

Larson (2012) has continued to track e-reading usage over the years, and in 2012, she noted:

One third of children ages 9-17 would read more books for fun if they had access to e-books, including children who already read five to seven days per week as well as those who read less than once each week. Because children express such interest in e-book reading, it is important that educators and researchers understand how [effectively to integrate] this technology into educational settings (Larson, 2012, pp. 280-281).

This rising engagement in e-readers is due largely to their increased prevalence in several accessible and affordable forms; however, many teachers hesitate to integrate e-books because it can be an “overwhelming and intimidating experience” (Larson, 2012, p. 281). The new federal standards put forth by the government and adopted by most states encourage the use of technology and e-readers in the classroom. The new standards, The Common Cores, “recognize the need to prepare students for future success by embedding rigorous reading standing and calling for literacy learning through the use of technology” (Larson, 2012, p. 281). Between rising student engagement, prevalence of e-readers, and new educational standards calling for more technology use, it is imperative that educational systems begin to explore effective integration programs for e-reading technology.

Another emerging aspect contributing to the e-readers and education discussion is the concept of educating upcoming teachers with the technology itself. Larson (2012) asserted, “To prepare future teachers to use and teach with a wide range of technologies, these tools need to be infused into both content and methods courses” (p. 282). To accomplish that goal, “teacher

education programs must get pre-service teachers off to a running start on acquiring the knowledge, skill, and will it takes to be an effective teacher” (Larson, 2012, p. 282). To assess pre-service teachers’ current readiness levels and to add effective teaching ideas for other teacher education professors, Larson (2012) conducted a qualitative style study that yielded results worth considering for teacher education curriculum designers.

Larson (2012) collected a sample of 49 pre-service teachers from her own college courses and had them complete one of the required course readings with an e-book platform of their choice. Larson (2012) began her study with a survey of her students to assess their use and familiarity with e-books. Once the survey was completed, the students read the assigned books over a three-week period. During that period, students read the book in and out of class and discussed their impressions with small groups within the classroom and as an entire class. Part of using the e-reader included instruction on the tools that come with that platform. All of the e-books had the capability to adjust font size, highlight, take notes, create bookmarks, and utilize a built in dictionary. Once the study was completed, the 49 pre-service teachers completed post-reading reflections that examined their experiences with the e-texts and the functionality and use of the individual features. The data yielded that all of the functions were utilized by at least half of the participants. Of the functions, 66% of the students adjusted the font size, 84% highlighted, over one-half took notes and used bookmarks, and 73% used the dictionary. As Larson (2012) consulted the reflections, the data were less consistent. Of her students, 53% felt the e-book improved his or her reading comprehension, 16% felt the e-book was a hindrance to his or her reading comprehension, and 31% believed the e-book had a neutral effect on his or her reading comprehension. Although the majority of students felt the e-book helped in reading comprehension, 65% of participants said they would still prefer to read from a print book.

Larson (2012) reflected that educators must “not let string personal preferences interfere with their willingness to provide students with both new and traditional literacy experiences” (p. 288). Overall, Larson (2012) asserted, “providing authentic experiences in teacher preparation programs will support both pre- and in-service teachers in their quest to create meaningful and productive learning contexts” (p. 289). If students are going to be taught with innovative technology that keeps them at the cutting edge and competitive, then teachers need to be educated how to meaningfully incorporate technology into the classroom to meet Common Core standards and to ensure students are adequately prepared to be high functioning in the 21st century world.

Studies of E-Readers

Lotta Larson (2010) conducted a case study observing two second grade students using e-readers. In the study, each girl “read *Friendship According to Humphrey* for 40 minutes daily. While reading, Amy and Winnie physically interacted with the text by using tools and features unique to the Kindle. For example, the girls adjusted font size, listened to parts of the story by activating the text-to-speech feature, highlighted key passages or vocabulary, used the built-in dictionary, and searched for keywords or phrases within the book” (Larson, 2010, p. 17). From these interactions, the girls’ experience with the text was enriched, and their teacher was able to assess their level of engagement and areas for improvement based on her review of the girls’ use of the tools.

Another reason e-readers have been slow to be embraced by educators is the concept that the e-readers are a fad and that they do not create a deeper educational experience. Eileen Honan

(2012) also embarked on a case study to evaluate this issue. Honan (2012) followed four primary grades Australian teachers who integrated e-readers into their classrooms. Honan (2012) discovered through the literature that many people feel that “integrating new technologies into classrooms requires something more substantial than claiming schools need to make use of technology to sustain the engagement and motivation of learners...what are sometimes reported as exemplary practices by teachers who are using technologies resembles the ‘new wine in old bottles’” (p. 83). Honan (2012) discovered through her case study this was not the case with these particular teachers, lending support to the idea that technology and e-readers can have an effective place in the classroom.

Margolin et al. (2013) entered into the e-reader efficacy study with a quantitative approach examining several aspects of e-reading. In their study, Margolin et al. (2013) collected 90 participants and had each person read 10 texts split into two categories: five expository texts and five narrative texts. The first randomly assigned platform was “a packet of standard 8.5 x 11 inch white paper on which the passages were printed with black 12-point Times New Roman font” (Margolin et al., 2012, p. 515). The second group utilized a “PDF file in Adobe Acrobat Reader 9, version 9.9.0 on a desktop Dell OPTIPLEX 380 personal computer”, and the final group read from “a second generation Amazon Kindle with a 6 inch 600 x 800 resolution screen that displays black text on a white matte background, using electrophoretic ink (e-ink) technology (Margolin et al., 2013, p. 515). The study design was “a two-factor design, with type of text (expository and narrative) as a within-subjects factor and media presentation (paper, computer, and Kindle) as a between subjects factor” (Margolin et al., 2013, p. 515). After conducting an analysis of variance, the researchers concluded that “neither the main effect of media presentation $F < 1$, nor the interaction of the two variable were significant, $F(1, 87) =$

1.03, $MSE = .01$, $p > .36$ (Margolin et al., 2013, p. 516). Overall, their research concluded that media type did not contribute to a significant difference, but reading habits, such as using a finger to follow a text or reading aloud to oneself, provided no difference for the reader's comprehension. Finally, the researchers admitted there were several limitations to their study. To begin the average age of the participant was 19 years old, "a population in which many are familiar with technology... the result may differ with an older population, where readers may be less familiar with technology and therefore may be reluctant to use it or try something new" (Margolin et al., 2013, p. 517). Furthermore, the study was limited in that each participant only read via one medium, and "it would be valuable to measure comprehension scores of one student as they read from all of the mediums" (Margolin et al., 2013, p, 517). Finally, the researchers conceded, "the comprehension measure used was one-dimensional. Other measures, such as online measures (e.g., reading speed) or activation measures (e.g., probe word recognition) would give more information about the influence of technology on readers' comprehension processes" (Margolin et al., 2013, p. 517).

In a small study sponsored by the Alabama State Department of Education, Suell et al. (2013) took a group of nine struggling upcoming high school freshman and tested whether or not e-readers could increase reading comprehension and engagement with the text. In this study, struggling eighth grade students were identified by their teachers and nominated to participate in this study. Each student was paired with a local university mentor who met with the student once a week for an hour. The students were given a Kindle loaded with the required summer reading and their mentors read the selection along with them. At the end of the summer, the students were given a survey to assess engagement and their pre and post program AR scores and STAR reading averages were compared. In the case of AR scores, the researchers noted a 1.07-

point gain in overall average scores and a 19.8-point gain to the STAR reading average scores. While the data were encouraging, the researchers noted the study had several limitations such as “the small sample size and lack of demographic information on the high school students” (Suell et al., 2013, p. 80). The researchers concluded that this study “should continue and expand with modifications to the data collection and student selection” (Suell et al., 2013, p. 80).

In their study, Wright, Fugett, and Caputa (2013) studied three participants to ascertain reading comprehension, engagement, and tool usage of paper books versus books read on an iPad. Three students, all second grade females, were chosen to read four different selections: two via traditional paper book versions and two on the iPad. The students were a homogenous grouping, all within the normal range for cognitive abilities, middle socioeconomic status, and English was their first language. The researchers implemented an “AB experimental design conducted between two reading methods with the participants serving as their own control in both conditions (Wright, Fugett, & Caputa, 2013, p. 371). To familiarize the participants with the different tools available, “prior to the first and third session, participants were given instructions on the use, and recording processes of the available resources (dictionary, thesaurus, and word pronunciation) for each reading method” (Wright, Fugett, & Caputa, 2013, p. 371). During the reading sessions, the participants were assigned a specific number of pages to get through and provided a comfortable environment to do their reading. At the conclusion of the study, the “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” (Wright, Fugett, & Caputa, 2013, p. 372). The data yielded:

A significant difference between the number of reading resources reported for print and electronic resources, $X^2(1, n = 3) = 7, p < .05$. 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 (Wright, Fugett, & Caputa, 2013, p. 373).

As they continued their data analysis, Wright, Fugett, and Caputa (2013) noted:

Based on the frequency of the number of correct quiz responses for those using print books compared to the number of correct quiz responses for those using electronic book, results indicated that there was not a significant difference between the number of correct responses reported from print and electronic sources, $X^2(1, n = 3) = .47, p < .05$...these results do not indicate a change in comprehension based on reading score (p. 373).

Although the researchers noted no significant difference on reading comprehension scores, they did allow the participants to refer back to the text while taking the comprehension quizzes.

Wright, Fugett, and Caputa (2013) acknowledge that “allowing the child to refer back to the story while testing reading comprehension could contribute to the lack of significant results” (p. 374). From an educational standpoint:

The logical conclusion is that the evidence supports the use of e-texts in reading groups and in the classroom... while there was no improvement in reading comprehension scores, it is important to note there is no reduction in scores. Further, the participants do have an increased use of resources... finally, the participants reported that reading on the iPad was more “fun ” (Wright, Fugett, & Caputa, 2013, p. 374).

Aydemir, Ozturk, and Horzum (2013) also conducted a quantitative study examining the difference of screen versus book reading in regards to narrative and informational text. In their

study, they included 60 public school students and chose six texts (three narratives and three expository) in line with the public school curriculum. In the design, the experimental group read all of the texts on a computer screen and the control group read from the class textbook. Each of the texts had a researcher created comprehension test to provide data for analysis. In the analysis, the researchers concluded “there was no significant difference between the reading comprehension levels of students reading the narrative texts from the printed material and the students who read them in a computer environment” (Aydemir, Ozturk, & Horzum, 2013, p. 2275); however, the informational test groups showed a significant difference favoring the computer screen group.

Korat and Shamir (2012) examined the “effect of direct and indirect teaching of vocabulary and word reading on pre-kindergarten and kindergarten children following use of an electronic storybook” (p. 135). The researchers wanted to ascertain whether e-texts could be helpful in facilitating word meaning and reading for students before they were formally taught to read and write at age six. In this study, “the sample consisted of 288 Israeli children... children in each age group were randomly assigned to an intervention group ($n = 72$) which read the e-book five times and to a comparison group ($n = 72$) which was afforded the regular school program” (Korat & Shamir, 2012, p. 140). Before and after the students read the book, testing covered three concepts: vocabulary, word reading, and story comprehension. The vocabulary testing asked the students the meaning of several words from the selection, and “the total score for this task ranged from 0-16. The alpha score for this measure was .67” (Korat & Shamir, 2012, p. 142). Next, the students were pre- and posttested for their ability to read the 16 vocabulary words. The scores ranged from 1-4 and “the inter-rater reliability for this measure across two raters, using Cohen’s Kappa, was .82. The alpha task score for this task was .90”

(Korat & Shamir, 2012, p. 143). Finally, the students' comprehension of the text was tested via 16 true and false items. After gaining one point for each correct response, "the alpha score for this task was .70" (Korat & Shamir, 2012, p. 143).

The researchers conducted several different analyses of the data beginning with "a 2-way MANOVA (age group; pre-kindergarten vs. kindergarten) x 2 (type group; intervention vs. e-control) being conducted (Korat & Shamir, 2012, p. 144). Upon the conclusion of these tests, "significant differences appeared for age groups [$F(4, 281) = 33.69, p < .001, \eta^2 = .32$]. No differences between group type [$F(4, 281) = .35, n.s., \eta^2 = .01$] and no interaction between group and group type [$F(4, 281) = .08, n.s., \eta^2 = .00$]" (Korat & Shamir, 2012, p. 144). The researchers continued their analysis with an ANOVA to examine each age group for each measure and overall, the kindergarten students outscored the pre-kindergarten students in all areas with and without support. Further, the study included another 2-way MANOVA examining "the children's improvement scores in word meaning and reading with and without the software support, to address the extent of improvement in the children's literacy levels as a function of age group and intervention group. A significant difference was found in the improvement of the experimental group compared to the control [$F(4, 281) = 8.33, p < .001, \eta^2 = .11$]" (Korat & Shamir, 2012, p. 144). That was the only significant difference found for this test as no other interactions indicated significance. Finally, "another ANOVA analysis comparing the experimental and the control groups was performed for each measure...significant differences were found in the progress scores favoring the experimental group" (Korat & Shamir, 2012, p. 145). Overall, the researchers concluded, "the children in the experimental group who experienced e-book reading progressed significantly more than the children from the control group who did not read the book" (Korat & Shamir, 2012, p. 147). This study varied in that it

did not use older, more experienced readers; rather, pre-emergent and beginner readers were assessed. While the sample population was different, “these results support the idea that children as young as pre-kindergarten age can learn to read words after exposure to a highlighted digital text (without any explanations) (Korat & Shamir, 2012, p. 147) thus validating another use for e-texts in the classroom.

Grimshaw et al. (2007) conducted a study in which they examined four aspects of e-reading versus traditional book reading. First, they sought to ascertain if print versus electronic texts affect reading comprehension. Secondly, Grimshaw et al. (2007) sought to ascertain “whether the medium of presentation affects the direct retrieval of information and/or the integration of material as shown by the ability to make inferences” (p. 586). Furthermore, the researchers sought to “identify the particular features of the medium that might be responsible for any advantage in reading comprehension” (Grimshaw et al., 2007, p. 578) and finally to understand if e-readers create a more enjoyable reading experience. To answer this question, the researchers assembled 132 students ranging in age from nine to 11 years old. Of the total sample, 76 read some electronic version of one of the two books while the remaining 56 read the print version of the book. All of the children were read a short summary of the excerpt they were about to read and the electronic reader participants were given a tutorial on the aspects of their equipment such as narration and integrated dictionaries. The printed group was also given an age appropriate print dictionary to use during reading. All of the participants were allowed to refer back to the text while they took the accompanying comprehension test.

Overall, Grimshaw et al. (2007) failed to identify any significant differences in reading comprehension between the e-reader and the printed reader groups. The only significant difference presented with the use of resources. The researchers discovered “there was a

significantly greater usage of the electronic dictionary compared with that of the printed dictionary provided for all children who read the printed version, $t = 4.01$, $df = 25.04$, $p < 0.0005$ " (Grimshaw et al., 2007, p. 595). Since there were no significant gains in reading comprehensions, the researchers speculated:

The uptake of the dictionary may have been because of its novelty value rather than of actual use. This still may be seen as an advantage of the electronic medium, for even if the dictionary usage is because of novelty rather than of need, the habit of accessing it may become established in a young reader. An alternative explanation for the lack of benefit obtained may be that the definitions provided were not suitably matched to the reading level of the children (Grimshaw et al., 2007, pp. 596-597).

Katia Ciampa (2012) also explored the efficacy of e-readers with young readers. She explored two pertinent research questions:

1. How does online reading affect grade 1 readers' attitude toward online reading?
2. How does online reading affect grade 1 readers' comprehension of a text when listening? (Ciampa, 2012, p. 32).

For this study, Ciampa (2012) used six participants from the same suburban school district, all of whom were native English speakers and seven years old. These children then participated in 12 e-book reading sessions over the course of three months, which also included taking a pre and posttest. Each student was taught how to navigate the online software and read two e-books per 45-minute session. At the last session, "each of the participants completed a different version of the listening comprehension test and the same motivation questionnaire with a few additional items included" (Ciampa, 2012, p. 34). The motivation of the e-book on the reader was gauged with a researcher created questionnaire based off the Motivation for Reading Questionnaire from

Gamrell et al. (1995) and the Reading Activity Inventory from Guthrie et al. (1994). The students' listening comprehension was gauged using the fourth edition of the Gray Oral Reading Test, which offered a form A and B for the pre- and posttests.

When examining the data from the motivational questionnaire, each respondent indicated that he or she enjoyed each e-book that he or she read indicating the format had a positive impact on reading motivation and enjoyment. The listening comprehension test also showed growth in the overall sample. Ciampa observed, "three participants reached higher ceilings, and all of the participants gained in their listening comprehension performance from pretest to posttest. Total average comprehension scores dramatically increased, as evidenced by a pretest mean score of 49.2% and a posttest mean of 71.7%" (p. 47). When discussing the implications of the data analysis, Ciampa concluded "the online e-books provided a multisensory reading experience that supported comprehension and critical reading by posing questions before, during, and after reading, which may have facilitated grade 1 children's listening comprehension and increased their level of engagement during e-book reading" (p. 55).

Chen et al. (2013) examined the use of sustained reading using e-books for the support of English language learners. Specifically, the researchers wanted to discover if sustained e-book reading would have a positive effect on the readers' attitude toward reading, comprehension, and vocabulary acquisition. For this study, the researchers assembled 89 participants from a homogenous sample assigning 46 to the experimental group and 43 to the control group. The control group participated in the traditional English class to learn the language while the experimental group received that same treatment plus "an extensive reading program via e-books" (Chen et al., 2013, p. 306). All of the participants were given a pretest to assess their "reading attitude, reading comprehension, and vocabulary" (Chen et al., 2013, p. 306). Once

the experiment was concluded, the students took “another version of Reading Comprehension Tests adapted from the TOFEL 2000 reading test, the same Stockman’s Reading Attitude Scale, and another version of Schmitt et al. (2001) vocabulary test” (Chen et al., 2013, p. 306). To analyze the data, Chen et al., (2013) implemented independent and paired samples t-tests to assess any significant differences on any of the three variables from the pre to the posttest. Also, an “ANCOVA analysis with pretest as a covariate was used if there was any significant group difference in the pretest of attitude, reading comprehension, or vocabulary test” (Chen et al., 2013, p. 307).

In the data analysis, the data showed a significant difference in reading attitude between the control and experimental group. Further, the independent sample t-test used to investigate the difference in reading comprehension between groups also indicated a statistically significant difference. Finally, the ANCOVA analysis showed a significant difference in the vocabulary acquisition. Based on the gains exhibited by the experimental group, teachers of English language learners may consider the use of e-books in the classroom to support the learning process. Further studies in this area would help to validate this pedagogical decision.

Summary

Overall, “little is known about the use of e-books among children, especially the digital natives” (Huang et al.2012, p. 718). Overall, even as technology has rapidly changed and has become more pervasive, educational research is slow to quantify the benefits these tools could have on student readers. One of the few current studies concurred with this thought as “the authors were able to locate only one study (Larson, 2010) that reported students using an eReader, specifically the Kindle, to read eBooks in the classroom” (McClanahan et al., 2012, p. 21). There were an increasing numbers of studies examining the perceived benefits of e-texts, but

there was a lack of statistical data to confirm those perceptions as well as “little well controlled experimental research on the effectiveness of technology” in reference to reading comprehension (McClanahan et al., 2012, p. 20). Furthermore, the studies that do try to quantify the results tend to rely on researcher created instruments; thus, the results are not as valid. The tool of measurement in most current studies shows little reliability and very few studies can attest to tool’s reliability data or norm testing. This study sought to close that gap and provided quantifiable data in reference to the efficacy of e-texts in relation to reading comprehension. While studies showed students perceive increased fluency, more data were required to validate or invalidate that perspective. Once that data become available, educators and stakeholders can make more informed decisions in reference to the allocation of funds for and integration of new technology in schools.

CHAPTER THREE: METHODS

Design

A quasi-experimental nonequivalent comparison group design was used to conduct the study. The study was completed in a public high school; therefore, it was impossible to implement a true experimental study because students were conveniently placed in classes based on varying cognitive levels, class size constraints, and teacher availability. Thus, the sampling strategy used was a convenience sample. With these constraints in mind, the study was quasi-experimental with a treatment group and comparison group. The comparison group, though not randomly selected, was similar in demographics and ability to the treatment group. “The design can control for history, maturation, pretesting, and instrumentation, but this must be confirmed. Unless a researcher can keep conditions between the [treatment] and comparison group the same from pretest to posttest, one group may have an experience that affects its posttest data” (O’Sullivan, Rassel, & Berner, 2008, p. 79). While the study began with a nonequivalent comparison group, data analysis later changed the study to a static comparison due to the fact the pretest showed no influence on the posttest results; therefore, the pretest data was not used.

Reading comprehension strategies were taught using a class novel available in two formats: paperback novel and an e-reader, specifically, a Kindle or the Kindle app. Five classes of American Literature students totaling 128 students were used in this study. Each student was administered a pre- and a posttest at the beginning and the end of the novel unit. Because this study used a pretest, the nonequivalent comparison group design with a covariate was utilized. The use of a covariate was to eliminate pretest conditioning, a threat to the validity of the study.

Research Questions and Hypotheses

RQ 1: Is there a difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text?

H₀1: There is no significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text.

RQ 2: Is there a difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text?

H₀2: There is no significant difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text.

Participants and Setting

The sample for this study included five eleventh grade classes at a suburban high school in northern Georgia. The classes contained 128 students spread across five classes. All classes were the same instructional level (college prep). Students participating in resource, inclusion, and gifted sections of eleventh grade literature were omitted from this study to create a homogenous sample. The creation of a homogenous sample preserved population validity and allowed the study to be generalized and recreated with general ease.

Teacher A is an English teacher at the high School. He has been teaching at this high school for four years and has a total of ten years in the teaching field. He holds a Bachelor's degree in English, a Master's degree in Secondary English Education, and holds an A.B.D. status

in English Literacy. All of his degrees were attained at differing universities in the state of Georgia. Teacher A is male, White, and 35 years old.

This study followed five of Teacher A's American Literature College Prep level classes at the high school. The students in these classes were high school juniors and were 16-18 years old. A College Prep student intends to attend a two or four year college upon graduation and this class's curriculum was designed to prepare these students for this goal. These classes mirrored the ethnic makeup of the school, and no Special Education students participated in these classes. The total number of students between the five classes who participated in this study was 128.

The high school was situated in a suburb approximately 30 miles north of a major metropolitan city. The entire school district consisted of 24 elementary schools, seven middle schools, six high schools, one evening high school, and one combined alternative middle/high school. The entire district educated 38,313 students, and 1,734 students attended the high school. Students at the high school were in grades nine through 12 and ranged in age from 14 to 19. A breakdown of student ethnicity and subgroups are displayed in Table 1.

Table 1

Demographics of the High School

Characteristic	Percentage
Ethnicity	
White	64
Hispanic	13
African American	14
Asian	5
Multiracial	4
Students with disabilities	10
Students eligible for free and reduced lunch	16

(Georgia Department of Education)

Instrumentation

To assess each students level of reading comprehension before and after the treatment was administered, the TORC 4 Test of Reading Comprehension will be administered. The Test of Reading Comprehension – Fourth Edition (TORC-4) was a testing silent reading comprehension test that can be used to (a) identify students reading comprehension rates are significantly below their peers, (b) document student progress in remedial programs, and (c) serve as a research tool in studies investigating reading problems in students. The TORC-4 was normed on 1,942 students in 14 states, all new normative data were collected in 2006-2007, and reliability coefficients were computed by age and subgroups within the normative sample

The TORC-4 has five subtests that all measured word identification and contextual meaning. The first four subtests were used in the current study to measure language comprehension skills. The last subtest was used to measure decoding skills. The subtests are:

1. **Relational Vocabulary:** From the Student Question Booklet, the student read a set of three words that were in some way related to each other. Then, the student is to read silently another four words and chose two words that were related to the first set of three words.
2. **Sentence Completion:** From the Student Question Booklet, the student silently read a sentence that was missing two words. The student then silently read a list of word pairs and chooses the word pair that best completed the sentence.
3. **Paragraph Construction:** After silently reading a list of sentences that are not in logical order, the student then rearranged the sentences to form a coherent paragraph.
4. **Text Comprehension:** Students silently read a short passage and then answered five multiple-choice questions relative to the passage.
5. **Contextual Fluency:** This subtest measures how many individual words students can recognize, in 3 minutes, in a series of passages taken from the Text Comprehension Subtest. Each passage, printed in uppercase letters without punctuation or spaces between words, becomes progressively more difficult in content, vocabulary, and grammar.

The five subtests were combined to form a composite called the Reading Comprehension Index, a standard score with a mean of 100 and a standard deviation of 15. This index represented the students' ability to understand printed material (Pro-Ed, 2012). The scaled scores for the TORC-4 ranged between 1 and 20 and had a mean of 10 and a standard deviation of 3. The TORC-4 was normed in 2006–2007 on 1,942 students in 14 states. Reliability coefficients were calculated using three types of correlation coefficients. Table 2 contains the reliability

values for each source of error. In addition, Brown et al. (2008) reported that validity studies show the test results are valid for the general population and subgroups. Table 3 contains the range and descriptive terms for the scaled scores of the TORC-4.

Table 2

Summary of Test Reliability for the TORC 4 Test of Reading Comprehension

Test component	Coefficient alpha	Test-retest	Scorer
Relational vocabulary subtest	.92	.82	.97
Sentence completion subtest	.94	.84	.96
Paragraph construction subtest	.97	.80	.96
Text comprehension subtest	.95	.83	.95
Contextual fluency subtest	.89	.89	.96
Reading comprehension index	.98	.94	.99

Table 3

Range and Descriptive Terms for Scaled Scores of the TORC-4

Subtest scaled score	Descriptive term	Percentage of sample in each interval
17–20	Very superior	2
15–16	Superior	7
13–14	Above average	16
8–12	Average	50
6–7	Below average	16
4–5	Poor	7
1–3	Very poor	2

Source: (Pro-Ed, 2012).

Procedures

Approval from the Instructional Review Board was obtained after a successful proposal defense. Once Instructional Review Board approval was granted, the candidate completed the next step of the process and obtained permission from the local district that the high school is situated in to conduct this research. Once that permission was obtained, parental consent forms and student assent forms were distributed to each student stating he or she was willing to participate in the research process and his or her parents allowed participation. Students who did not wish to participate in the study took part in the novel unit of study as that is the unit of instruction for the class; however, those students did not have to participate when the TORC-4 Test of Reading Comprehension was given to the classes.

The study began with five classes of high school College Prep American Literature students totaling 128 students participating. All participating students began the study by taking the TORC-4. Test for Reading Comprehension, as a pretest. The results of this test were recorded in Excel and SPSS and served as the baseline data for each student's level of reading comprehension.

Once the e-readers and traditional copies of the novel were distributed, a unit of study covering the novel was executed. The teacher, Teacher A, followed a timeline and lessons provided by a professional lesson planning company. All students received identical instruction of the novel.

Once the novel unit was concluded and the novel was completed, students took the TORC-4 Test of Reading Comprehension as a posttest. The results of this test were recorded in Excel and IBM SPSS® and served as the comparison data for each student's level of reading comprehension after the treatment.

Data Analysis

Pretest and posttest scaled scores for each subtest were analyzed using the IBM Statistical Package for the Social Sciences. These scores were used to address two research questions. The means and standard deviations of all variables were obtained and reported. All data were tested to ensure that the assumptions of the ANCOVA analyses were met. The assumption of homogeneity of regression slopes (of the dependent variable and covariate) was also tested for each variable. If the regression slopes were found to be the same, the covariate was not used in the model.

Research Question 1: Is there a difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text?

An Analysis of Covariance was used to address Research Question 1. The independent variable was type of text (e-reader or printed). The dependent variable was the posttest scaled score of the contextual fluency subtest of the TORC-4. The pretest scaled score of the contextual fluency subtest of the TORC-4 was used as the covariate, if needed.

Research Question 2: Is there a difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text?

A multivariate Analysis of Covariance was constructed to address Research Question 2. The independent variable was type of text (e-reader or printed). The dependent variables were the posttest scaled scores of the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4. The pretest scaled scores of the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4 were used as the covariate, if needed. Wilks' lambda performs, in the multivariate setting, with a combination of dependent variables (relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests), the same role as the F-test performs in one-way analysis of variance. Wilks' lambda is a direct measure of the proportion of variance in the combination of dependent variables that is unaccounted for by the independent variable (the grouping variable or factor). If a large proportion of the variance is accounted for

by the independent variable then it suggests that there is an effect from the grouping variable and that the groups (e-readers and traditional texts) have different mean values.

Although the nonequivalent control group design allows the researcher to perform comparisons that you ordinarily might not be able to make, there are some drawbacks to the design. First, the validity of the design will be compromised if your two groups differ on some important variable before the study begins (Campbell & Stanley, 1963). To minimize this problem, your groups must be matched as closely as possible prior to your study. Second, if either group is selected on the basis of extreme scores on the pretest, then any shift of scores from pretest to posttest toward the less extreme values may be due to regression toward the mean rather than to the effect of your treatment (Campbell & Stanley, 1963).

Campbell and Stanley (1963) discuss pretest–posttest designs extensively. Administering the pretest to participants may change the way they perform after introducing your intervention because the researcher is drawing the participants’ attention to the behaviors being assessed on the posttests, assessing, providing practice on the test, or introducing fatigue. Normally, you would control such carryover effects through counterbalancing. However, the pretest and posttest administrations cannot be counterbalanced. Therefore, a simple pretest–posttest research design leads to problems with internal validity. To ensure internal validity, the researcher will include a comparison group (Bordens, 2008, p. 335).

The Analysis of Covariance (ANCOVA) is used to “test the statistical significance of the difference between all the groups simultaneously while holding the Type I error level constant” (Steinberg, 2007, p. 290). The purpose of covariate is to partition out the influence of one or more variables before conducting the ANOVA. A covariate (pretest) is a variable that has a substantial correlation with the dependent variable (posttest) and it is included in the quasi-

experiment to adjust the results for differences existing among subjects before the start of the experiment. The purpose is to exclude variance in the posttest levels that is determined by the pretest level (George and Mallery, 2010, p. 163).

The ANCOVA in this quasi-experiment has three assumptions:

1. Each subject in the quasi-experiment is independent of every other subject.
2. The scores on the posttest in the populations sampled are normally distributed.
3. The variances of scores in the populations are equal (homogeneity of variance).

To test for normality of the dependent variable (posttest level), the Shapiro-Wilk nonparametric test will be performed. If the significance level is less than $\alpha = 0.05$, then the assumption that the dependent variable posttest level is normally distributed will be rejected. Levene's test examines the assumption that the variance of each dependent variable is the same as the variance of all other dependent variables. Levene's homogeneity of variance test does this by conducting an ANOVA on the differences between each case and the mean for that variable, rather than for the value of that variable itself.

In ANCOVA, like ANOVA, an F statistic is calculated with the treatment effect determined from the differences between group variances since it is not possible for a single mean difference to represent treatment differences between more than two groups. If the group means are similar, they will cluster close together. This makes variance between the means small. On the other hand, if the group means are very different from one another, they will be more dispersed. This makes the variance between the means large. Therefore, ANCOVA like ANOVA calculates the between-groups variance to determine whether there are any mean differences between the groups. The One-Way ANCOVA breaks down the total variation in the

scores of the quasi-experiment into the variance (mean of a sum of squares or mean square) that varies with both the systematic effect of the independent variable and sampling error among the group means, and a variance that varies only with the within-groups error variation. The analysis of variance sorts the total variation of the scores in the quasi-experiment into between-group and within-group variances by assuming a simple model for a participant's score. Including any treatment effect, the group means also differ from each other because of sampling error. Although the independent variable may have no effect, the group mean will differ somewhat from the grand mean simply because of sampling error. Therefore, any effect of the independent variable in the quasi-experiment occurs against a background of sampling error (Kiehl and Green, 2010, p. 245).

After evaluating the results of the ANCOVA, the researcher will need to determine whether the calculated value exceeds the value at the specified Type 1 error level. The researcher will assume that it is acceptable to make a Type 1 error 5% of the time. At $\alpha = .05$, what is the critical value of the F statistic and can the null hypothesis be rejected? When an F test is significant, we know that there is a significant difference among the means of the posttest levels for the comparison group and the treatment/program group. Therefore, post hoc tests are not necessary.

“What constitutes a meaningful difference, as opposed to a merely statistically significant difference?” To address that question, the researcher should measure the practical or clinical importance of an effect. Such measures have come to be called effect size (Steinberg, 2007, p. 395). With ANCOVA, the effect size is measured by eta (η). A small effect size occurs when $\eta < 0.25$, a medium effect is for η between 0.25 and 0.40, and a large effect is found when $\eta > 0.40$.

Quasi-experimental research results should correctly detect not only when there is *not* a real difference in treatments, but also when there *is* a real difference in treatments. This relates to a Type II error and its inverse, power. Power occurs when the null hypothesis is really false, and we correctly reject the null hypothesis. To express it another way, power is when there really is a difference between groups due to the treatment, and we do find it (Steinberg, 2007, p. 407).

CHAPTER 4: FINDINGS

Introduction

The purpose of this study is to discover whether there is a significant difference made in reading comprehension rates of students using e-readers compared to printed texts within a secondary classroom . Students who used the e-readers also had access to the tools the technology contained. To assess if there were any significant changes in language comprehension and decoding, the TORC-4 was administered to the participants as a pretest and posttest. Scores from the pre- and posttests were collected from 128 students and analyzed for differences. For the first research question, an analysis of variance was used to examine the data to determine if there was any significant difference in decoding scores among the participants based on using the e-reader or traditional text. For the second research question, a multivariate analysis of variance was utilized to assess differences in language comprehension amongst the participants. For the first research question, there was no statistically significant difference in the results; however, the second research question examining language comprehension did yield a significant difference in two out of the four subtests of the TORC-4, specifically, text comprehension and language completion. Chapter 4 contains the results of the analyses to answer two research questions.

Research Questions and Hypotheses

RQ 1: Is there a difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text?

H₀1: There is no significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text.

RQ 2: Is there a difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text?

H₀2: There is no significant difference in language comprehension skills (as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4) between students who use e-readers and students who use printed text.

Descriptive Statistics

Statistical inferential tests can be quite sensitive to outliers, often because the calculations rely on squared deviations from the mean. One or two values that are far from the mean can alter the results considerably. One way to identify univariate outliers is to convert all of the scores for a variable to standard scores. If the sample size is larger than 80 cases, a case is an outlier if its standard score is ± 3.0 or beyond. Stem and leaf plots were produced to identify the number of extreme outliers while the boxplots identified the actual case number of the extreme outliers. SPSS distinguishes “extreme” outliers by identifying values more than 3 box lengths from either hinge. Boxplots are preferred over histograms since they can identify potential outliers. In addition, the Mahalanobis (Mahal) D^2 , a multidimensional version of a z-score, was calculated to validate the identification of outliers in the dataset. The Mahal distance measures how far each case lies from the multidimensional mean of the distribution, given the multidimensional variance, or covariance, of the distribution. A case was determined to be a multivariate outlier when the probability associated with its D^2 was 0.001 or less. D^2 is similar to a chi-square distribution with degrees of freedom equal to the number of variables.

Based on this procedure, the original dataset was reduced to an n size of 114, resulting in 56 participants in the e-reader (treatment) group and 58 students in the paperback reading (comparison) group.

The data were examined for outliers and 14 cases were removed. The data from the remaining 114 students were used in the analyses. Fifty-eight students participated in the traditional paperback novel comparison group. Thirty-eight (65.5%) of the participants were male and 20 (34.5%) of the participants were female. There were 56 students who participated in the e-reader treatment group. Thirty-four (60.7%) of the participants were male and 22 (39%) of participants were female. Approximately two thirds of the sample was males in both the e-reader group and the paperback book group (Table 4). More than two thirds of the sample was White, and approximately 10%–15% was Hispanic or Black. The proportions of males and females and ethnicities were similar across the two groups. The sample for this study was comprised of five eleventh grade (American Literature) classes at one high school in northern Georgia. The classes contained 128 students spread across five classes. All classes were the same instructional level: college prep. Students participating in resource, inclusion, and gifted sections of eleventh grade literature were omitted from this study to create a homogenous sample. The creation of a homogenous sample enhanced validity and could allow the study to be generalized and replicated.

Table 4

Description of the Sample

Characteristic	e-reader ($n = 56$)		Paperback book ($n = 58$)	
	n	%	n	%
Gender				
Male	34	60.7	38	65.5

Female	22	39.3	20	34.5
Ethnicity				
Black	7	12.5	9	15.5
Asian	0	0.0	3	5.2
Hispanic	7	12.5	6	10.3
White	41	73.2	39	67.2
Other	1	1.8	1	1.7

The pretest and posttest scaled scores of five subtests of the TORC-4 were used as measures of decoding skills (contextual fluency) and language comprehension skills (relational vocabulary, sentence completion, paragraph construction, and text comprehension). The means and standard deviations for the pretests and posttests for each group are presented in Table 5.

Table 5

Description of the Variables of Interest

Test/Subtest	e-reader ($n = 56$)		Paperback book ($n = 58$)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pretest				
Relational vocabulary	10.09	1.72	9.69	2.23
Sentence completion	11.39	2.78	9.66	2.43
Paragraph construction	11.16	1.60	11.28	1.44
Text comprehension	10.11	2.18	10.28	2.29
Contextual fluency	7.39	2.85	8.33	2.68
Posttest				
Relational vocabulary	10.61	1.94	10.66	1.91

Sentence completion	11.64	2.18	9.81	2.87
Paragraph construction	11.50	1.73	11.55	1.99
Text comprehension	11.12	1.84	10.26	1.88
Contextual fluency	9.59	3.46	9.57	2.63

Results

Null Hypothesis One

The first null hypothesis predicted that there would be no significant difference between the comparison group who read the paperback novels and the e-reader group when decoding scores were compared.

Several assumptions must be met to include a covariate in the model. Assumptions of normality, Levene's test for homogeneity of variance, and the assumption of linearity were evaluated to determine whether an ANCOVA was an appropriate General Linear Model. The assumption for normality using a Shapiro Wilk's test (see Table 6) fails for both the covariate ($p=0.001$) and dependent variable ($p=0.015$). However Levene's test for equal variances ($p=0.471$) was met (see Table 7).

Table 6

Shapiro-Wilk's Test of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PSTCF	.110	114	.001	.974	114	.015
PRECF	.137	114	.000	.962	114	.001

a. Lilliefors Significance Correction

Table 7

Levene's Test for Homogeneity of Variance

Dependent Variable PSTF pstcf

F	df1	df2	Sig.
0.524	1	112	0.471

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

From Table 8 below, the assumption of linearity was not met ($p < 0.05$).

Table 8

Test of Linearity Assumption for Pre- and Posttest of Contextual Fluency

			Sum of Squares	df	Mean Square	F	Sig.
PSTCF *	Between	(Combined)	224.899	12	18.742	2.418	.008
PRECF	Groups	Linearity	100.523	1	100.523	12.971	.000
		Deviation from Linearity	124.377	11	11.307	1.459	.159
	Within Groups		782.759	101	7.750		
	Total		1007.658	113			

Evaluating Table 9, the assumption of homogeneity of regression slopes was not met, indicating that the covariate should be eliminated [$F(1)=5.475$, $p < 0.05$]. Therefore, rather than an ANCOVA, an analysis of variance was used to address the research question.

Table 9

Homogeneity of Regression Slopes Assumption

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	162.817 ^a	3	54.272	6.716	.000
Intercept	570.445	1	570.445	70.586	.000
Group	31.696	1	31.696	3.922	.050
PRECF	112.227	1	112.227	13.887	.000
Group*PRECF	44.243	1	44.243	5.475	.021
Error	888.973	110	8.082		
Total	11512.000	114			
Corrected Total	1051.789	113			

a. R Squared = .155 (Adjusted R Squared = .132)

Dependent Variable-PSTCF

The independent variable was type of text (e-reader or printed), the dependent variable was the posttest scaled score of the contextual fluency subtest of the TORC-4, and the pretest scaled score of the contextual fluency subtest of the TORC-4 was used as another independent factor. Table 10 contains the results of the analysis. No difference in decoding skills was found between the two types of text [$F(1) = 0.45, p = .51$]; therefore, the researcher failed to reject the null hypothesis.

Table 10

Differences in Decoding Skills by Type of Text

Source	SS	df	MS	F	p
Corrected model	118.57	2	59.29	7.05	< .01
Intercept	545.33	1	545.33	64.86	< .01
Pretest	118.56	1	118.56	14.10	< .01
Group	3.76	1	3.76	0.45	.51
Error	933.22	111	8.41		
Total	11512.00	114			

Corrected total	1051.79	113
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Null Hypothesis Two

The second null hypothesis predicted that there would be no significant difference in students' language comprehension scores between the comparison group who read the paperback novels and the e-reader treatment group. There were four subtests of language comprehension utilized: relational vocabulary, sentence completion, paragraph construction, and text comprehension.

Relational Vocabulary Subtest

Assumptions of normality, Levene's test for homogeneity of variance, and the assumption of linearity were evaluated to determine whether an ANCOVA was an appropriate General Linear Model. Only the test for equal variances held ($p=0.674$).

Table 11

Normality test using Shapiro Wilk's

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PSTRV	.213	114	.000	.929	114	.000
PRERV	.160	114	.000	.937	114	.000

a. Lilliefors Significance Correction

Table 12

Homogeneity of Variances Assumption

Dependent Variable PSTRV pstRV

F	df1	df2	Sig.
0.178	1	112	0.674

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 13

Assumption of Linearity for Relational Vocabulary

				Sum of	df	Mean	F	Sig.
				Squares		Square		
PSTRV	pstRV *	Between	(Combined)	105.237	9	11.693	3.932	.000
PRERV	preRV	Groups	Linearity	85.265	1	85.265	28.671	.000
				Deviation	8	2.497	0.839	.570
				from				
				Linearity				
		Within		309.289	104	2.974		
		Groups						
		Total		414.526	113			

Sentence Completion Subtest

Assumptions of normality, Levene's test for homogeneity of variance, and the assumption of linearity were analyzed to determine whether an ANCOVA was the appropriate General Linear Model. All assumptions failed ($p < 0.05$).

Table 14

Normality test using Shapiro Wilk's

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRESC	.142	114	.000	.950	114	.000
PSTSC	.119	114	.000	.943	114	.000

a. Lilliefors Significance Correction

Table 15

Homogeneity of Variances Assumption

Dependent Variable PSTSC pstSC			
F	df1	df2	Sig.
7.861	1	112	0.006

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 16

Assumption of Linearity for Sentence Completion

			Sum of		Mean		
			Squares	df	Square	F	Sig.
PSTSC *	Between	(Combined)	145.521	9	16.169	2.462	.014
PRESC	Groups	Linearity	85.991	1	85.991	13.092	.000
		Deviation from Linearity	59.530	8	7.441	1.133	.348
	Within Groups		683.110	104	6.568		
	Total		828.632	113			

Paragraph Construction Subtest

To determine the appropriateness of an ANCOVA model, assumptions of normality, Levene's test for homogeneity of variance, and the assumption of linearity were tested. The test for homogeneity of variances was the only assumption that was met ($p=0.199$).

Table 17

Normality test using Shapiro Wilk's

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PSTPC	.164	114	.000	.955	114	.001
PREPC	.182	114	.000	.908	114	.000

a. Lilliefors Significance Correction

Table 18

Homogeneity of Variances Assumption

Dependent Variable PSTPC pstPC

F	df1	df2	Sig.
1.668	1	112	0.119

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 19

Assumption of Linearity for Sentence Completion

		Sum of Squares	df	Mean Square	F	Sig.
PSTPC *	Between Groups	36.134	6	6.022	1.818	.102
PREPC	Linearity	22.021	1	22.021	6.649	.011
	Deviation from Linearity	14.113	5	2.823	.852	.516
	Within Groups	354.358	107	3.312		
	Total	390.491	113			

Text Comprehension Subtest

To determine the appropriateness of an ANCOVA model, assumptions of normality, Levene's test for homogeneity of variance, and the assumption of linearity were analyzed. Levene's test for homogeneity of variances was the only assumption that was met ($p=0.857$).

Table 20

Normality test using Shapiro Wilk's

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRETC	.163	114	.000	.940	114	.000
PSTTC	.231	114	.000	.577	114	.000

a. Lilliefors Significance Correction

Table 21

Homogeneity of Variances Assumption

Dependent Variable	PSTTC			pstTC		
	F	df1	df2	Sig.		
	0.032	1	112	0.857		

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 22

Assumption of Linearity for Sentence Completion

			Sum of Squares	df	Mean Square	F	Sig.
PSTTC *	Between	(Combined)	73.580	11	6.689	.564	.854
PRETC	Groups	Linearity	41.608	1	41.608	3.510	.064
		Deviation from Linearity	31.972	10	3.197	.270	.986
	Within Groups		1209.157	102	11.854		
	Total		1282.737	113			

Further assumptions had to be tested to determine whether the interaction of the group variable and the dependent variable were significant. The tests used were the homogeneity of regression slopes test. From Table 23, these tests held for all subtests; the relational vocabulary subtest variable ($p=0.802$), sentence completion subtest variable ($p=0.991$), paragraph construction ($p=0.758$), and text comprehension ($p=0.678$).

Table 23

Homogeneity of Regression Slopes Assumption-Relational Vocabulary

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	88.867 ^a	3	28.956	9.721	.000
Intercept	155.894	1	155.894	52.336	.000
Group	0.423	1	0.423	0.142	.707
PRERV	82.305	1	82.305	27.631	.000
Group*PRERV	0.188	1	0.188	0.063	.802
Error	327.659	110	2.979		
Total	13300.000	114			
Corrected Total	414.526	113			

a. R Squared = .210 (Adjusted R Squared = .188)

Dependent Variable-PSTRV

Table 24

Homogeneity of Regression Slopes Assumption-Sentence Completion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	88.867 ^a	3	43.936	6.947	.000
Intercept	372.895	1	372.895	58.965	.000
Group	2.685	1	2.685	0.425	.516
PRESC	36.086	1	36.086	5.706	.019
Group*PRESC	0.001	1	0.001	0.000	.991
Error	695.641	110	6.324		
Total	13905.000	114			
Corrected Total	827.447	113			

a. R Squared = .159 (Adjusted R Squared = .136)

Dependent Variable-PSTSC

Table 25

Homogeneity of Regression Slopes Assumption-Paragraph Construction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21.502 ^a	3	7.167	2.137	.100
Intercept	138.363	1	138.363	41.256	.000
Group	1.000	1	1.000	0.298	.586
PREPC	21.065	1	21.065	6.281	.014
Group*PREPC	1.046	1	1.046	0.312	.578
Error	368.919	110	3.354		
Total	15536.000	114			
Corrected Total	390.421	113			

a. R Squared = .159 (Adjusted R Squared = .136)

Dependent Variable-PSTPC

Table 26

Homogeneity of Regression Slopes Assumption-Text Comprehension

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	83.648 ^a	3	27.883	9.438	.000
Intercept	276.010	1	276.010	93.424	.000
Group	3.047	1	3.047	1.031	.312
PRETC	60.699	1	60.699	20.545	.000
Group*PRETC	0.513	1	0.513	0.174	.678
Error	324.983	110	2.954		
Total	13422.000	114			
Corrected Total	408.632	113			

a. R Squared = .159 (Adjusted R Squared = .136)
Dependent Variable-PSTTC

Because the three assumptions for an ANCOVA were not met and the homogeneity of regression slopes held, a multivariate analysis of variance (MANOVA) was performed. Therefore, the covariate for each dependent variable was removed from the model and the MANOVA was conducted. The independent variable was type of text (e-reader or printed). The dependent variables were the posttest scaled scores of the relational vocabulary, sentence completion, paragraph construction, and text comprehension subtests of the TORC-4.

When using a MANOVA, a Wilk's Lambda (λ) was the test statistic used to determine whether there was an overall difference in several dependent variables between groups. For the multivariate analysis of variance, the Wilks' lambda (λ) performs the same role as the F-test in a univariate one-way analysis of variance. Wilks' lambda (λ) measures the proportion of variance in the combination of dependent variables that is not considered by the independent variable (groups). If a large proportion of the variance is accounted for by the independent variable, then the effect is that those groups have different mean values.

Overall, the analysis found a statistically significant difference [$F(4, 109) = 5.92, p < 0.01$] between the use of e-readers and printed text (see Table 28). The univariate analyses showed significant differences in sentence completion [$F(1,112) = 14.64, p < 0.01$] and text comprehension [$F(1,112) = 6.09, p = 0.01$]. The null hypothesis was rejected in both cases. In both cases, the students who used the e-reader scored significantly higher than the students who used the printed text. Students in the e-reader group ($M=11.64, SD=2.18$) scored significantly higher on the sentence completion subtest than those who used the printed text ($M=9.81, SD=2.87$). Similarly, the e-reader treatment group ($M=11.12, SD=1.84$) had significantly higher scores on the subtest related to text comprehension than those in the comparison group that made use of only printed text ($M=10.26, SD=1.88$).

There were no other significant findings. In this study, the use of e-readers was found to enhance students' ability in their language comprehension skills in terms of completing sentences and understanding the text of what they are reading.

Table 27

Marginal Means for E-Reader and Printed Text Groups

	GROUP ^a	MEAN	STD. DEVIATION	N
PSTRV	0	10.6071	1.94168	56
	1	10.6552	1.90615	58
	Total	10.6316	1.91530	114
PSTSC	0	11.6429	2.17781	56
	1	9.8103	2.87431	58
	Total	10.7105	2.70602	114
PSTPC	0	11.5000	1.72679	56
	1	11.5517	1.99273	58
	Total	11.5263	1.85878	114
PSTTC	0	11.1250	1.83959	56
	1	10.2586	1.87841	58
	Total	10.6842	1.90163	114

a. 0= EReader group 1= printed text group

Table 28

*Multivariate and Univariate Test Results:**Differences in Language Comprehension Skills by Type of Text*

Multivariate Test Results	<i>A</i>	<i>p</i>	<i>Hypothesis df</i>	<i>Error df</i>
Multivariate/Wilks' Lambda (<i>A</i>)	5.92	<0.01	4	109
			<i>Corrected Model df</i>	<i>Error df</i>
Univariate Test Results	F	p		
Relational vocabulary	0.02	0.89	1	112
Sentence completion	14.64	< 0.01	1	112
Paragraph construction	0.02	0.88	1	112
Text comprehension	6.19	0.01	1	112

Summary

Data from 114 students in four American literature college prep classes were used to determine if the use of e-readers improved decoding and language comprehension scores of students who used them. Subtests of the TORC-4 were used to measure decoding and language comprehension skills. Due to the fact that the three assumptions tests were not met for either research question, the pretest data was not utilized and the study shifted from nonequivalent comparison group to a static comparison group design. There was no significant difference between the printed text group and the e-reader group. The analyses found that students who used e-readers had improved scores on the sentence completion and text comprehension subtests; thus, there was emerging evidence that indicated e-readers could be a tool to improve reading comprehension in high school students. A discussion of the results, conclusions drawn from

them, the implications for theory and practice, and recommendations for further research are presented in Chapter 5.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Overview

This study examined whether the use of e-readers could help to improve decoding and comprehension skills among high school juniors. Chapter Five consists of an overview of the chapter, a summary of the findings, a discussion of the findings and the implications in light of the relevant literature and theory, an implications section (methodological and practical), an outline of the study limitations, and recommendations for future research. The discussion of findings presents the study findings in relationship to the empirical and theoretical literature reviewed in Chapter Two. Implications for practice and theory are provided to address the theoretical, empirical, and practical implications of the study. Delimitations set by the researcher and limitations beyond the researcher's control are noted in this chapter. Chapter Five offers multiple recommendations and directions for future research. The chapter concludes with a summary of the study highlighting the most important results and additions to the body of knowledge.

Summary of Findings

The study began with addressing the first research question of whether there was a significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text? No significant difference was found; thus, the researcher failed to reject the null hypothesis [$F(1) = 0.45, p = .51$]. There was no statistically significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) between students who use e-readers and students who use printed text.

The second null hypothesis tested if a significant difference was found in language comprehension skills between students who use e-readers and students who use printed text. The

four subtests, from the TORC-4, of language comprehension utilized were relational vocabulary, sentence completion, paragraph construction, and text comprehension. In this case, the null hypothesis was rejected. Because the three assumptions for an ANCOVA were not met and the homogeneity of regression slopes held, a multivariate analysis of variance (MANOVA) was performed. The univariate analyses showed significant differences in sentence completion [$F(1,112) = 14.64, p < 0.01$] and text comprehension [$F(1,112) = 6.09, p = 0.01$]. The null hypothesis was rejected in both cases. In both cases, the students who used the e-reader scored significantly higher than the students who used the printed text. Students in the e-reader group ($M=11.64, SD=2.18$) scored significantly higher on the sentence completion subtest than those who used the printed text ($M=9.81, SD=2.87$). Similarly, the e-reader treatment group ($M=11.12, SD=1.84$) had significantly higher scores on the subtest related to text comprehension than those in the comparison group that made use of only printed text ($M=10.26, SD=1.88$). However, the null hypotheses for relational vocabulary ($p=0.89$) and paragraph construction subtests of language comprehension skills held and there were no significant differences between e-readers and printed text use.

Discussion

As in this study, the research validated the idea that decoding is not necessarily a required component to improve language comprehension, especially in the case of older, more mature readers as in this study. Decoding is a skill that a child begins at a young age with acquisition of sight words as a pre-emergent reader (SEDL, 2014). Decoding is then augmented as a child learns the rules to create words that follow the conventions of English and the exceptions. As opposed to language comprehension, readers are in the process of decoding from the time they can recognize shapes and letters. Hogan et al. (2011) discovered that “even when children show

similar vocabulary, grammar, and word reading (decoding) abilities, higher level language skills are poor in school-age children with poor reading comprehension than those with good reading comprehension” (p. 3). This research indicated that while decoding is important; however, language comprehension is required for decoding to an effective factor on overall comprehension, especially in older readers. Samuelstuen and Braten (2005) emphasized that decoding is an important skill for successful reading comprehension, but its degree of importance was questionable. Samuelstuen and Braten (2005) conducted research that validated the idea that a weak decoder could still be a proficient reader if his or her comprehension skills were strong enough to compensate for the deficiency on the other side of the spectrum. In both cases, decoding is seen as a lower level skill that is required; however, the complex nature of language comprehension must be considered when examining reading comprehension. In the case of this study, the literature and the results appear to be in line. Decoding did not show improvement as it is a lower level skill that was developed in earlier years.

The study discovered no significant differences in the language comprehension skill scores between the paperback novel group and the e-reader group for relational vocabulary and paragraph completion. On the other hand, the data yielded significant differences in the scores between the pre- and posttest in the sentence completion and text comprehension tests. In this case, the null hypothesis was rejected as the research results supported the idea that an e-reader can improve language comprehension scores as evidenced from these two subtests.

More studies are emerging examining the efficacy of e-readers in regards to improving reading comprehension; however, many of the studies have yielded conflicting results. One reason for the conflicting result may be the instrument. In most current research, researchers are relying on self-created assessment tools that lack the reliability of the TORC-4, the instrument

used in this study. It is possible to consider if the instrument was more mainstreamed and reliable, the results of the emerging research could be more consistent. Some of the studies, such as the one conducted by Margolin et al. (2012) have concluded that e-readers do not have any bearing on improved reading comprehension. In this study, the researchers had subjects read expository and narrative texts on a variety of computer screen platforms as well as paper version. In their results, Margolin et al. (2012) asserted that reading from the computer screen versus the paper version had no impact on a reader's comprehension; thus, the results of that study are in conflict with the improved scores in text comprehension and language completion identified in this study.

Wright, Fugett, and Caputa (2013) also examined the reading comprehension rates, engagement, and tool usage of three participants reading paperback books and on iPads. As the researchers analyzed the data, tool usage was increased with the iPad group; however, the data yielded no significant differences in the reading comprehension scores of the two groups. In this case, the tools offered on the iPads did not seem to have an impact on the reading comprehension scores of the three participants, which is unlike the data in this study. Similarly, Aydemir, Ozturk, & Horzum, 2013 also conducted a quantitative study following 60 school age students. In this study, the participants were split into a control (paperback version) group and a treatment (computer screen) group. This study was larger in number of participants and the number of texts which was six per participants. Although there were more participants, this study also indicated "there was no significant difference between the reading comprehension levels of students reading the narrative texts from the printed material and the students who read them in a computer environment" (Aydemir, Ozturk, & Horzum, 2013, p. 2275).

On the other hand, there were other researchers that discovered results lending toward the idea the e-readers to have an impact on reading comprehension. In a small study sponsored by the Alabama State Department of Education, Suell et al. (2013) identified a group of nine incoming high school freshmen that were identified as struggling learners and tested whether or not e-readers could increase reading comprehension and engagement with the text to intervene before high school. The baseline data that were used was the students' existing standardized test scores, and at the end of the treatment, the students were given a survey to assess engagement and their reading averages were compared. In the case of AR scores, the researchers noted a 1.07-point gain in overall average scores and a 19.8-point gain to the STAR reading average scores. While the data were encouraging, the researchers noted the study had several limitations such as "the small sample size and lack of demographic information on the high school students" (Suell et al., 2013, p. 80). While this study mimicked the format and findings of this current research, Suell et al. (2013) admitted that other studies "should continue and expand with modifications to the data collection and student selection" (Suell et al., 2013, p. 80). This is similar to the results in this study in the case that the initial data here are encouraging, but more research is required to truly assess the efficacy of the treatment of the e-readers.

Ciampa (2012) also conducted a quantitative study utilizing six participants all of whom were seven years old from the same suburban school district. Unlike the Suell et al. (2013) study, these readers were considered on level readers and were at a different phase of reading development. Ciampa (2012) had participants read age appropriate texts over the course of three months, and a pre and posttest was administered to assess growth in reading comprehension. In this study, each respondent indicated that he or she enjoyed each e-book that he or she read indicating the format had a positive impact on reading motivation and enjoyment. In reference to

quantitative reading comprehension gains, “three participants reached higher ceilings, and all of the participants gained in their listening comprehension performance from pretest to posttest. Total average comprehension scores dramatically increased, as evidenced by a pretest mean score of 49.2% and a posttest mean of 71.7%” (Ciampa, 2012, p. 47).

Also working with young readers, Korat and Shamir (2012) examined the “effect of direct and indirect teaching of vocabulary and word reading on pre-kindergarten and kindergarten children following use of an electronic storybook” (p. 135). The researchers wanted to ascertain whether e-texts could be helpful in facilitating word meaning and reading for students before they were formally taught to read and write at age six. A similar age group as Ciampa (2012) was utilized to ascertain the efficacy of e-readers on emerging readers in a study conducted in Israel. Korat and Shamir (2012) utilized a much larger group of participants ($n = 288$), and this study examined vocabulary, word, reading, and story comprehension. In the end, the researchers concluded, “the children in the experimental group who experienced e-book reading progressed significantly more than the children from the control group who did not read the book” (Korat & Shamir, 2012, p. 147).

Both the Ciampa (2012) study and the (Korat & Shamir, 2012) studies validated the initial findings of this study: e-readers can have a positive impact on reading comprehension of students. The age of the participants of those studies and this one are different indicating the need to continue to examine the efficacy of e-readers on students of varying ages and reading levels.

Chen et al. (2013) also examined e-readers, but with a different type of reader. In this study, the researchers worked with English Language Learners to discover the impact of e-readers on “reading attitude, reading comprehension, and vocabulary” (Chen, et al., 2013, p.

306). Eight-nine students participated in this study, and each group took a pre and post-test to assess each of the experimental areas. The data showed a significant difference in reading attitude between the control and experimental group. Further, the independent sample t-test used to investigate the difference in reading comprehension between groups also indicated a statistically significant difference. Finally, the ANCOVA analysis showed a significant difference in the vocabulary acquisition, all of which mirror the data of this study that e-readers could have a positive impact on reading comprehension.

Research has proven over multiple decades that two of the most important items a proficient reader brings to the text in his or her own knowledge and experiences and the ability to relate them to the text. The knowledge the reader brings in called his or her prior knowledge and when a reader can connect his or her prior knowledge, to the text, Larson (2009b) asserted that allowed for a text to be more engaging and meaningful for the reader and the reader would be able to create personal connections with the text. Additionally, schemes are based on a reader's prior knowledge making the two function interdependently. Bransford (2010) noted that schemes that are effectively built allow the reader create inferences and fill in missing information in a text. One of the added benefits of an e-reader is the tools the app or device comes preloaded with which could help to build upon the reader's prior knowledge. Most e-readers have the capability to define words, support note taking and bookmarking, and may even contain hyperlinks to additional information. Lotta Larson (2012) followed the tool usage in e-readers among 49 education students at the university where she taught and found that most students used the tools several times while reading the e-text. Wright, Fugett, and Caputa (2013) also commented that tool usage in e-readers was high. In their study, the researchers noted that when the participants had access to the e-reader dictionary, his or her usage of the dictionary was

significantly higher than when give a paperback book and dictionary. Furthermore, Grimshaw et al. (2007) conducted a study in which one of the research questions dealt with tool usage in e-readers and paperback books. While their study showed no difference in comprehension, there was a significant difference in tool usage. The participants with e-readers used their tools much more frequently versus the paperback readers who were given a dictionary as a tool. These studies all validated the idea that when given an e-text, the reader will use the tools that are available from the device or app which can have an impact on comprehension.

Another tool the e-readers contained was the ability to highlight and taken notes in the text. This capability ties into the concept of metacognition, which simply means being aware of engaged cognitive processes. Hacker (2010) elaborated on the concept of metacognitive experiences by detailing these are the moments when a reader is actively aware of how he or she is reading and comprehending and the reader can monitor his or her own progress towards a reading goal. Hall (1998) noted that when a reader successfully engaged with metacognition and monitors his or her own reading and reading strategies, his or her own reading comprehension was improved. Another theory important in reading comprehension research is the theory of metacognition in the reader. According to Hacker (2010), “metacognitive experiences are concerned with one’s awareness of his or her cognitive or affective processes and whether progress is being made toward the goal of a current process” (p. 757). Overall, when a reader is engaging with a text, if he or she is actively channeling strategies to be successful with the text, the goal has a higher likelihood of being met. Taking notes and engaging with the text would allow for metacognition to be facilitated in the reader of the e-text.

In both the case of building prior knowledge and the use of metacognition, the research results support the findings in the literature. It stands to reason the tools the e-reader offered, in

regards to language comprehension (dictionary, note taking capabilities, and highlighting), did create higher scores in the e-reader group. These tools improved the comprehension rates of the readers; thus, they engaged in strategies that have been proven to improve reading capability.

As found in some of the current research, this study indicated there were significant gains in language comprehension among the group who read with the e-readers. These findings are significant because with so much emerging technology coming into existence, it is vital to assess which technologies have educational value and which ones do not. Larson and Miller (2011) noted that “students need an increased expertise in digital technologies (computers, electronic white boards, GPS, etc.). Of greater importance is the need for students’ ability to use technology to research, organize, evaluate, and communicate information” (p. 122). Lamb and Johnson (2011) acknowledged that “technology, both inside and outside of the school library, is changing the way children read, as well as our approach to teaching... this new breed of reader feels comfortable working with many devices” (pp. 1-2). With these changes impacting students of all ages from all different areas of the country, a study such as this is vital to introduce new pedagogical approaches to meet students’ needs. Furthermore, schools do not only have an obligation to meet state and federal curriculum standards, modern schools have an obligation to create learners who are prepared to compete in a global fashion, and technology is the key to making that happen.

The existing research is still ambiguous as to whether e-readers affect reading comprehension, and the age of the reader seems to be a possible factor not fully taken into consideration at this time. For each study that finds gains, another one does not, yet no researcher seems to be talking about the age of the participant and how that may or may not impact the findings of the study. Studies such as this one that continue to ask these research

questions need to continue to be conducted to create a data pool that is deep enough to make informed decisions in reference to implementing e-readers in the classroom. Furthermore, with the findings of this study, more concentrated and focused research questions can be created and tested in future studies to investigate further the specific reasons e-readers may be helpful in increasing reading comprehension.

From the findings in this study, it could be theorized that one possible reason for the gains found in sentence completion and text comprehension could be the access to tools, such as links and dictionaries, on the e-readers. Hall (1998) commented that strong and effective reading is not a sequential process; rather, it is an interactive one. In the case of e-readers, the tools could create a more interactive environment lending to Hall's theory. Having access to and using the tools was the main difference between the control and treatment group, so it is worth considering the tools may be the catalyst for the significant difference in the data. This is validated by Larson (2009) who noted that "many e-books employ multimodal features – such as video, audio, and hyperlinks – as well as interactive tools. Such tools invite readers to physically interact with the text" (p. 255). This interaction may have been present in this study, and that supports the gains found in the pre and posttest scores and is supported by the current research.

In this study, the specific subtests that saw significant gains were sentence completion and text comprehension. The e-reader used in this study gave participants access to an integrated dictionary. All the reader had to do was long hold the word on the screen and the definition would pop up. With easy access to an integrated dictionary, it was very simple for the reader to stop and define unknown words. This could have two outcomes. First, the dictionary created a more engaged and active reader. Having a reader who takes the time to stop and define unknown words is someone who is paying close attention to the text. This engaged reading habit could

then be translated to other reading situations. Secondly, taking the time to search for the definition and spelling of unknown words and learning them in context increased the reader's lexicon and background knowledge, which would also translate to future reading experiences. The specific subtests that showed gains would also support this idea. While relational vocabulary and paragraph construction did not show gains in pre and posttest scores, sentence completion and text comprehension did. If participants were using this feature in the e-reader, it would make sense the increased word comprehension would allow the reader to improve his or her sentence completion and text comprehension skills.

Further examining the second research question concerning a difference in language comprehension skills, as measured by the relational vocabulary, sentence completion, paragraph construction, and text comprehension between students who use e-readers and students who use printed text, it is worth examining the additional features the e-readers possess. In addition to the dictionary on the e-reader increasing comprehension, having hyperlinks in the e-text could have served as a reason for an increase in language comprehension scores. In the case of the e-text that was utilized, there were links throughout the text that took the reader to another page that explained the text in more detail and increased the reader's prior knowledge about the subject. Through increasing a reader's prior knowledge, effective schemes were created, reinforcing the idea that e-readers can increase language comprehension. The use of the hyperlinks in e-readers have could allowed the reader to bridge the gap between his or her existing knowledge and the last pieces needed to build the effective scheme; thus, the comprehension of the text would be improved. While scheme creation is useful to improve comprehension, they are even more useful when coupled the use of metacognitive strategies.

While students used schemes to activate their prior knowledge thus creating a context for the piece, metacognitive strategies allow for self-monitoring of comprehension (Miller, 2011, p. 34; Anderson, 2010, p. 594), which another tool the e-reader could facilitate. In reference to metacognition, the use of the highlighting, bookmarking, and note taking features all lend to the concept of activating that process while reading. Research indicated that when readers monitor their activities, their comprehension also was improved. In this case, taking notes, making predictions, drawing inferences, etc. with the built in tools would allow a reader to increase engagement and comprehension of the text at hand.

In the case of this study, several of the e-reading participants did in fact use the tools integrated into the e-readers. Several students mentioned using find and defining features to help with class assignments related to the text, and well as the highlighting sections of text and adding annotations. It may be that the device itself is not what accounted for the scores; rather, the tools that were available and the thinking processes they elicited. While those same reading comprehension strategies are certainly available without the use of an e-reader, modern students are so acclimated to technology all around them; it could be that they are more likely to use the tools when they are in a digital format. The current high school student is so acclimated to absorbing almost all information from a digital source, so it would make sense that he or she would be more engaged in reading comprehension strategies that are delivered in an electronic format.

Implications

While research about e-readers is growing, there is still a very small body of studies that examined the impact of e-reading on overall comprehension, and virtually none that examined specific domains of reading comprehension. According to Pecjak, Podlesek, & Pirc

(2011), research in the field of the efficacy of different reading platforms needs to be expanded to because:

Reading skills and abilities have always been important in the educational context, especially nowadays, in the era of information society. These skills represent an effective means for acceptance, organization, and usage of information in different areas. Thus, reading skills and the ability to comprehend written material have become an important cross curriculum experience, which influences one's educational achievement, since the vast majority of information in educational settings is transferred through written materials (p. 53)

Maynard (2010) also calls for more research into the emerging e-reader revolution from the reading for pleasure side. She contends that young readers who are engaged with a text experience more enjoyment; thus, these readers improve their skills more rapidly. If the e-readers can be shown to not only increase comprehension, but also engagement, there could be multiple reasons for schools to introduce them to students of all ages. Stephens (2012) also weighed in on the ability of e-readers to increase reader engagement with the text. In her article, Stephens (2012) observations lend to the idea that e-readers have the ability to create a more engaging reading experience based on their supportive and interactive features.

The first research question examined whether e-readers could improve decoding rates in high school readers. In the case of this research, because decoding rates were not improved, it narrows down the areas of reading comprehension to be examined by different ages. On the other hand, the second research question examined language comprehension skills and this study, supported by the research, has indicted that it is possible that e-readers could have a positive effect on readers of varying ages and readiness levels. Furthermore, this study indicates

that language comprehension can be improved by using e-readers, and with reading difficulty that increases across the curriculum each year, these data give a valid tool for improving the more advanced side of reading comprehension.

Furthermore, this study helped to create a valid reason to increase school spending on e-reading technology. Many schools want to integrate technology, but have difficulty validating the cost. In the case of e-readers, storage rooms full of novels and textbooks make it very difficult to rationalize purchasing e-readers or the license to release titles to them. If further research continues to lend to the idea that e-readers are more than a novelty, and that these devices can actually increase reading comprehension skills, school systems would be wise to invest in this next wave of educational technology.

Also, most states recently adopted the Common Core Standards, a nationwide set of Pre-K through 12th grade standards. Within these standards, there was a sizeable increase in the level of reading of nonfiction texts and texts that are more rigorous. Nationwide, the expectation is that American students need to read, comprehend, and synthesize a variety of literary and informational texts on an increasingly more difficult reading level. Once again, if e-readers proved to be an effective tool to increase reading comprehension, they can be put into place in classrooms in states that have adopted these rigorous standards as a way to help students meet the most recent set of expectations in education.

Limitations

A delimitation of this study is the fact that there was very little ethnic variation among the students. The high school setting for the study has little variation among its student population, so replication of this study should include more diverse population.

Furthermore, this study only considered a small, homogenous group of participants; thus, the results are not generalized for multiple populations. The process of the study allows for easy replication to consider these different learners; however, this study did not create any conclusions that can be used outside of the general education population.

Recommendations for Future Research

In the case of this study, decoding rates were found to be unaffected by the use of an e-reader. Since decoding is a skill that emerges at a younger age, it would be useful to replicate this study with a range of ages of readers to determine at which age decoding and language comprehension begin to switch prominence in reading comprehension.

Instrument reliability has come to be a major factor in the studies on e-readers over the last several years. In the case of most studies, researchers are creating simple multiple choice style instruments that correlate only to the text the subject read, and these researchers are not looking at the overall skill on reading comprehension. As research in this field continues, researchers need to consider two items. First, they need to be examining reading comprehension overall, and not just comprehension of one specific text. Secondly, researchers need to be choosing tools that are more reliable and that have been normed to lead to stronger data collection and analysis.

Another recommendation would be to have a more diverse population participate in the study to ascertain if socio-economic status has an impact on the use of e-readers. In this case, the majority of participants came from average or above average income homes where technology and the means to provide for it financially were prevalent. Future studies focusing on economically disadvantaged students would help to validate or invalidate using e-readers with the general student population, or whether or not to keep them confined to certain groups.

Furthermore, future studies would be improved if they included a survey that assessed e-reader tool usage. It is a strong possibility the tools available in the e-reading platforms contributed to the difference in the language comprehension scores between the two groups, but no research question in this study evaluated tool usage. Future researchers who want to investigate this field, who do notice an improvement in comprehension, would possibly have justification for the use of e-readers. Emerging research has claimed that reader interaction with the tools on e-readers can have a positive impact on reading engagement which has been loosely linked to increased reading skills. Stephens (2012) discovered, “use of e-readers has been shown to produce a more positive attitude toward the reading experience among middle school boys,” a typically less engaged demographic of readers, indicating that there is something about the tools of the e-readers that are more engaging to some readers, and further research to identify that component, along with reading comprehension gains, is necessary (p. 29).

Finally, a study that targets students participating in special education could yield very useful information. Students with special needs oftentimes have difficulty accessing the general education curriculum due to reading deficiencies. A well-planned study with a group of similar learning-disabled students could, once again, validate or invalidate the use of e-readers as an intervention for struggling learners.

Summary

This dissertation examined whether the use of e-readers could help to improve decoding and comprehension skills among high school juniors. No statistically significant difference in decoding skills (as measured by the contextual fluency subtest of the TORC-4) was discovered between students who use e-readers and students who use printed text. Another important finding from this research was that students in the e-reader treatment group scored significantly

higher on the sentence completion subtest and on the subtest related to text comprehension than those who used the printed text comparison group.

The study found that language comprehension can be improved by using e-readers and, with reading difficulty that increases across the curriculum each year, these data give a valid tool for improving the more advanced side of reading comprehension. If further research continues to lend to the idea that e-readers are more than a novelty, and that these devices can actually increase reading comprehension skills, school systems would be wise to invest in this next wave of educational technology.

Overall, this study has validated the idea that e-readers can have a positive impact on reading comprehension rates in high school age readers. With emerging and constantly changing technology, it is vital that the educational community evaluate these devices to assess their potential efficacy for students. This study has also proven the need for additional studies that look more specifically at the features of e-readers and how the usage of these features may have a direct impact on the different domains of reading comprehension.

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APPENDIX A
CONSENT FORM

The Impact of E-Texts on Reading Comprehension in High School Students

Erika Carden

Liberty University

Department of Education

You are invited to be in a research study about strategies to improve reading comprehension rates among high school students. You were selected as a possible participant because of your placement in your English class. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Erika Carden, English Department at Roswell High School and Doctoral Candidate at Liberty University.

Background Information:

The purpose of this study is to examine if reading there is a difference in reading comprehension rates when a student reads a novel via an e-text versus a traditional paperback version.

Procedures:

If you agree to be in this study, I would ask you to do the following things:

Participating in this study will require no extra work, time, or effort from the participants. The study will begin by having the students take a baseline test, in class, to assess their current reading level. From there, students will be randomly assigned to an e-text or paperback version of an in class novel. All of the students will read the novel and receive identical instruction from the teacher during the reading process. Finally, the posttest will be administered to assess if any changes in reading comprehension levels occurred after the students read using one of the two formats: e-text and paperback.

Risks and Benefits of being in the Study:

The risks are no more than the participant would encounter in everyday life.

The benefits to participation are a potential increase in the participants reading comprehension skills as well as giving the participants an opportunity to learn how to read on a new platform. At large, the benefits from this study could change the delivery of texts to students if it is proven that e-texts do significantly improve reading comprehension rates

Compensation:

You will not receive payment for your participation in this study.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researcher will have access to the records. Records will be stored

electronically, and only the researcher will have access to the passwords required to access that computer. Furthermore, none of the participant names will be included with the files. Participants will be assigned random numbers and identified as such.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University or Roswell High School. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Erika Carden. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me at e.carden@yahoo.com. My committee chair, Dr. Randall Dunn, can also be reached at 434-592-3716 or at rdunn@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24502 or email at irb@liberty.edu

You will be given a copy of this information to keep for your records.

Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature: _____ Date: _____

Signature of parent or guardian: _____ Date: _____

(If minors are involved)

Signature of Investigator: _____ Date: _____

IRB Code Numbers: 1823.041414

IRB Expiration Date: April 14, 2015

APPENDIX B

LIBERTY UNIVERSITY
INSTITUTIONAL REVIEW BOARD

April 14, 2014

Erika Carden
IRB Approval 1823.041414: The Impact of E-Texts on the Domains of Reading
Comprehension in High School Students

Dear Erika,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Please retain this letter for your records. Also, if you are conducting research as part of the requirements for a master's thesis or doctoral dissertation, this approval letter should be included as an appendix to your completed thesis or dissertation.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054

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