DO STUDENTS USING ELECTRONIC BOOKS DISPLAY DIFFERENT READING
COMPREHENSION AND MOTIVATION LEVELS THAN STUDENTS USING
TRADITIONAL PRINT BOOKS?

by

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A Dissertation Proposal Presented in Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

Liberty University
November, 2012
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ABSTRACT

The effect of electronic books on the reading comprehension of middle and high school students was examined using an experimental posttest-only control-group design. A convenience sample of 140 randomly assigned middle and high school English students at an independent school in eastern North Carolina participated. Half of the students used passages from text read on tablets while half utilized traditional print text passages. Data was collected during one class period in which the reading comprehension section of the Gates-MacGinitie Reading Tests®, a 35 minute test containing 48 questions, was administered. Reading comprehension data was analyzed using an independent t-test.

The effect of electronic books on the reading motivation of middle and high school students was examined using a quasi-experimental pretest-posttest control-group design. All students from the Reading Comprehension testing took the initial Motivations for Reading Questionnaire, a 15-20 minute survey containing 53 questions, on day two. A posttest MRQ was administered in which 27 participants completed the MRQ after reading a book excerpt in paper form, and 27 participants completed the MRQ after reading the same excerpt in electronic form. Reading motivation data was analyzed using a MANOVA. Results demonstrated no significant differences in either reading comprehension or motivation levels based on book format.

Descriptors: Electronic books, reading comprehension, reading motivation.
Acknowledgements

A sentence could never begin to describe the thanks that I owe my family. My wife and I have often joked that she deserves the degree as much as I do, and that is absolutely true. Without her support, there is no way this would have been accomplished. I look forward to spending time with all of you that doesn’t involve stopping to work on coursework or some aspect of the dissertation.

I owe a great deal of thanks to my chair, Dr. Szapkiw, and committee members Drs. Holder and O’Brien. Dr. Szapkiw, you are an amazing “solutions” person. For every problem I presented, and there were many, you handled them with a positive attitude that always put my concerns at ease. Dr. Holder, your constructive feedback forced me to consider many aspects of the research that aided my understanding greatly. Dr. O’Brien, it was a great advantage to simply walk down the hall and discuss issues with you, and I thank you for the time you put into the research.

Finally, to the research school, I owe many thanks. To the administrators who allowed me to conduct this study, even knowing how hectic the research days would be, I am grateful. To the faculty who worked so diligently to implement the research and ensure its success, I offer my thanks. To the students, your volunteering to help me attain this goal speaks volumes about your character.
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List of Abbreviations

Confirmatory Fit Index (CFI)

Gates-MacGinitie Reading Tests® (GMRT®)

Multivariate Analysis of Variance (MANOVA)

Motivations for Reading Questionnaire (MRQ)
CHAPTER ONE: INTRODUCTION

The use of electronic books continues to expand as eBooks are increasingly adopted by academic communities. Major publishers, such as McGraw-Hill, Pearson, and John Wiley & Sons, are working with colleges and universities to expand eBook adoption. Some colleges and universities now charge students a mandatory course-materials fee; this fee includes the use of the course eBook (Acker, 2011; Young, 2010). The University of California-Berkeley, University of Minnesota, University of Wisconsin, University of Virginia, and Cornell University now require the use of eBooks in certain courses (Abutaleb, 2012). Increased eBook offerings, and mandatory use of eBooks for some college courses, will continue to drive expansion of eBooks into the educational environment. With the increased use of mobile devices in the K-12 setting, the 2011 Horizon Report projected a one year or less timeframe for school systems to begin widespread use of eBooks (Johnson, Smith, Willis, Levine, & Haywood, 2011). The 2012 Horizon Report followed with a prediction of widespread use of tablet computers within a one-year timeframe (Johnson, Adams, & Cummins, 2012). As eBooks are increasingly adopted in the K-12 setting, it is necessary to consider their effect on academic performance. Reading comprehension is a foundational skill, with instruction beginning in kindergarten and continuing throughout the educational process (Pardo, 2004). There is a direct link connecting level of comprehension to the transaction between reader and text (Kucer, 2001). Cognitive science views this transaction as occurring when the body engages the physical world and thus studies transaction in the context of interactions between people and environment (Gibbs, 2003). Research
displaying the effect of format on transaction has been mixed. A study using random assignment of 40 adults required groups to read from either a paper or electronic text and found no difference in recall levels and information retrieval based upon text format (Morineau, Blanche, Tobin, & Gueguen, 2005). This study used electronic books read on a Pocket PC using a thin film transistor LCD screen with 240 x 320 pixels and back-illumination (Morineau et. al., 2005). A separate study found reading comprehension to be superior using the print format (Noyes & Garland, 2008). Noyes & Garland (2008) were reporting the results of studies conducted using Cathode Ray Tube screens, and admitted that technological improvements could lead to computer and paper equivalence. This contradiction in results displays the need for further study. Also inherent in this study is the need to determine how new technology has altered results. The two studies noted used text passages read on different types of screens. The current study will use passages read on Lenovo X220 Tablets. These tablets offer 12.5 inch, LED backlit screens with a resolution of 1366 x 768. Tablet devices have proven effective tools for reading instruction in grades K-5 (Dundar & Akcayir, 2012), but this research needs to be extended through high school. This research will not incorporate electronic books read using e-ink technology. E-ink devices, such as Amazon’s Kindle, feature resolutions of 600 x 800 and are composed of microcapsules containing charged ink granules (Torres, 2012). When the device changes the electric field, it forces either the white or black granules to move to the top of the capsule, displaying text (Torres, 2012).

Reading motivation is a second key factor in reading performance. Motivated readers work harder to build meaning in their reading and display increased comprehension (Pardo, 2004). eBooks are currently being promoted as a less expensive
and more efficient method for reading (Jones & Brown, 2011). Such efficient, inexpensive availability affects selection, and selection of high-interest material has been shown to increase motivation and engagement (Flowerday, Schraw, & Stevens, 2004; Jones & Brown, 2011; Marinak & Gambrell, 2008). Thus, the effect of eBook use on reading motivation is an essential component for researching eBooks and reading comprehension. If the eBook format has positive or no effect on comprehension and motivation, the many benefits regarding portability and cost encourage continued use. If the effect is negative, however, the adoption must be reconsidered.

This study examined middle and high school students’ use of a tablet computer to read eBook passages displayed using Riverside Publishing’s (2012) Testing Interface. The study determined the effect of eBooks on the reading comprehension and motivation levels of middle and high school students.

Chapter one will provide an extensive background regarding the transition from print to digital formats that is taking place within the educational setting. Special emphasis will be placed on the lack of research regarding how this transition has affected reading comprehension and motivation for middle and high school students, and how the study’s research questions are derived from the literature. Chapter one will conclude with a brief overview of the research plan, including the assumptions and limitations inherent in this research.

**EBook Adoption**

The adoption of eBooks has occurred in our society. Miller and Bosman (2011) reported that beginning in April, 2011, at Amazon’s site, 105 eBooks sell for every 100 traditional print books. The authors detailed Amazon’s predictions that, within a decade, fewer than 25% of books sold will be print versions. The International Digital Publishing
Forum (2011), providing quarterly earnings reports for the Association of American Publishers, placed U.S. trade electronic book sales in 2010 at greater than $340 million. Libraries are increasingly adopting and offering eBooks. Statistics provided by the American Library Association revealed that 66% of public libraries currently make eBooks available to their patrons (Osnos, 2011). Korah, Cassidy, Elmore, and Jerabek (2009) found that 88% of 552 college libraries surveyed provided access to eBooks, with 45% providing access to greater than 10,000 eBooks. Many college students are opting for e-textbooks. In a survey, students at the University of Illinois reported their acceptance of e-texts. Fifty six percent of the survey participants reported using a combination of traditional and e-texts (Shelburne, 2009). While such results indicated that eBooks are far from eliminating the print format entirely, their use at this level is increasing. Monetary savings present a compelling reason for not only universities, but also K-12 school systems to transition from print to digital formats. Storage costs for both universities and school systems are considerably cheaper for eBooks than print books (Schell, Ginanni, & Heet, 2010). A University of Texas study determined the costs per use for printed books to range from $3.24 to $28.57 when expenses for heating, cooling, shelving, and maintenance were included, while the costs per use for eBooks was reported to range from $0.25 to $4.80 (Bunkell & Dyas-Correia, 2009). The academic impact of eBook adoption is also being realized. In a trial study at the University of Florida, 392 introductory psychology students were offered either traditional or electronic texts; only 37 chose the eBook. The e-text group reported spending less time in reading, yet displayed no significant difference in course grades (Shepperd, Grace, & Koch, 2008). The e-text in this study was accessed using
traditional computer interface, not tablet computers. The use of eBooks has been shown to increase reading motivation and literacy among elementary students. Shamir and Korat (2007) studied 72 kindergarten students from three schools located in low socioeconomic communities to determine the effect to which eBooks supported emergent literacy. An experimental group of 48 students read CD ROM storybooks while a control group of 48 students read a traditional print form. Interaction with an eBook was reported to improve word recognition, emergent literacy, writing, and phonological awareness. The eBook was accessed using a CD ROM, not a tablet computer. Larson (2010) studied 17 second grade students and reported that students used the tools available with the eBook reader to engage with the text through font manipulation, dictionary use, and text to speech features. The eBook reader in this study was the Amazon Kindle. The classroom studied had access to only two Kindles, thus the research was conducted using two students reading from a Kindle at the same time. Research has, thus far, indicated eBooks to have either a positive effect or no effect on emergent literacy. The fact that eBook use has not adversely affected student readers, coupled with the monetary benefits for school systems, supports further implementation at the primary level.

Although such studies have indicated the benefits associated with eBook incorporation, limitations have been noted. Reports of negative effects have largely focused on ease of reading. Students have reported greater eye fatigue and discomfort when reading electronic versions (Clark, Goodwin, Samuelson, & Coker, 2008; Gunter, 2005; Jamali, Nicholas, & Rowlands, 2009; Kang, Wang, & Lin, 2009; Rockinson-Szapkiw, Holder, & Dunn, 2011), as well as citing the difficulty of reading from a screen
as the reason for preferring hard copies (Jamali et. al., 2009; Lam, Lam, Lam, & McNaught, 2009). Some students have also reported a preference for traditional print books (Kang et. al., 2009; Rockinson-Szapkiw et. al., 2011; Shepperd et. al., 2008; Woody, Daniel, & Baker, 2010). Research has also found that computers present too many distractions for students (Kelley & Warbuton, 2011).

At the collegiate level, research has focused on the monetary, portability, and connectivity advantages that both schools and students receive from the incorporation of this technology (Clark et. al., 2008; Jamali et. al., 2009; Shepperd et. al., 2008). Much of the research at the elementary level focuses on how eBooks aid in the process of literacy development and increased reading motivation for emergent readers (Korat, Segal-Drori, & Klein, 2009; Larson, 2010; Moody, 2010; Rhodes & Milby, 2007; Shamir, 2009; Shepperd et. al., 2008). These studies highlight two significant gaps in the literature. Studies have been relegated to elementary and collegiate levels, and have only recently begun to research middle and high school students. Through my search of the literature, using databases such as ERIC and Education Research Complete, I have located only minimal research studying the effect of eBooks on middle and high school students (Fisher, Lapp, & Wood, 2011; Mardis & Everhart, 2011), and none that specifically study the effect eBooks have on the reading comprehension and motivation levels of middle and high school students. Thus, research to make such a determination for students at the middle and secondary levels was needed. This research determined how the use of eBooks affected the comprehension and motivation levels of these students. Previous studies had also used desktop or laptop computers to access the eBooks. This research
differed in its use of a tablet to access the online GMRT® using Riverside Publishing’s (2012) Testing Interface.

**Theoretical Basis**

The theoretical basis for this research on reading comprehension is found within Piaget’s (1952) focus on schema. Schemas guide the transfer of information from the page to the brain, allowing the reader to construct an understanding of the new information (Pressley, 2003; Schallert & Martin, 2003). Schema theory, developed by R. C. Anderson, expands the meaning of schema to include the importance of general knowledge and concept understanding in reading comprehension, specifying that most reading difficulties can be traced to insufficient prior knowledge (Anderson, Pearson, & Bolt, 1984; Little & Box, 2011). When readers’ schemata do not provide sufficient understanding of the incoming text, problems comprehending the text exist (Rumelhart, 1982). According to schema theory, a reader’s prior knowledge, experiences, concepts, and vocabulary significantly influence reading comprehension (Little & Box, 2011). The lack of tools to recognize terms and understand concepts presents the greatest obstacle to comprehension (Little & Box, 2011). This presents an area of potential impact for eBooks. The digital format offers readers the opportunity to determine immediately the meaning of unfamiliar vocabulary terms using linked dictionaries. E-Readers with internet connectivity offer the opportunity to search key concepts and terms, improving background knowledge and expanding the schema through which meaning is constructed. The ability to manipulate font size and style, highlight passages, use linked glossaries and hear the writing via text-to-speech features do not exist in the print format, and allow the reader increased interaction in the eBook format.
The theoretical basis for this research on reading motivation is found within Social Cognitive Theory, and Bandura’s (1997) emphasis on the role of self-efficacy in motivation. This view of motivation asserts that efficacy beliefs, involving both intrinsic and extrinsic motivation as well as the individual’s purposes for achievement, play an integral role in the decision to perform activities, and the amount of effort exerted in the chosen activities (Baker & Wigfield, 1999; Bandura, 1997). Motivation and comprehension are connected via the expectancy-value theory of motivation, which asserts that motivation is strongly influenced by expectation of success or failure (Eccles, 1983; Ford, 1992; Winne, 1985). Students who succeed at reading and comprehend easily are more motivated to read. Students who struggle with comprehension do not perceive reading as a valuable task and do not display continued motivation to read. This is a cycle that eBooks have the potential to break. eBook tools hold the potential to improve schema, which leads to improved comprehension. Improved comprehension leads to viewing reading as a valuable task. Increased value placed on reading provides increased motivation for reading.

These theories indicate the importance of schema as the vehicle for comprehension, and the positive influence of expected success in motivating students to read. eBooks offer many new possibilities directly affecting both areas. A new level of interaction with the text is provided through eBooks, and linkage of dictionaries and search capabilities allow readers to construct schema in ways traditional print offerings do not. Improving schema leads to increased comprehension. Increasing comprehension success increases student motivation to read. The determination of eBook impact on reading comprehension must be made prior to widespread implementation of this
technology within the K-12 setting. The study of motivation is necessary due to the question of whether students assign greater value to reading when using eBooks. If the eBooks positively affect comprehension, then they hold the potential to also positively impact motivation as students experience greater success in reading. If comprehension and motivation are positively affected, then the incorporation of eBooks will promote student reading. If comprehension and motivation are not affected, then monetary advantages are valid reasons for transitioning from print to digital books. If comprehension and motivation are negatively affected, then the transition from print to digital formats must be reconsidered.

**Problem Statement**

The problem addressed in this study was the lack of research regarding the effect of eBooks on reading comprehension and motivation at the middle and high school level. Reading comprehension is commonly defined as the process in which readers incorporate prior knowledge and experience with information in the text in order to construct meaning, and is considered one of the most important skills for students to develop if they are to be successful (Pardo, 2004). Comprehension is essential not only to learning in all academic areas, but to lifelong learning as well (Durkin, 1993). The National Reading Panel (2000) viewed comprehension as such an essential part of the learning process that it was listed as one of the five most important areas for further study. The effect of computer technology on reading instruction was viewed as an additional listing within the five areas in need of further study (National Reading Panel, 2000). The importance of comprehension as a foundational skill essential to understanding and succeeding in any academic discipline, combined with a lack of understanding regarding how computer technology will affect this area, made this an important study. The
benefits of transitioning from print to digital format, such as decreased costs, maintenance, and environmental impact, as well as increased access and portability make the adoption of eBooks a very attractive option. These benefits, however, mean little in comparison to the overriding goal of improving student academic performance. An initial area of great importance given the use of any textbook is a determination of whether students actually understand what is presented in the text. Thus, the effect of eBooks on the reading comprehension levels of middle and high school students must be determined.

A second focal point in this study was whether students were motivated to read the text. Wigfield and Guthrie (1997) state that motivation to accomplish any task is based on individual beliefs, values, and goals, and the closer reading activities match these values and goals, the greater the likelihood that students will be motivated to read. Motivation for reading influences the reader’s material selection, interest, purpose, emotion, engagement persistence, and ultimate competence (Butcher & Kintsch, 2003; Schallert & Martin, 2003; Pitcher et al., 2007). Considerable research exists to directly link motivation and achievement (Gambrell, Palmer, Codling, & Mazzoni, 1996). It is this connection between motivation and achievement that was of great interest in this study. Students who succeed at reading and comprehend easily are motivated to read while students who struggle with comprehension do not perceive reading as a valuable task and do not display continued motivation to read. eBooks can alter this cycle through their potential to improve schema. Increased schema improves comprehension. Increased comprehension raises the value of reading. Increased value provides increased
motivation for reading. Thus, the effect of eBooks on the reading motivation levels of middle and high school students must be determined.

**Purpose Statement**

The purpose of this experimental posttest-only control-group design study was to determine if there was a statistically significant difference in the reading comprehension levels of middle and high school English students when using eBooks versus traditional print books. The purpose of this quasi-experimental pretest-posttest control-group design study was to determine if there was a statistically significant difference in the reading motivation levels of middle and high school English students when using eBooks versus traditional print books. A convenience sample of 140 middle and high school English students at an independent school in eastern North Carolina served as the sample for this study. The independent variable was defined as the type of book – electronic or traditional. The dependent variable was defined as student reading comprehension and motivation. The RAND Reading Study Group (2002) stated that comprehension is, “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (p. 11). Reading comprehension was measured using the Gates-MacGinitie Reading Tests® (GMRT®; MacGinitie, MacGinitie, Maria, & Dryer, 2006). Motivation, as specifically applied to reading, is framed in terms of attitudes towards reading. More motivated readers display a positive attitude toward reading as revealed through increased interest, engagement, and persistence in reading (Baker & Wigfield, 1999). Motivation was measured using the Motivations for Reading Questionnaire (MRQ; Wigfield & Guthrie, 1997).
Significance of the Study

The research problem represented an essential study due to its possible alteration of secondary schools’ book/textbook systems. The transition to electronic books/textbooks due to an increasing implementation of technology within our educational system, and its possible cost effectiveness for school systems, seems destined to greatly impact the field of secondary education. Yet, given its impending implementation, very little research has measured the impact such technology will have on student reading comprehension and motivation at this level.

This research contributed to the current knowledge base as its population is largely absent in the literature. Studies involving the effect of eBooks on reading comprehension and motivation have focused on elementary and collegiate students. Studies displaying the effect of this technology on students at the middle and high school levels have been few. This study examined the gap in the literature by displaying the effect of eBooks on a sample of middle and high school students. This research will also directly contribute to the knowledge base administrators access in determining if their school/district should make the switch from print to digital format for textbooks.

Studies at the collegiate level have focused on the potential monetary savings to be realized by colleges and their libraries (Schell et. al., 2010; Bunkell & Dyas-Correia, 2009). Studies at the elementary level have provided information on student achievement, but have only included students in kindergarten through fifth grade (Larson, 2010; Rhodes & Milby, 2007; Shamir, 2009; Shamir & Korat, 2007). To date, only minimal research has been located that studies middle and high school students (Fisher et al., 2011; Mardis & Everhart, 2011), and none that determines the effect of using eBooks on the reading comprehension and motivation of middle and high school students.
Determining the effect this technology has on student reading comprehension and motivation is essential. In an educational environment where 292 school districts across the US have reduced the school week to four days in order to save money, school systems will be attracted to the monetary advantages of transitioning from print to electronic books (Layton, 2011). Money, however, cannot be the driving factor. The effect on students must remain the priority, and research must be conducted to statistically establish the effect this transition has on reading comprehension and motivation prior to making such a drastic change.

**Research Questions**

The following research questions guided this study:

- **R₁.** Is there a statistically significant difference in the reading comprehension of middle and high school English students using electronic books compared to students using traditional print books?

- **R₂.** Is there a statistically significant difference in the reading motivation of middle and high school English students using electronic books compared to students using traditional print books?

**Research Hypotheses in Null Form**

- **H₁.** Middle and high school English students using traditional print and electronic books will display statistically significant different levels of reading comprehension as measured using the Gates-MacGinitie Reading Tests®.

- **H₀₁.** Middle and high school English students using traditional print and electronic books will not display statistically significant different levels of reading comprehension as measured using the Gates-MacGinitie Reading Tests®.
$H_2$. Middle and high school English students using traditional print and electronic books will display statistically significant differences in their mean scores for the linear combination of the reading motivation scales as measured using the Motivations for Reading Questionnaire.

$H_{02}$. Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the linear combination of the reading motivation scales as measured using the Motivations for Reading Questionnaire.

$H_{02.1}$. Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Reading Efficacy scale as measured using the Motivations for Reading Questionnaire.

$H_{02.2}$. Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Reading Challenge scale as measured using the Motivations for Reading Questionnaire.

$H_{02.3}$. Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Reading Curiosity scale as measured using the Motivations for Reading Questionnaire.

$H_{02.4}$. Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores
for the Reading Involvement scale as measured using the Motivations for Reading Questionnaire.

\( H_{02.5} \). Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Importance of Reading scale as measured using the Motivations for Reading Questionnaire.

\( H_{02.6} \). Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Reading Work Avoidance scale as measured using the Motivations for Reading Questionnaire.

\( H_{02.7} \). Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Competition in Reading scale as measured using the Motivations for Reading Questionnaire.

\( H_{02.8} \). Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Recognition in Reading scale as measured using the Motivations for Reading Questionnaire.

\( H_{02.9} \). Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Reading for Grades scale as measured using the Motivations for Reading Questionnaire.
**H_{0.10}.** Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Social Reasons for Reading scale as measured using the Motivations for Reading Questionnaire.

**H_{0.11}.** Middle and high school English students using traditional print and electronic books will display no statistically significant difference in their mean scores for the Compliance scale as measured using the Motivations for Reading Questionnaire.

**Identification of Variables**

The independent variable for research questions one and two was book format. There were two levels to the independent variable: (1) Print book format, and (2) Electronic book format. For the purposes of this study, an electronic book was defined as a book published in electronic form that could be delivered, via the internet, to any electronic device capable of receiving it (Sparrowhawk, 2005). The electronic book passages used in this study were included in the GMRT\textsuperscript{®} online and accessed through Riverside Publishing’s (2012) Testing Interface. For the purposes of this study, a traditional print book was defined as reading passages presented in paper format.

The dependent variable for research question one was student reading comprehension as measured using the Gates-MacGinitie Reading Test\textsuperscript{®} (MacGinitie, Maria, & Dreyer, 2006). The GMRT\textsuperscript{®} is designed to provide a general assessment of reading achievement in grades 3-12 (MacGinitie et. al., 2006).

Reading passages included in the GMRT\textsuperscript{®} are taken from published books and periodicals (MacGinitie et. al., 2006). The print format was delivered in the form of a traditional pencil and paper version of the test, while the electronic format delivered both
the reading passages and answer sections through an online version of the test accessed using Riverside Publishing’s (2012) Testing Interface.

The dependent variable for research question two was student reading motivation as measured using the Motivations for Reading Questionnaire. The MRQ is a student rated assessment of the extent to which each student is motivated to read (Wigfield & Guthrie, 1997). Motivation was chosen as the second factor due to its influence on student engagement with the text (Butcher & Kintsch, 2003; Schallert & Martin, 2003). Text engagement is the key to establishing the link between motivation, achievement, and literacy learning (Gambrell et. al., 1995). The MRQ contained 53 questions and measured 11 constructs of reading motivation (Wigfield & Guthrie, 1997). The Reading Efficacy construct measured the expectation each student had for reading success (Wigfield & Guthrie, 1997). The Reading Challenge construct measured the satisfaction each student feels when mastering complex issues within the text (Wigfield & Guthrie, 1997). The Reading Curiosity construct measured the desire to learn about a topic (Wigfield & Guthrie, 1997). The Reading Involvement construct measured each student’s enjoyment when reading new kinds of text (Wigfield & Guthrie, 1997). The Importance of Reading construct measured the value each student places on accomplishing the task of reading (Wigfield & Guthrie, 1997). The Reading Work Avoidance construct measured what each student does not like about reading (Wigfield & Guthrie, 1997). The Competition in Reading construct measured each student’s desire to outperform other readers (Wigfield & Guthrie, 1997). The Recognition for Reading construct measured the pleasure each student feels when receiving recognition for their reading accomplishments (Wigfield & Guthrie, 1997). The Reading for Grades construct
measured each student’s desire to receive good grades in reading (Wigfield & Guthrie, 1997). The Social Reasons for Reading construct measured the degree to which each student shares their reading with family and friends (Wigfield & Guthrie, 1997). The final construct, Compliance, measured the effect of external requirements on student reading (Wigfield & Guthrie, 1997).
CHAPTER TWO: LITERATURE REVIEW

Introduction

The purpose of this true-experimental posttest-only control-group design study was to determine if there was a statistically significant difference in the reading comprehension levels of middle and high school English students when using eBooks compared to traditional print books. The purpose of this quasi-experimental pretest-posttest control-group design study was to determine if there was a statistically significant difference in the reading motivation levels of middle and high school English students when using eBooks compared to traditional print books. The following research indicates the effect of electronic devices on reading comprehension and motivation levels has been measured at the collegiate and elementary levels, but little research on these aspects of reading has been conducted at the middle and high school levels.

Chapter Two will review the cognitive framework upon which the study of reading comprehension and motivation was based, the historical usage of eBooks in both general public and academic environments, and the overall benefits and limitations of using eBooks in schools. Specific studies will be detailed in which comprehension and motivation were studied at the elementary level with special emphasis on what is missing in the literature – similar studies at the middle and high school levels. Chapter Two will conclude with a summary of the literature review.

Theoretical Framework

Comprehension

Schema theory. Piaget referred to an organized pattern of thought used to explain experiences as a scheme (Piaget, 1952; Shaffer, 2002). Cognitive scientists use the term schema to describe how prior knowledge is used to understand, organize,
store new information (Gillani, 2010; Vacca & Vacca, 2005; Zhang, 2010). Rumelhart (1982) referred to schema as the building blocks of cognition since they serve as the network of information through which people make sense of new experiences. Schema theory expands this meaning to include the importance of general knowledge and concept understanding in reading comprehension, specifying that most reading difficulties can be traced to insufficient prior knowledge (Anderson et. al., 1984). Schema theory is based on Goodman’s (1967) psycholinguistic model. The psycholinguistic model views reading as a psycholinguistic guessing game, involving an interaction between thought and language based not on a precise understanding of each element within the reading, but an ability to use a partial understanding of the material to process the unknown and make decisions regarding meaning (Goodman, 1967). According to the psycholinguistic model, the ability to anticipate that which has not been seen is vital to reading comprehension (Goodman, 1967). Proper anticipation is based upon key word understanding, and schema theory indicates key words and concepts presented to the reader through the text allow the reader to temporarily transfer information stored in long-term memory to short-term memory and use that information during reading to interact with, and construct an understanding of, new information (Pressley, 2003; Schallert & Martin, 2003). This information is often used to construct mental representations that allow the readers to exit the transaction with a mental image or summary of the text (Pardo, 2004; van den Broek, 1994).

**Transactional theory.** The use of schema in understanding reading is further explained using Rosenblatt’s (1995) transactional theory of reader response. According to Rosenblatt, each reader breathes life into the text as they consider the material through
the lens of their individual experiences, and work to construct personal meanings. As readers interact with the text, they make text-to-text, text-to-self, and text-to-world connections leading to comprehension (Keene & Zimmerman, 1997; Miller, 2002). It is during this transaction between the reader and the text that comprehension occurs (Kucer, 2001; Rosenblatt, 1978). This transaction is based upon a model of comprehension that places equal importance on context and culture (Pardo, 2004). Culture is important to the transaction because the reader’s culture must match the culture of the writer/text (Pardo, 2004). Context is important to the transaction because each reader varies in the skills, knowledge, and cognitive development they bring to the text (Butcher & Kintsch, 2003; Navarez, 2002). This meeting of the reader’s context and culture with that of the text forces a transaction between reader and text. When the context and the culture of the reader and text are similar, the transaction allows for the construction of meaning, and true comprehension of the text occurs.

**Cognitive science and transaction.** Cognitive science views this transaction as occurring when the body engages the physical world and thus studies transaction in the context of interactions between people and environment (Gibbs, 2003). Transaction using the paper format, as measured in terms of reading comprehension, has thus far been superior to the electronic format (Noyes & Garland, 2008). Numerous studies have reported difficulties in reading from a computer screen (Clark et. al., 2008; Jamali et. al., 2010). Given that the readability of the text, specifically font type and size, play a significant role in the transaction between reader and text (Tracey & Morrow, 2002), difficulties reading from a screen present a significant issue for eBook success. Developments in screen technology, however, have lessened the impact of reading.
difficulties, and improvements in the transaction using the electronic format have been noted (Noyes & Garland, 2008). Tablets have been shown to be effective tools for reading in grades K-5 (Dundar & Akcayir, 2012). Tablets such as Amazon’s Kindle and Apple’s iPad are having the greatest impact in terms of changing people’s attitudes regarding reading on a screen (Chesser, 2011). eBooks now offer many opportunities for the reader to make adjustments to readability features. Font adjustments are easily made, interaction with the text via hyperlinks and glossaries is instantaneous, and new information can be researched, understood, and organized (Hancock, 2008; Larson, 2009). eBooks have the ability to incorporate aspects of inquiry based learning in ways that traditional print resources cannot (Gillani, 2010). Tools for inquiry based learning can improve schema, which leads to increased comprehension. Students who comprehend what they read are more motivated to read. Thus, eBooks, through an improved interaction with the text, offer an interesting opportunity to affect both reading comprehension and motivation.

**Motivation**

**Self-efficacy.** A second goal of the research is to determine the effect of eBooks on motivation. The theoretical framework for this study’s motivational research is based upon Social Cognitive Theory, specifically Bandura’s (1997) ideas regarding self-efficacy and the major role this plays in the motivational level for any task. This view of motivation asserts that efficacy beliefs, involving both intrinsic and extrinsic motivation as well as the individual’s purposes for achievement, play an integral role in the decision to perform activities, and the amount of effort exerted in the chosen activities (Baker & Wigfield, 1999; Bandura, 1997; Eccles, Wigfield, & Schiefele, 1998; Wigfield, Eccles, &
Rodriguez, 1998). Eccles (1983) built upon this framework in developing the expectancy-value theory of motivation, which states that motivation is influenced by the participant’s expectation of failure or success, and by the attractiveness or value the participant places on the task. Ford (1992) furthered the expectancy-value theory’s focus on the value of a task in his motivational systems theory, which states that participants are motivated to achieve goals they value and perceive as achievable. Winne (1985) focused on the expectancy-value theory’s effect on reading motivation by stating the reader will only be motivated to read materials perceived to have personal value or practical importance. A major influence in value perception is the provision of materials (Arzubiaga, Rueda, & Monzo, 2002; Clark, Power, Blom-Huffman, Dwyer, Kellecher, & Novak, 2003; Flowerday et. al, 2004; Jones & Brown, 2011; Marinak & Gambrell, 2008; McGlinn & Parrish, 2002; Wigfield et. al., 2008). Reading motivation and engagement are positively affected when high-interest material is available (Jones & Brown, 2011; Flowerday et. al, 2004). Students who perceive reading to have personal value and importance engage with the text to a much greater extent (Ames & Archer, 1988; Dweck & Elliot, 1983; Gambrell et. al., 1996; Paris & Oka, 1986). Engagement with the text has been shown to be an accurate predictor of motivation to read and reading achievement (Jones & Brown, 2011; Wigfield et. al., 2008)

**Expectancy-value theory and achievement.** Motivation and comprehension are connected via the expectancy-value theory of motivation, which asserts that motivation is strongly influenced by expectation of success or failure (Eccles, 1983; Ford, 1992; Winne, 1985). Students who succeed at reading and comprehend easily are more motivated to read. Students who struggle with comprehension do not perceive reading as
a valuable task and do not display continued motivation to read. Students who are motivated to read display greater academic achievement (Cox & Guthrie, 2001; O’Flahavan, Gambrell, Guthrie, Stahl, Baumann, & Alvermann, 1992; Sachs, 2001; Sankaran & Bui, 2001; Schunk, Pintrich, & Meese, 2007).

The displayed link between motivation and achievement indicates an opportunity to use technological innovation to improve both reading comprehension and motivation. Students who have access to a high interest selection of materials display increased motivation. Paper libraries do not possess the capability of matching eBooks when it comes to the immediate availability of high interest resources. Increased motivation has been directly linked to increased achievement. While promising, the issue with this foundational research, as with the specific focal points listed, is the vast majority of research was conducted using either collegiate or elementary students. Little to no research exists to make these links between motivation and achievement for students in middle and high school.

**The Transition to eBooks**

**Current and Projected Data**

The use of eBooks is expanding at a rapid pace. Wholesale eBook sales started at under $2 million per quarter in 2002 and had risen to $8 million per quarter by 2008 (Grudzien & Casey, 2008). In 2009, the Association of American Publishers reported that eBooks still accounted for a very small percentage of total book sales, but their popularity had increased drastically and the increased availability and use of eBook readers were further driving the expansion. U.S. trade electronic book sales in 2010 exceeded $340 million (International Digital Publishing Forum, 2011). Beginning in April, 2011, at Amazon’s site, 105 eBooks sold for every 100 traditional print books
Amazon’s predictions indicated that, within a decade, fewer than 25% of books sold would be print versions (Miller & Bosman, 2011). Increased adoption of eBooks by students and faculty has been projected over the next three years (Becker, 2010). The 2011 Horizon Report cites the time-to-adoption for eBooks as one year or less (Johnson et al., 2011). Although eBook sales are expanding, e-textbooks remain a very small percentage of overall book sales. For example, electronic textbooks have been projected to grow at a rate of 49% through 2013, yet even then they will account for only 11% of all textbooks sold (Murray & Perez, 2011). The continued growth in student computing footprint is projected to increase the rate of transition. A 2010 Educause survey revealed that almost every college student owns both a computer and phone and 80% own a laptop (Smith & Caruson, 2010). This expansion is placing greater pressure on publishers to provide materials that can be accessed using laptops, tablets, and smartphones (Chesser, 2011). A similar expansion is also occurring within school districts. McAllen Independent School District in Texas is the largest to attempt full coverage of tablet devices, having distributed 6,800 iPads and iPods in February of 2012, with a goal of providing all 25,000 students in grades K-12 with a device (Sherman, 2012). Zeeland public schools in Michigan provided iPads to all high school students in the Fall of 2011, with plans of providing iPads to every student in grades 3-12 (Sherman, 2012). Estimates indicate digital textbooks will be the dominant format inside of seven years, with revenues exceeding $1.5 billion within five years (Reynolds, 2011).

Lending further credence to the necessity of this study is the fact that Reynolds’ (2011) estimate of digital dominance within seven years was published prior to the
impact of Apple’s iPad being measured. A 2010 Campus Computing Survey of IT leaders revealed that nearly 80% of them expected eBook readers to be important platforms for instructional content within five years (Acker, 2011). Current projections estimate 20% of college students will carry tablet devices by the end of 2012 (Reynolds, 2011). The increase in tablet use will undoubtedly affect high school and middle school students as 46% of tablet owners have children under the age of 18 (Bizrate Insights/Forrester Study, 2011). The 2012 Horizon Report predicts widespread use of tablet computers in the K-12 environment within one year (Johnson et. al., 2012). Further predictions indicate that all students in the U.S. will be using mobile learning devices by 2015 (Norris & Soloway, 2011).

Many estimates are based on the expanding iPad market, yet there is a lack of research establishing the effect of tablet computers on reading comprehension and motivation. The current study was developed to use iPads as the delivery devices. The instrument’s (GMRT) use of Adobe Flash prevented the use of the iPad. As a result, this research will use a Lenovo X220 tablet computer to access Riverside Publishing’s Testing Interface via the Google ChromeTM internet browser. This tablet uses an LED backlit screen that is similar to the iPad, and will offer a measurement of how reading comprehension is affected through the use of tablet computers.

Conflicting estimates regarding growth and market share require further exploration. While Murray and Perez (2011) predict that only 11% of textbooks will be electronic by 2013, Reynolds (2011) expects digital textbooks to dominate within seven years. Significant differences in projections highlight the fact that these estimates are based on sales of electronic devices, and not on academic performance. Projections offer
no data proving that sales will increase as a result of students displaying increased comprehension or motivation. Student performance will affect purchasing, especially within the K-12 environment. The manner in which the electronic format effects academic performance, especially reading comprehension, must be determined prior to predictions of increased purchasing becoming a reality.

**International Influence**

Other countries have also rapidly transitioned to the digital format. South Korea has a stated goal of digitizing all textbooks by 2015, and this assertion has forced countries, including the U.S., to increase the resources they devote to digital learning (Eason, 2011). The change from traditional print to electronic book formats is occurring and will continue. While the change is occurring rapidly within the general public, the focus of this research involves how the transition will affect academic environments. Data is available for this transition within academia at the elementary and collegiate levels, but more is needed for the middle and high school levels.

**College Libraries**

The charge to make the electronic transition is being led by college and university libraries and library systems. The University of Houston has transitioned to using over 400,000 electronic books (Wu & Mitchell, 2010). The University of Illinois has transitioned to using over 250,000 electronic books (Martin & Mundle, 2009). Sam Houston State University uses over 50,000 eBooks (Korah et. al., 2009). A survey of 552 smaller college and university libraries reported that over 88% contained eBooks in their collections, with 45% of those surveyed containing greater than 10,000 eBooks (Korah et. al., 2009). A joint venture between the University of Texas, Notre Dame University,
and Trinity University has taken the transition to the electronic format a step further. These universities made the decision to use pay-per-view models for both electronic journals and books (Schell et. al., 2010). Transitioning to the electronic format allowed Trinity University, which faced an 8% increase in subscription prices and only a 2% budget increase, to save enough money to prevent staff cuts (Schell et. al., 2010).

Library transitions are based on monetary and storage savings. Data in these areas display the electronic format to have undeniable advantages in the library setting. Data does not, however, include explorations of effect on student performance. Money and space are significant within the library environment, but libraries quickly lose their effectiveness if the electronic materials they provide do not maintain or improve comprehension.

**Medical Libraries**

Medical libraries have followed a similar pattern. The University of Pittsburgh’s Health Sciences Library System allows bedside access to over 2500 titles from its eBook collection (Foust, Bergen, Maxeiner, & Pawlowski, 2007). Research conducted at Texas A&M’s Medical Services Library studied the usage of electronic textbooks, finding the electronic version of all 51 studied texts to have been accessed more frequently than print versions (Kimball, Ives, & Jackson, 2010; Ugaz & Resnick, 2008).

Data pertaining to medical libraries present a view of textbook accessibility, not comprehension. Quick access to specific information is of great value in the medical setting, not the reading of entire chapters or books. Research has proven that information can be located quickly, but more research is necessary to determine if students in these libraries comprehend the information once it is located.
Distance Learning

This transition is also implemented in libraries serving distance learning students. Schools offering distance programs must ensure online students have equal access to books with traditional students and the eBook format fits this need (Hutton, 2008). Royal Roads University in Canada transitioned from what was once a traditional brick and mortar school with only residential students to one in which 80% of students and faculty work at a distance (Croft & Davis, 2010). This shift in enrollment forced the library to make considerable changes that ensured all students and faculty members maintained access to a traditional collegiate quality library. As of December 2009, the Royal Roads University library had transitioned to 55,000 eBooks and only 48,000 traditional print books (Croft and Davis, 2010). A similar transition has occurred at Nova Southeastern University. In an attempt to increase library offerings for off-campus students, NSU’s Alvin Sherman library instituted a plan in which computer science, education, business, and psychology books were transitioned to eBooks accessible to students through a MyiLibrary platform (Buckley & Tritt, 2011).

Statistics displaying the benefits of eBooks, especially those indicating decreased storage space and costs, make the transition from traditional print books to eBooks an attractive option for libraries. The need to offer sufficient library resources to off-campus and online students also remains a valid motivation for the transition. The positive effect on the budget, however, cannot override the focus on student development and achievement. Providing cheaper and more convenient access to reading materials remains an insignificant achievement in an academic environment if student performance is not positively affected. Before academic institutions implement this collegiate model
in an effort to save money and increase access, the effect of this format on students must be determined. Some research has been conducted to this end.

**Benefits and Limitations of eBooks**

Research has demonstrated benefits and limitations associated with eBook use. The focus of research has been usability and preference. Accessibility, portability, and storage have been listed as significant benefits (Clark et. al., 2008). Discomfort with reading from a screen, inability to highlight and take notes within the text, and the reality that many students simply prefer print have been listed as significant limitations (Clark et. al., 2008; Kang et. al., 2009; Woody, Daniel, & Baker, 2010).

**Limitations of eBooks**

**Problems encountered.** Problems related to reading from a screen have been reported. Reading from a screen can cause greater eye fatigue (Clark et. al., 2008; Gunter, 2005; Jamali et. al., 2009; Kang et. al., 2009; Lam et. al., 2009). Students have indicated they are more likely to skim electronic texts, choosing to read in an “F” pattern searching for key words rather than line by line (Woody et. al., 2010). Students cited difficulty in taking notes using an eBook as a significant drawback (Polanka, 2011). Three quarters of paper readers report marking notes in paper text as they read while digital readers report the problem of having to type notes on a separate computer or use additional paper (Polanka, 2011).

Noted limitations all relate to usability, not academic performance. Eye fatigue is an issue with electronic devices, but included data contains no information regarding the comprehension of what is being read. The fact that students are more likely to skim electronic texts may harm comprehension, but it is necessary to determine if comprehension is affected in situations where students choose to read carefully.
Print preference. Students have reported they were more likely to use special features accompanying traditional print books than those incorporated into eBooks (Woody et. al., 2010) and preferred traditional print books (Buzzetto-More, Sweat-Guy, & Elobaid, 2007; Gregory, 2006; Jamali et. al., 2010; Woody et.al., 2010). Educational Marketer (2011) reported that 75.2% of college students prefer print over electronic textbooks. Students have also displayed a significant difference in format preference based on age. Studies reveal older students who grew up using the traditional print format display a preference for the traditional format while younger students prefer the electronic format (Kang et. al., 2009; Smith, 2008).

Limitations regarding print preference relate to usability, not academic performance. A preference for print includes no information regarding the effect of the electronic format on comprehension. The current research will seek to determine if a statistically significant difference in comprehension based on format exists. Age-based differences will also be addressed in the research as participants will range in age from 12-18.

Generation Y. Although limitations have been cited, these limitations may decrease as generations become more familiar with the electronic format and technology improves. People who learned using predominantly printed texts may find adjusting to the electronic format difficult (Kang et. al., 2009). Students for whom the electronic format is common are not required to make this adjustment. Studies displaying the continued preference for the format used in academic development indicate that preference for the electronic format will continue to increase as current students use eBooks to a much greater extent. A new generation of students, Generation Y, or
Millennials, outnumbered Baby Boomers at the end of 2010, with 96% of them being active on social networks (Rivero, 2010). This generation of students is one for whom reading from electronic books is not new, but rather the norm as technology has been integrated into every aspect of their lives, and they may display a continued preference for eBooks over print books.

**Technological development.** Issues with reading from a screen are being addressed through technological development. Noyes and Garland (2008) indicated that developments in display screen technology had reduced the presentation disparity between print and electronic formats. Chesser (2011) further highlighted how Amazon’s Kindle and Apple’s iPad were positively changing people’s attitudes about reading on screens. Estimates that Amazon will sell as many as 35 million Kindles by 2012, and greater than 33% of the U.S. will use tablet computers by 2015 indicate a growing trend in acceptance for reading from a screen (Chesser, 2011). As the comfort level with this technology grows, and the screen technology itself improves, limitations based on eye fatigue and reading from a screen will continue to decrease.

Studies indicate that acceptance of electronic devices is likely to increase as technology improves. Increased acceptance based on technological improvement, however, does not account for student performance. The current research will use a tablet that incorporates modern screen technology to determine if students display any difference in comprehension when using the electronic format.

**Benefits of eBooks**

Research has also suggested eBooks offer numerous benefits. Tracey and Morrow (2002) view the content of a text, especially the difficulty or readability based
upon font size and type as a factor in reader-text interaction and comprehension. E-
Readers have the capability to negate font distractions by allowing individual readers to
adjust surface features (Abram, 2010; Larson, 2009). Additionally, eBooks have been
cited as being convenient, lightweight, environmentally friendly, portable, and easily
stored (Clark et. al., 2008; Jamali et. al., 2009; Shepperd et. al., 2008). eBooks are also
never out of stock since they are downloadable (Crestani, Landoni, & Melucci, 2005).
Additional advantages cited are updatable book versions, linkage of passages, and key-
word searchability (Armstrong, Nardini, McCracken, Lugg, & Johnson, 2009; Crestani
et. al., 2005; Jamali et. al., 2009).

The highlighted benefits offer strong support for the increased use of electronic
books in academic environments, yet fail to include academic performance
measurements. The effect on reading comprehension and motivation has yet to be
determined, and is needed prior to using benefits associated with usability as valid
reasoning for transitioning to eBooks within schools and school districts.

**eBooks in Academic Environments**

**eBooks in College Courses**

**University trials.** The University of Texas at Austin conducted a trial in which
1200 students were provided Amazon’s Kindle e-reader as a replacement for traditional
textbooks (Butler, 2009). Students listed screen size as a significant restriction (Butler,
2009). The small size of the screens made the devices unsuitable to most textbooks, and
was especially problematic with science texts. A 500 student trial at Northwest Missouri
State University replaced traditional textbooks with electronic texts using Sony e-readers,
with the goal of utilizing electronic textbooks for all courses within five years (Butler,
2009). Dozens of the participants quit the trial after two weeks, citing the inability to flip
through pages randomly, take notes in the margins, and highlight the text as determining factors in their decision to purchase a print copy (Knutson & Fowler, 2009). Student focus groups reported the devices were not adequate to replace print textbooks, and the university transitioned to using laptops as the delivery devices in a further study (Tees, 2010). A study of first-year graduate students at the University of Washington examined Kindle DX usage. All students began doing their academic reading using the Kindle DX, and seven months into the study, 40% of the students continued to use the device (Polanka, 2011). Students who continued to use the Kindle listed the need to read near a computer in order to look up references and take notes, or the continued need to carry paper for better note taking as significant drawbacks (Polanka, 2011). The major limitation noted in this study was sample size, with only 39 participants (Polanka, 2011).

The University of Illinois conducted a trial in which nursing students were provided eBook access on their Personal Digital Assistants (Williams & Dittmer, 2009). The study focused on the usability aspects of portability and accessibility. Students cited beside access to information as a significant benefit, but listed the limited eight hour battery life of the device as a considerable challenge since nursing shifts were generally far longer (Williams & Dittmer, 2009).

The highlighted studies continue to display a significant gap in the literature regarding academic performance. Most studies at the collegiate level focus on usability, not academic performance. These studies fail to include a specific measurement of student reading comprehension or motivation, and focus solely on determining the reasons for student selections.
**Student Preference.** A study conducted at the University of Illinois surveyed students, faculty, and staff to determine their acceptance of electronic textbooks. Results revealed that while only 10% of the students used electronic textbooks alone, 56% of the students used a combination of traditional print and electronic texts (Shelburne, 2009). Further predictions indicated 11% of faculty and students expected to transition to using mostly electronic books, while 28% expected to use a combination of electronic and print books (Shelburne, 2009). This study was limited by sample size. Of the 47,000 community members invited to participate, only 3%, or 1547 members submitted responses (Shelburne, 2009). A study conducted at the University of Maryland Eastern Shore surveyed 261 freshmen and sophomore business students to determine their acceptance of eBooks (Buzzetto-More et. al., 2007). Over 54% of the students surveyed preferred a print text, but 44% stated they would purchase an eBook for a course if it was an option (Buzzetto-More et. al., 2007). The major limitation noted in this research was a lack of diversity. All students were enrolled in the same business course, and the University of Maryland Eastern Shore is an historically black institution with limited enrollment of non-black students (Buzzetto-More et. al., 2007). An additional study conducted at the University of Maine offered chemistry students the opportunity to purchase eBooks in six courses (Buntrock, 2011). eBooks were purchased in five of the six courses, but the majority of students preferred print (Buntrock, 2011).

These studies continue to focus on usage, not performance. The decision to purchase, or continue to use eBooks, while significant to sales predictions, presents no information regarding the effect of this format on student performance. For example, it would be useful to know, in addition to the selection information, if the chemistry
students selecting electronic textbooks displayed any significant difference in course grades or reading comprehension.

**Academic performance.** Some studies have focused more on academic achievement than usability. A trial conducted at the University of Florida allowed undergraduate psychology students to choose either traditional or electronic texts. The electronic text group reported spending less time in their reading, yet displayed no statistically significant difference in the grades received for the course (Shepperd et. al., 2008). This study was limited by its inability to assign students to the experimental group. Of the 329 total participants, only 37 chose to use an eBook (Shepperd et. al., 2008). This study was also limited by its admission that study habits were difficult to measure and open to multiple interpretations (Shepperd et. al., 2008). Results were based solely on final grade and a self-reported survey. Students were not required to report how much time they spent studying apart from reading the text. It remains possible that students who read less may have studied more, and study habits may have affected grades more than book format. Additional study would be required to determine if book format alone led to improved course grades. A pilot study conducted at a university in Virginia compared the use of eBooks and traditional books on undergraduate student learning in an educational history course. Results reported higher psychomotor learning levels for students using eBooks, and no difference in actual learning between the groups (Rockinson-Szapkiw & Holder, 2011). The study was limited by sample size, with only a convenience sample of 16 undergraduate student participants. The study was also limited by duration, with students using the eBook for only one course session, and not over the entire length of the 16 week course.
Moving beyond preference. Portability, convenience, decreased expense, storage capacity, and lessened environmental impact represent wonderful benefits to be realized through the use of the electronic format. As Rockinson-Szapkiw and Holder (2011) have highlighted, however, it is necessary to look beyond preferences and focus on the effectiveness of eBooks as learning tools. The educational reality is the reported benefits of eBooks are not as important as student development and achievement. While attractive, these attributes must coincide with increased student performance if eBooks are to be fully implemented in educational settings. Research on the effect of eBooks has also been limited to usage and perception, with few studies focusing on effectiveness as a learning tool (Rockinson-Szapkiw et. al., 2011; Woody et. al., 2010). Research that has focused on the effectiveness of eBooks has focused on collegiate and elementary students. Little to no research displaying the effect on student performance at the middle and high school levels has been located.

Additional research is needed. The initial results of these trial studies have been promising. Collegiate studies have focused on course grades, general usage, usability, effectiveness as a learning tool, and motivation. While providing much needed information on the effectiveness of eBooks for collegiate students, research displaying statistically significant effects on reading comprehension remains minimal. The lack of research highlights the difficulty of isolating book format as the sole factor affecting academic performance. Research remains limited for the K-12 environment as well.

eBooks in Elementary Schools

Kindergarten. A focal point in eBook research at the elementary level has been the effect of technology on low socioeconomic status kindergarten students (Korat et. al.,
Researchers attempted to determine if the students’ lack of access and experience regarding these devices prevented the devices from positively impacting student achievement in the classroom. Students using electronic books were found to display increased motivation to read, increased curiosity regarding both the device and the books available using the device, and increased literacy development (Korat et al., 2009; Moody, 2010; Shamir & Korat, 2007; Shamir, 2009). Problems noted with this research include the limited generalizability of the study, given the similarity of all three samples, and the vague description of what constitutes literacy development and emergent literacy (Korat et al., 2009; Moody, 2010; Shamir & Korat, 2007; Shamir, 2009). Literacy development and emergent literacy encompass word meaning, word recognition, emergent writing, phonological awareness, and letter naming (Scarborough, 2001; Shamir & Korat, 2007; Whitehurst & Longian, 2001), but include no information on reading comprehension.

K-2. Other researchers have taken this focus from kindergarten to the second grade level (Larson, 2010; Rhodes & Milby, 2007). The researchers studied second grade students, with some students reading traditional print books while others were provided access to an e-reader and eBooks. All students participated in an online discussion board to determine their level of understanding. Results indicated the students who had read the story using the e-reader displayed increased literacy development and increased motivation when compared to those students who had read traditional print versions (Larson, 2010; Rhodes & Milby, 2007). While these studies expanded the sample to the second grade level, the research continued to measure literacy development rather than focusing specifically on reading comprehension.
K-5. A meta-analysis of eBook use at the elementary level reported mixed results for their effectiveness in pre-K to grade 5 (Zucker, Moody, & McKenna, 2009). For inclusion in this analysis, the eBook was required to present a text on a computer and include an oral reading option and hypermedia (Zucker et. al., 2009). Peer-reviewed journal articles included in the analysis had publication dates ranging from January 1997 to January 2007 (Zucker et. al., 2009). Results of the analysis indicated the practical effects of this technology to be significant in terms of reading motivation, but moderate to small for comprehension outcomes. The conflicting results with respect to reading comprehension highlight an area of conflict for Rosenblatt’s transactional theory of reader response. Rosenblatt (1995) indicates that the transactional process applies to transactions using any media. Other researchers, however, have cited the tools provided in the electronic format as a reason for improved interactions between reader and text in this format, and have thus used Rosenblatt’s theory as a basis for explaining how surface features improve transaction (Larson, 2009; Pardo, 2004). Contradictory results regarding reading comprehension, along with the fact that Rosenblatt’s predictions occurred prior to many of the technological improvements included within tablet computers, make it imperative that research is conducted to fully understand the effect eBooks will have on comprehension and motivation.

Additional research is needed. The highlighted studies stand in agreement that motivation was positively impacted. It must be understood, however, that motivating students to read accomplishes little if students don’t comprehend what they are reading. Studies of students with disabilities have shown bimodal presentation using an electronic format to positively impact reading comprehension (Leong, 1995; Montali &
Lewandowski, 1996). Similar studies have not, however, been conducted on students without learning disabilities, nor has comprehension using only the visual format been measured in students reading from eBooks. Prior to making the foundational shift in educational formatting that will occur with the implementation of eBooks at the middle and high school levels, a determination of how this format will affect student reading comprehension and motivation must be made.

**eBooks in Middle and High Schools**

**Middle schools.** Recent research has begun to focus on the “deep reading” of middle school students when using the electronic format. Fisher et al. (2011) studied 100 eighth grade students reading science and social studies information in both the electronic and paper formats. Students completed the readings and responded to questions in order to assess their comprehension and attention to detail. There were no significant differences between the groups on questions related to main themes, but electronic students performed significantly poorer on questions related to specific details. While this research took a significant step towards understanding the effect of the electronic format on reading for this age group, it lacked many aspects needed for a statistically significant determination. The first issue noted with this research was formatting. Articles from electronic journals were read as they appeared on the journal’s website, and were not formatted to resemble book passages. The second major issue noted was research focus. Three aspects of electronic reading were considered: understanding the main theme, the three-dimensional nature of reading online, and deep reading (Fisher et al., 2011). Comprehension was not the main focal point, and researchers further admitted there were no significant differences in the overall responses, but rather focused on
differences in questions related to very specific information. The final issue noted was instrument selection. The research did not use a validated instrument for the measurement of reading comprehension, but rather researcher-created questions on the specific journal articles selected.

**High schools.** Research has also begun to focus on the use of electronic books and e-readers at the high school level. Such research has focused mainly on use and student acceptance, and only minimally on the effect of this format on academic achievement (Mardis & Everhart, 2011; Sherman, 2012). Mardis and Everhart (2011) reported on the implementation of eBooks within high school systems in Florida, Texas, and Massachusetts. These systems have implemented 1:1 reading device initiatives, and are currently serving as pilot programs for e-readers. Eighty percent of the surveyed students cited e-readers as increasing their reading enjoyment and comprehension (Mardis & Everhart, 2011). Major issues regarding sampling and instrument administration were noted. Student samples were minimal, often using 20 or fewer students in what were labeled as intensive reading classes. Additionally, effect on comprehension was reported using student survey results rather than through the administration of a validated reading comprehension instrument.

**Additional research is needed.** Research on the effect of the electronic format using tablets and mobile devices is increasing. The focus, thus far, has been on usage and student acceptance. Academic research using validated measurement instruments has been limited. Studies using minimal sample sizes and researcher-created questions on electronic article postings, or surveys reflecting how students perceived e-readers to affect their reading comprehension need to be replaced with research using validated
reading comprehension measurement instruments administered to sufficient sample sizes of middle and high school students from which to draw statistically determined conclusions.

Summary

The research clearly indicates that an expansion in eBook usage is occurring, both publicly and academically. Popularity, however, is not an accurate indicator of academic success. Research is needed to determine the effect this transition to an electronic format, and usage of tablet devices, will have on the reading comprehension and motivation of the students involved. While research has revealed extensive coverage regarding how eBooks are being used at the collegiate level, few studies have reported on their incorporation at the middle and high school levels, with no studies being located that focus specifically on reading comprehension and motivation. Numerous studies also exist to reveal how eBooks are being used at the elementary level, and how this increased usage is affecting student reading comprehension and motivation. The research, however, has been limited to pre-K through fifth grade. Few studies have detailed how the reading comprehension and motivation of middle and high school students will be impacted. Given the three possibilities of positive effect, negative effect, or no effect, this study represents an important determination. If eBook usage has positive or no effect on comprehension and motivation, then the many benefits cited in this review encourage widespread inclusion of this format within middle and high schools. If the effect is negative, however, the benefits must be bypassed in favor of student performance.
CHAPTER THREE: METHODOLOGY

Introduction

This study compared the effect of traditional books to electronic books on reading comprehension and motivation of students in middle and high school English classes. The purpose of the study was to fill a major gap in the literature that existed with respect to middle and high school students’ use of eBooks on mobile devices and the impact on academic performance. Much research exists to indicate the effect of transitioning to electronic books on university libraries (Croft & Davis, 2010; Kimball et. al., 2010; Schell et. al., 2010), and elementary students (Dundar & Akcayir, 2012; Larson, 2010; Rhodes & Milby, 2007; Shamir, 2009; Shamir & Korat, 2007), but only recently have research studies been conducted on middle and high school students (Fisher et al., 2011; Mardis & Everhart, 2011; Sherman, 2012).

Chapter three will describe the participants, setting, instrumentation, procedures, research design, and data analysis that were utilized in the study.

Participants

The participants in the study were a convenience sample of middle and high school students enrolled in English courses at a local independent school in eastern North Carolina. As middle and high school students must take English courses each year, all students were eligible to participate in the study. The total population available for the study was the 221 students in grades 6-12 taking English courses. All 221 students received an invitation to participate in the study as well as parent consent and student assent forms during their homeroom periods two weeks prior to the study. Consent/Assent forms were received from 152 students, a volunteer rate of 69%. For various reasons including absence and athletic participation, 12 of the approved students
were unable to participate in the reading comprehension portion of the study. As a result, the 140 student sample was divided into two 70 member groups. Two students in the paper group were released early for travel to an athletic competition, and were unable to complete the GMRT®, giving a final participation of 138 students. The minimum sample for the study, based on Cohen’s $d = 0.5$, Power = 0.8, and alpha level $p = 0.05$, was 128 students, with 64 per group (Soper, 2011). At the conclusion of the study, data for the GMRT® was collected and analyzed for 138 participants, with 68 in the paper group and 70 in the electronic group.

The Motivations for Reading Questionnaire pretest was administered on day two; a $t$ test was conducted that demonstrated that the two groups did not significantly differ in terms of motivation to read prior to implementation of the intervention. The Motivations for Reading Questionnaire posttest, administered on day three, used 54 participants, with 27 students assigned to each group.

The demographics of the school indicated the population to be approximately 88% Caucasian, 51% male, and 49% female (Research School, 2011). Tuition at the high school level exceeds $10,000 per year, with 24% of students receiving tuition assistance (Research School, 2011). A 2011 sample of the school population ($N = 118$) displayed above average performance on the Stanford 10 reading comprehension assessment ($M = 42.00$, $SD = 5.87$). This provided the population with a National Percentile Rank of 78.7 compared to the Mean National Rank of 66.1. Of the 152 participants available for the GMRT®, 88 (58%) were male and 64 (42%) female. Participants were randomly assigned to control and experimental groups for the GMRT® administration. The population available for the MRQ posttest consisted of 61 total students. Forty (66%) of
the potential participants were male, and 21 (34%) were female. Due to absences for illness and athletics, only 54 of the students participated.

**Setting**

The setting for the study was a local independent school in eastern North Carolina. The school has a total K-12 enrollment of approximately 400 students, with 221 students in grades 6-12. Eighty-eight percent of the student body is Caucasian, 51% are males, and 49% are females (Research School, 2011).

The school is located in a small city of approximately 60,000 and a county of 100,000 located in eastern North Carolina (U.S. Census Bureau, 2010). City demographic data indicates a population that is 56% Black, 41% White, 2% Hispanic, and 1% Asian (U.S. Census Bureau, 2010). County demographic data indicates a population that is 56% White, 37% Black, 6% Hispanic, and 1% Asian (U.S Census Bureau, 2010).

For the comprehension portion of the study, students were randomly assigned to the treatment or control group using a random number generator and both groups were simultaneously administered the treatment and instruments during a regularly scheduled Flex period beginning at 1:08 p.m. each school day. Flex time is normally used for club meetings. Participants initially reported to the school cafeteria. Once all students were seated, each student received a number. Using a random number generator, the students were assigned to either the paper group or the electronic group. Electronic group members were then distributed to the library and middle school classrooms. All electronic students were initially scheduled to remain in the cafeteria for the administration of the GMRT®. A wireless access point at this location failed as students began logging into the online GMRT® website, and proctors had to relocate electronic
students to the school’s library and to middle school classrooms in order to access additional wireless access points. Paper group students remained in the cafeteria when the electronic students were reassigned. Treatment diffusion was addressed using group separation, through instructions to not discuss any information related to the instrument administration, and through teacher monitoring to ensure no discussions regarding the research took place during administration of the instrument. Both groups were administered the same reading comprehension section of the Gates-MacGinitie Reading Tests®. The only difference was in format. Paper group students were administered the reading comprehension section using the traditional paper test booklets. Electronic group students were administered the reading comprehension section by accessing the GMRT® online version through Riverside Publishing’s (2012) Testing Interface.

On day two, students reported to their normally assigned FLEX classrooms at 1:08 for the Motivations for Reading Questionnaire pretest. All participants completed the Motivations for Reading Questionnaire.

On day three, students reported to their normally assigned FLEX classrooms at 1:08 pm for the MRQ posttest. All participants read an excerpt from James L. Swanson’s (2009) book entitled *Chasing Lincoln’s Killer: The Search for John Wilkes Booth*, and completed the Motivations for Reading Questionnaire. Three classrooms were assigned to the paper group and read the book excerpt in paper form prior to responding to the MRQ. Three classrooms were assigned to the electronic group and read the book excerpt in electronic form using their Lenovo tablet prior to responding to the MRQ.

A validated reading comprehension instrument capable of tablet administration and traditional administration proved difficult to locate. Few avenues provided
assessments meeting these criteria, but Riverside Publishing’s 2010 release of an online version of the Gates-MacGinitie Reading Tests® offered a solution. Though the online version was designed for access from traditional computers, it was accessed using a Lenovo X220 Tablet in the current study. Originally, the study was to be conducted using Apple iPads as the delivery devices. A trial conducted with Riverside Publishing revealed that the inability of the iPad to support Adobe Flash® player would prevent the device from being used with the GMRT® online. Students accessed the GMRT® online through Riverside Publishing’s (2012) Testing Interface. The Testing Interface can be accessed using a standard web browser. For this research, Google’s Chrome™ internet browser was used. The comprehension sections are designed so that students do not need to scroll. The reading passage appears on the left side of the screen and the questions appear on the right of the screen. The bottom of the screen contains a grey progress bar displaying the number of questions answered and the elapsed time, as well as green arrows allowing the student to “Go Back” to previous questions or to “Go On” to the next question. A sample screen for the GMRT® online is displayed below (Riverside Publishing, 2012).
The independent variable for research question one was book format. There were two levels to the independent variable: (1) Print book format, and (2) Electronic book format. The dependent variable for research question one was student reading comprehension as measured using the Gates-MacGinitie Reading Tests®. The GMRT® normally includes both a vocabulary and comprehension assessment and requires 55 minutes to administer both (Riverside Publishing, 2012). This research focused only on comprehension, and thus, required 35 minutes for the administration of the comprehension assessment. The vocabulary section was voided by simply omitting the section in the paper format. This was accomplished in the online version by opting to void the vocabulary section at the beginning of the assessment. The comprehension assessment measured students’ abilities to understand various types of writing (Riverside Publishing, 2012). Reading passages were selected for similarity to both school-related and recreational reading, and include fiction and nonfiction as well as different styles of writing (MacGinitie et. al., 2006; Riverside Publishing, 2012). The GMRT® uses leveled
tests for students in varying ability groups from pre-reading through adult reading. This research used the Level 7/9 version which was designed to provide a general assessment of reading for students in grades 7-9 (Riverside Publishing, 2012). The GMRT® online allows students in grades 4-12 to be tested in the same room at the same time (Riverside Publishing, 2012).

The GMRT® has a test reliability coefficient of 0.90, and a reading comprehension reliability coefficient of 0.89 (MacGinitie et. al., 2006). The reliability estimates indicate strong total test and subtest consistency levels. A rigorous, nationally representative standardization sample of 65,000 Kindergarten through 12th grade students and approximately 2,800 adult community college students participated in the standardization procedure (MacGinitie et. al., 2006). Content validity was ensured through the test development process; however, no discussion of validity was included in the technical report (MacGinitie et. al., 2006). Perhaps the greatest statement of validity was offered by Pearson’s Developmental Reading Assessment, K-8, Second Edition. In the spring of 2008, students were administered the DRA followed by one of the following reading tests within a one week period (Pearson, 2009). The Grays Oral Reading Test – 4th Edition (Gort-4; Wiederholt & Bryant, 2001), DIBELS Oral Reading Fluency Test – 6th Edition (DORF; Good, Kaminski, & Dill, 2002), and the Gates MacGinitie Reading Tests – 4th Edition (MacGinitie et. al., 2002) were used to determine concurrent validity (Pearson, 2009). The fact that the GMRT® was such an accepted assessment as to be used in validating more recent reading assessments displays it positioning as a valid, well respected assessment of reading. The GMRT® print test was scored by the researcher using scoring manuals purchased through Riverside publishing. The GMRT® online was
scored by the publisher and reported to the researcher within 24 hours using Riverside Publishing’s Interactive Results Manager (iRM) (Riverside Publishing, 2012). Raw scores were used for statistical analysis in this study.

The independent variable for research question two was book format. There were two levels to the independent variable: (1) Print book format, and (2) Electronic book format. The dependent variable was student reading motivation as measured using the Motivations for Reading Questionnaire (MRQ; Wigfield & Guthrie, 1997). The MRQ was also given as a pretest. Originally developed by Wigfield and Guthrie in 1995 and including 82 items, the MRQ was revised to its current form in 1997 with 53 items (Wigfield & Guthrie, 1997). As a group, students read the instrument directions and completed the remaining questionnaire independently. The response format for the 53 items is a 4-point Likert scale with 1 = Very different from me, 2 = A little different from me, 3 = A little like me, and 4 = A lot like me (Wigfield & Guthrie, 1997). Eleven constructs of reading motivation are measured (Wigfield & Guthrie, 1997). Of the 53 total questions, responses to three items determine Construct One - Reading Efficacy; five questions determine Construct Two - Reading Challenge; six questions determine Construct Three - Reading Curiosity; six questions determine Construct Four - Reading Involvement; two questions determine Construct Five - Importance of Reading; four questions determine Construct Six - Reading Work Avoidance; six questions determine Construct Seven - Competition in Reading; five questions determine Construct Eight - Recognition for Reading; four questions determine Construct Nine - Reading for Grades; seven questions determine Construct Ten - Social Reasons for Reading; and five questions determine Construct Eleven - Compliance (Wigfield & Guthrie, 1997). All
students were able to complete the 53 items on the MRQ in one 20 minute session (Wigfield & Guthrie, 1997).

The MRQ was initially administered to 371 fifth and sixth grade students, 52% girls and 48% boys, attending six elementary schools in a large mid-Atlantic city (Baker & Wigfield, 1999). Wigfield and Guthrie (1997) reported reliability values for the MRQ to range from .52 to .81. The Work Avoidance and Reading for Grades constructs initially reported the lowest reliabilities at .44 and .43 (Wigfield & Guthrie, 1997). Twenty-eight of the original items were dropped to improve the instrument in these areas, and further studies have revealed reliabilities for the two constructs to have risen to .60 and .59 (Baker & Wigfield, 1999; Wigfield & Guthrie, 1997). The remaining nine constructs have consistently displayed internal reliabilities approaching or exceeding 0.70, and reaching .81 (Baker & Wigfield, 1999; Wigfield & Guthrie, 1997). Goodness-of-fit index for the instrument was reported as 0.90 (Baker & Wigfield, 1999). Unrau and Schlackman (2006) reported validity of the MRQ, following its use with a sample of 2000 6th, 7th, and 8th grade students with a confirmatory fit index (CFI) of .90. The sample consisted of students who were 75% Hispanic, 20% Asian, and 5% African American, American Indian or White (Unrau & Schlackman, 2006). Internal consistency estimates of reliability will be calculated for the survey using Cronbach’s coefficient alpha for the present data and reported here.

Scoring was performed by the researcher. Students were assigned an overall score by summing the scores of all items with the exception of the Work Avoidance dimension (Wigfield & Guthrie, 1997). The response format for the 53 items was a 4-point Likert type scale with 1 = Very different from me, 2 = A little different from me, 3
= A little like me, and 4 = A lot like me (Wigfield & Guthrie, 1997). Students were assigned individual construct scores by summing the item scores and dividing by the total number of questions used to measure the construct (Wigfield & Guthrie, 1997). An exception was noted for the Compliance construct. To obtain an accurate score for this scale, the first two items were reversed; a score of 1 was converted to a 4, a score of 2 converted to a 3, a score of 3 converted to a 2, and a score of 4 converted to a 1 (Wigfield & Guthrie, 1997).

**Procedures**

In August 2012, the middle and high school principals as well as the school headmaster were contacted to obtain pre-approval to conduct the study on the selected campus. The Institutional Review Board packet was completed and submitted to the IRB for approval. Once IRB approval was received, English teachers at the selected site were contacted to request their participation as proctors.

The researcher met with individual English teachers and principals to explain the study and testing procedures and to determine the best dates on which to administer the treatment and tests.

In Fall 2012, parental consent and student assent forms were distributed to parents and students two weeks prior to the study. Forms were sent home via students. The forms were given to students during homeroom periods. Notifications were then emailed to parents as well. Forms had to be signed by the parents and students and returned to the school in order for students to participate in the study.

On day one of the testing, students participated in the Gates MacGinitie Reading Tests® (MacGinitie et. al., 2006). The test was administered during the students’ normally assigned Flex period, with teachers serving as test administrators, and required
a single 35 minute session. While the Flex period is normally allotted only 24 minutes, the researcher received permission for students to remain for the duration of the GMRT®. At 1:08 p.m., students reported to the school cafeteria with their tablet computers. Upon entering, students were seated at the cafeteria tables. A teacher then presented each student with an index card containing a specific number. The administrators then assigned each student to either the experimental group or the control group based upon the index card’s number using a random assignment list generated by the researcher through GraphPad software’s (2012) QuickCalcs generator. All electronic students were initially scheduled to remain in the cafeteria for testing. A wireless access point in the cafeteria failed while students were logging into the GMRT® online website. As a result, electronic students had to be distributed to the library and middle school classrooms to prevent overloading any single wireless access point. Students in the control group remained in the cafeteria. Each group was instructed to not discuss the research, and was monitored by teachers during movement to the alternative locations and during instrument administration. Students in the experimental group did not receive paper materials, but rather accessed the GMRT® online through Riverside Publishing’s (2012) Testing Interface via their Lenovo X220 Tablet. Students in the control group were provided test booklets and pencils to read and respond to the GMRT® passages using the traditional print format. Both groups read the same passages; only the format differed. Students taking the print version were guided through the assessment by the proctor and printed instructions included with the test booklet. Students taking the on-line version accessed the GMRT® portal, and were kept in a virtual waiting area that prevented them from beginning until all students were logged in. The GMRT® is a proctored test, and
once all students were correctly logged in and in the waiting room, teachers notified the researcher. Once all students were ready, the administrator electronically started the test. On-line students were guided through the test by the directions included in the online version. Students taking the print version were instructed by the on-site proctor to begin their test at the same time. As online students completed the test, they logged out of the GMRT® portal. Proctors collected materials from print students once they finished. All materials were returned to the researcher immediately following administration.

Reading passages for the GMRT® were selected for similarity to both school-related and recreational reading (MacGinitie et. al., 2006; Riverside Publishing, 2012). The passages included fiction and nonfiction, and incorporated different types of writing as well (MacGinitie et. al., 2006; Riverside Publishing, 2012). Questions 1-5 were based on an excerpt from *Yolanda’s Genius*, by Carol Fenner (1995). Questions 6-9 were based on an excerpt from *Rear-View Mirrors*, by Paul Fleischman (1986). Questions 10-15 were based on an excerpt from *Long Lance: The Autobiography of a Blackfoot Indian Chief*, by Chief Buffalo Child Long Lance (1928). Questions 16-19 were based on an excerpt from *Minn of the Mississippi*, by Holling Clancy Holling (1951). Questions 20-23 were based on an excerpt from *Invisible Man*, by Ralph Ellison (1947). Questions 24-28 were based on an excerpt from *Caterpillars and How They Live*, by Robert McClung (1965). Questions 29-31 were based on an excerpt from *O Pioneers!* by Willa Cather (1913). Questions 32-35 were based on an excerpt from *Geography Facts*, by Dougal Dixon (1992). Questions 36-38 were based on an excerpt from *The Story of Furniture*, by Edmund Hunter (1971). Questions 39-43 were based on an excerpt from *Silent Dancing: A Partial Remembrance of a Puerto Rican Childhood*, (1990). Questions 44-
48 were based on an excerpt from *Humanities: The Evolution of Values*, by Lee A. Jacobus (1986).

On day two of the testing, students participated in the Motivations for Reading Questionnaire pretest during their normally assigned Flex period. The test was administered in a single 20 minute session, thus no additional scheduling was necessary. Students were seated and provided paper copies of the MRQ. Administrators then allowed the necessary time for MRQ responses to be circled. Response forms were collected by the teachers serving as proctors and returned to the researcher for grading. MRQ scoring was conducted by hand using directions provided by the questionnaire’s authors.

On day three of the testing, students participated in the Motivations for Reading Questionnaire posttest during their normally assigned FLEX periods. Random assignment in the educational setting was not possible for this aspect of the study; thus, three classrooms were selected to serve as members of the control (paper) group and three classrooms were selected to serve as members of the experimental (electronic) group. Students were seated and provided paper copies of the MRQ. Control group students read a paper excerpt from John Swanson’s (2009) book, *Chasing Lincoln’s Killer – The Search for John Wilkes Booth*. Experimental students used their Lenovo tablets to access the excerpt. Administrators then allowed the necessary time for MRQ responses to be circled. Response forms were collected by the teachers serving as proctors and returned to the researcher for grading. MRQ scoring was conducted by hand using directions provided by the questionnaire’s authors. Scoring data was statistically analyzed using a MANOVA; a $t$ test was conducted on pretest scores and determined
there was not a significant difference in the scores for control (Paper GMRT®) group
students ($M = 2.62, SD = .50$) and experimental (Electronic GMRT®) group students ($M = 2.56, SD = .42$) on the conditions; $t(138) = .73, p = .47$.

**Research Design**

Research question one was studied using a true experimental posttest-only
control-group design. This design was chosen for its rigor, and due to the ability to
randomly assign the sample. The choice to exclude a pretest was based on the fact that
administering a pretest may have adversely affected scores on the posttest (Gall, Gall, &
Borg, 2007; Wiersma & Jurs, 2005). Random assignment allowed for the assumption of
equal groups (Campbell & Stanley, 1963).

Research question two was studied using a quasi-experimental pretest-posttest
control-group design. This design was chosen due to the inability of the researcher to
randomly assign the sample on days two and three of the study; this design is often used
in educational settings for this reason and is thus appropriate for this study (Gall et. al.,
2007). The study research questions were:

**R₁:** Is there a statistically significant difference in the reading comprehension of
middle and high school English students using electronic books compared to students
using traditional print books as measured using the Gates-MacGinitie Reading Tests®
(GMRT®)?

**R₂:** Is there a statistically significant difference in the reading motivation of
middle and high school English students using electronic books when compared to those
using traditional print books as measured by the Motivations for Reading Questionnaire
(MRQ)?
Data Analysis

The first research question was analyzed using an independent $t$-test to evaluate the null hypothesis that middle and high school English students using print and electronic books would not display a statistically significant difference in reading comprehension as measured by the Gates MacGinitie Reading Tests®. This was the appropriate statistical test due to the fact that the research was testing hypotheses of difference with one independent variable having two levels, one dependent variable, and no covariate (Gall et. al., 2007). The alpha level for the study was $p < 0.05$ in order to prevent the incorrect rejection of the null hypothesis (Sprinthall, 2003). The number of participants calculated with an alpha level of $p < 0.05$, Cohen’s $d$ value of 0.5, and a power level of 0.80 provided a minimum sample size for an independent $t$-test of 128 (Soper, 2011). Effect size was reported as Cohen’s $d$ (Ary, Jacobs, Razavieh, & Sorenson, 2006). Prior to conducting the analysis assumption testing was conducted. Normality was assessed using histograms (Sprinthall, 2003). Equal variance was assessed using Levene’s test of homogeneity (Sprinthall, 2003). Large sample sizes (i.e., when both groups have >25 subjects) and equally sized groups made this test robust to violations of normality and homogeneity of variance assumptions (Diekhoff, 1992); thus, minor violations were not a concern. The sample for this research included 138 students divided into a paper group of 68 and an electronic group of 70. The presence of outliers was examined using box plots (Howell, 2008). Outliers resulting from errors were eliminated. Representative outliers forced a drop from interval to ordinal tests of significance (Sprinthall, 2003).

The second research question used a one-way multivariate analysis of variance (MANOVA) to evaluate the null hypothesis that middle and high school English students
reading an excerpt from John Swanson’s (2009) book, *Chasing Lincoln’s Killer – The Search for John Wilkes Booth* in traditional print and electronic formats would display no statistically significant difference in their mean scores for the linear combination of the reading motivation scales as measured using the Motivations for Reading Questionnaire. A MANOVA was chosen because it tests the significance of group differences between two or more groups when there are correlated dependent variables (Tabachnick & Fidell, 2007). The optimal number of participants per group range from 20 to 10 times the number of dependent variables for this analysis (Swanson & Holton, 2005); the convention for the design used 54 posttest participants in two groups of 27, exceeding the 15 per group minimum set by Gall, et al. (2007), and providing a sufficient, but small sample size. A $p < .05$ level of significance was used for all analyses to determine if the null hypotheses could be rejected. The effect size was calculated using the Eta squared statistic and interpreted using Cohen’s $d$ (1988).

Assumption testing was conducted prior to the analysis. The assumption of outliers was examined using boxplots (Sprinthall, 2003). The assumption of normality was examined using a One-Sample Kolmogorov-Smirnov test with Lilliefors’s correction, (Lilliefors, 1967; Shapiro & Wilk, 1965). Mahalanobis distance was calculated to test for multivariate normality. Correlations and scatterplots were analyzed to evaluate assumptions for linearity, singularity, and multicollinearity. The assumption of homogeneity of variances and covariance was completed using Levene’s test and Box’s $M$ test (Box, 1949; Sprinthall, 2003). The assumption of sphericity was examined using Bartlett’s and Mauchly’s tests (Mauchly, 1940; Snedecor & Cochran, 1989).

An independent $t$-test of the MRQ pretest scores was conducted to determine if there was a significant difference in scores based on group assignment. No significant
difference was found between the scores for control (Paper GMRT®) group students ($M = 2.62, SD = .50$) and experimental (Electronic GMRT®) group students ($M = 2.56, SD = .42$) on the conditions; $t(131) = .73, p = .47$. The finding of no statistically significant difference between the groups on the pretest led to the use of a MANOVA for data analysis as there was no need to determine the effect of a covariate.
CHAPTER FOUR: FINDINGS

Introduction

This chapter contains a summary of the results for each of the research questions, and a detailed description of the decisions regarding the research hypotheses for this study. The data presented in this chapter was used to determine the effect of book format on the reading comprehension and motivation of middle and high school students. Data for the reading comprehension section of the study was collected from 138 randomly assigned 6th – 12th grade students and statistical analyses were conducted to compare the data between the study’s experimental group and control group. Data from the t test was used to determine if a significant difference in student reading comprehension scores existed based on book format.

Data for the reading motivation section of the study was collected from 54 middle and high school students and statistical analyses were conducted to compare the data between the study’s experimental group and control group. Data from the multivariate analysis of variance (MANOVA) was used to determine the association between the dependent variables, reading motivation levels as measured by the 11 subscales of the Motivations for Reading Questionnaire (MRQ), based on the independent variable, book format.

Question One: Independent t-Test

Descriptive Statistics

The first research question was, “Is there a statistically significant difference in the reading comprehension of middle and high school English students using electronic books compared to students using traditional print books?” An independent two-tailed t
– test was performed to determine if a statistically significant difference existed between
the experimental group and the control group in the level of reading comprehension as
measured using raw scores from the Gates-MacGinitie Reading Tests®. Group
assignment, experimental (electronic) or control (paper) was used as the independent
variable when evaluating the equality or differences among population means. The
means and standard deviations for reading comprehension as represented by the
participants’ group assignments are reported in Table 4.2.
Table 4.2.

Descriptive Statistics for Reading Comprehension based on Group Assignment

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Experimental Group ($n = 70$)</th>
<th>Control Group ($n = 68$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>GMRT Raw Score</td>
<td>37.84</td>
<td>7.63</td>
</tr>
</tbody>
</table>

Assumption testing was performed to determine whether the following assumptions were tenable: Normality, homogeneity of variance, and no extreme outliers. Normality and no extreme outliers were assessed using histograms and box plots. There were no extreme outliers presented in the graphs to indicate any errors or inconsistencies in the data.

Equal variance was assessed using Levene’s test of homogeneity. For this research, Levene’s test reported significance of .75, indicating the two variances were approximately equal (Sprinthall, 2003). $t$-tests are also robust to violations of normality and homogeneity of variance assumptions when sample sizes are large (i.e., when both groups have > 25 subjects) (Diekhoff, 1992). This study used 138 participants in two groups, with a control group of 68 participants and an experimental group of 70 participants.

**Inferential Statistics**

Among 6th – 12th grade students taking the GMRT ($N = 138$), there was not a statistically significant difference between the paper group ($M = 37.71, SD = 7.33$) and the electronic group ($M = 37.84, SD = 7.63$), $t(136) = -.11, p = .92$. Therefore, the
research failed to reject the null hypothesis. Cohen’s effect size value \((d = .02)\) suggested low practical significance, and observed power = .83.

**Question Two: MANOVA**

**Descriptive Statistics**

The second research question was, “Is there a statistically significant difference in the reading motivation of middle and high school English students using electronic books compared to students using traditional print books?” A one-way multivariate analysis of variance (MANOVA) was performed to identify whether a significant difference between the experimental group and the control group in the level of reading motivation associated with book format existed. The linear combination of the 11 subscales of the Motivations for Reading Questionnaire served as the dependent variables. These variables included reading efficacy, reading challenge, reading curiosity, reading involvement, importance of reading, reading work avoidance, competition in reading, recognition in reading, reading for grades, social reasons for reading, and compliance. Group assignment, experimental or control, was used as the independent variable when evaluating the equality or differences among population means. The means and standard deviations for each of the 11 subscales represented by the participants’ group assignments are reported in Table 4.3.
Table 4.3.

*Descriptive Statistics for Reading Motivation based on Group Assignment*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Experimental Group $(n = 27)$</th>
<th>Control Group $(n = 27)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Reading Efficacy</td>
<td>2.72</td>
<td>.68</td>
</tr>
<tr>
<td>Reading Challenge</td>
<td>2.60</td>
<td>.68</td>
</tr>
<tr>
<td>Reading Curiosity</td>
<td>2.76</td>
<td>.69</td>
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<tr>
<td>Reading Involvement</td>
<td>2.56</td>
<td>.68</td>
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<tr>
<td>Importance of Reading</td>
<td>2.40</td>
<td>1.05</td>
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<td>Reading Work Avoidance</td>
<td>2.66</td>
<td>.69</td>
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<tr>
<td>Competition in Reading</td>
<td>2.47</td>
<td>.76</td>
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<tr>
<td>Recognition in Reading</td>
<td>2.41</td>
<td>.89</td>
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<tr>
<td>Reading for Grades</td>
<td>2.55</td>
<td>.81</td>
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<tr>
<td>Social Reading</td>
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<td>.63</td>
</tr>
<tr>
<td>Compliance</td>
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<td>.62</td>
</tr>
<tr>
<td>Linear Combination</td>
<td>2.51</td>
<td>.39</td>
</tr>
</tbody>
</table>

Prior to conducting a MANOVA, assumption testing was completed to determine whether the following assumptions were tenable: sample size, normality, outliers, homogeneity of variance-covariance, linearity, and multicollinearity/singularity. For a MANOVA, there should be more cases in each cell than total dependent variables for the study (Pallant, 2011). For this study, the sample size assumption is satisfied by having 27
cases in each cell with only 11 dependent variables. The Kolmogorov-Smirnov statistic was examined to check univariate normality. For this test, an alpha value greater than .05 indicates normality (Pallant, 2011). Normality was present in all dependent variables. As an additional check for normality and univariate outliers, histograms, Q-Q plots, and boxplots were examined. Boxplots revealed four extreme outliers for the Reading Involvement scale and one for the Reading Avoidance scale. The outliers were first checked to ensure they were not the result of recording errors (Gall et. al., 2007). Since a MANOVA is tolerant to outliers if values are not too extreme and $N >$ the number of dependent variables, the outliers were not removed (Tabachnick & Fidell, 2007). A Mahalanobis distance statistic was calculated to examine multivariate outliers; the Mahalanobis distance values were assessed using $\chi^2 (11, N = 54) = 32.9, p < .001$. The Mahalanobis distance value was compared against a critical value to determine if there was a violation of this assumption within the data set (Pallant, 2011). The critical value of 32.9 was determined using a chi-square table with the number of dependent variables (11) as the degrees of freedom and an alpha value of $p = .001$. There were no violations of this assumption as none of the cases were larger than the critical value, indicating a lack of multivariate outliers for this study. The assumption of homogeneity of variance-covariance was tenable based on Box’s $M = 98.92, F(66, 8621) = 1.16, p = .18$.

A matrix of scatterplots was generated to check for linearity assumptions. The plots showed no evidence of non-linearity; therefore, the assumption of linearity was satisfied. Pearson’s $r$ correlations were conducted to examine multicollinearity among the dependent variables. A Pearson’s $r$ correlation shows the strength of the relationship between groups of students on each of the 11 scales (Reading Efficacy, Reading
Challenge, Reading Curiosity, Reading Involvement, Importance of Reading, Reading Work Avoidance, Competition in Reading, Recognition in Reading, Reading for Grades, Social Reasons for Reading, and Compliance). Correlations exceeding .8 are reasons for concern (Pallant, 2011). For this data set, the correlations among the dependent variables are all below .8; therefore the data set does not violate the assumptions of multicollinearity and singularity. Results for this data set at shown in Table 4.4.
Table 4.4.

Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>EFF</th>
<th>CHA</th>
<th>CUR</th>
<th>INV</th>
<th>IMP</th>
<th>WA</th>
<th>CR</th>
<th>RR</th>
<th>RG</th>
<th>SR</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Efficacy</td>
<td>1</td>
<td>.58**</td>
<td>.64**</td>
<td>.52**</td>
<td>.52**</td>
<td>-.43**</td>
<td>.40**</td>
<td>.48**</td>
<td>.43**</td>
<td>.28*</td>
<td>.36**</td>
</tr>
<tr>
<td>Reading Challenge</td>
<td>.58**</td>
<td>1</td>
<td>.76**</td>
<td>.63**</td>
<td>.53**</td>
<td>-.47**</td>
<td>.42**</td>
<td>.39**</td>
<td>.46**</td>
<td>.55**</td>
<td>.44**</td>
</tr>
<tr>
<td>Reading Curiosity</td>
<td>.64**</td>
<td>.76**</td>
<td>1</td>
<td>.49**</td>
<td>.47**</td>
<td>-.43**</td>
<td>.33*</td>
<td>.30*</td>
<td>.36**</td>
<td>.37**</td>
<td>.39**</td>
</tr>
<tr>
<td>Reading Involvement</td>
<td>.52**</td>
<td>.63**</td>
<td>.49**</td>
<td>1</td>
<td>.57**</td>
<td>-.41**</td>
<td>.39**</td>
<td>.43**</td>
<td>.30*</td>
<td>.50**</td>
<td>.54**</td>
</tr>
<tr>
<td>Importance of Reading</td>
<td>.52**</td>
<td>.53**</td>
<td>.47**</td>
<td>.57**</td>
<td>1</td>
<td>-.34*</td>
<td>.69**</td>
<td>.74**</td>
<td>.71**</td>
<td>.63**</td>
<td>.58**</td>
</tr>
<tr>
<td>Reading Work Avoidance</td>
<td>-.43**</td>
<td>-.47**</td>
<td>-.43**</td>
<td>-.41**</td>
<td>-.34*</td>
<td>1</td>
<td>-.09</td>
<td>-.26</td>
<td>-.29*</td>
<td>-.27*</td>
<td>-.32*</td>
</tr>
<tr>
<td>Competition in Reading</td>
<td>.40**</td>
<td>.42**</td>
<td>.33*</td>
<td>.39**</td>
<td>.69**</td>
<td>-.09</td>
<td>1</td>
<td>.74**</td>
<td>.60**</td>
<td>.59**</td>
<td>.54**</td>
</tr>
<tr>
<td>Recognition in Reading</td>
<td>.48**</td>
<td>.39**</td>
<td>.30*</td>
<td>.43**</td>
<td>.74**</td>
<td>-.26</td>
<td>.74**</td>
<td>1</td>
<td>.73**</td>
<td>.58**</td>
<td>.58**</td>
</tr>
<tr>
<td>Reading for Grades</td>
<td>.43**</td>
<td>.46**</td>
<td>.36**</td>
<td>.29*</td>
<td>.71**</td>
<td>-.29*</td>
<td>.60**</td>
<td>.73**</td>
<td>1</td>
<td>.58**</td>
<td>.54**</td>
</tr>
<tr>
<td>Social Reasons</td>
<td>.28*</td>
<td>.55**</td>
<td>.37**</td>
<td>.50**</td>
<td>.63**</td>
<td>-.27*</td>
<td>.59**</td>
<td>.59**</td>
<td>.58**</td>
<td>1</td>
<td>.52**</td>
</tr>
<tr>
<td>Compliance</td>
<td>.36**</td>
<td>.44**</td>
<td>.39**</td>
<td>.54**</td>
<td>.58**</td>
<td>-.32*</td>
<td>.54**</td>
<td>.58**</td>
<td>.54**</td>
<td>.52**</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: **Correlation is significant at the 0.01 level.
*Correlation is significant at the 0.05 level.
Table 4.4 was also used to assess correlations among the dependent variables and to determine if the MANOVA was the most appropriate choice of analysis.

The MRQ was designed with multiple subscales and each of those subscales served as a dependent variable in this study. In previous research, the subscales have been significantly correlated. All subscales are significantly positively correlated with one another, with the exception of the subscale Work Avoidance (Wigfield & Guthrie, 1997). This subscale is negatively correlated with other subscales (Wigfield & Guthrie, 1997). Consistent with previous research, Table 4.4 demonstrates that the subscales in this study are significantly positively correlated with the exception of the Work Avoidance scale. Given the significant correlations among the dependent variables, the MANOVA was conducted and deemed appropriate as the MANOVA considers the interrelationship between variables and determines whether groups differ on more than one dependent variable (Gall et. al., 2007).

Wilk’s Lambda was used to indicate statistically significant differences among the variables since there were no violations.

**Inferential Statistics**

The results of the MANOVA indicated there was not a statistically significant difference between reading motivation levels based on book format, Wilk’s lambda = .750, $F(11, 42) = 1.27$, $p = .27$, partial $\eta^2 = .25$. Further, Cohen’s effect size value for the linear combination of the reading motivation scales $d = .26$. Based on the nonsignificant results, the decision was made to fail to reject the null hypothesis. Observed power = .59, which indicates a 59% probability that failing to reject the null hypothesis was correct.
The impact of book format on responses to the Motivations for Reading Questionnaire was evaluated using the effect size statistic, partial eta squared. Results revealed that book format was associated with overall reading motivation for only 1.6% of participants. A further breakdown of results based on partial eta squared showed that 0.8% of students’ reading efficacy, 0.9% of students’ reading challenge, 0.0% of students’ reading curiosity, 0.3% of students’ reading involvement, 1.8% of students’ reading importance, 2.5% of students’ reading avoidance, 1.9% of students’ reading competition, 1.6% of students’ recognition for reading, 5.6% of students’ reading for grades, 0.1% of students’ social reasons for reading, and 7.5% of students’ reading compliance was associated with book format.

In summary, the $F$ statistic was not significant, indicating that the middle and high school English students who used the electronic format did not differ significantly in their mean scores with respect to the 11 subscales of the Motivations for Reading Questionnaire than the students who used the paper format (Gall et. al., 2007; Howell, 2008). Since the MANOVA $F$ statistic was not significant, individual ANOVAs for each dependent variable were not performed (Gall et. al., 2007).

Summary

The results of the data analysis displayed no statistically significant differences between the experimental and control groups for this study. Based on the results, the research failed to reject the null hypotheses for the following research questions: (1) Is there a statistically significant difference in the reading comprehension of middle and high school English students using electronic books compared to students using traditional print books? and (2) Is there a statistically significant difference in the reading motivation of middle and high school English students using electronic books compared
to students using traditional print books? An independent $t$-test displayed no statistically significant difference in reading comprehension based on book format. Preliminary assumption testing was conducted to check for normality, outliers, and homogeneity of variance. Among 6$^{th}$ – 12$^{th}$ grade students taking the GMRT® ($N = 138$), there was no statistically significant difference between the paper group ($M = 37.71, SD = 7.33$) and the electronic group ($M = 37.84, SD = 7.63$), $t (136) = -0.11, p \geq .05$. Therefore, we fail to reject the null hypothesis that middle and high school English students using traditional print and electronic books will not display significantly different levels of reading comprehension as measured using the Gates-MacGinitie Reading Tests®. A one-way between groups multivariate analysis of variance was performed to investigate group differences in students’ reading motivation based on book format. Eleven dependent variables were used: Reading Efficacy, Reading Challenge, Reading Curiosity, Reading Involvement, Importance of Reading, Reading Work Avoidance, Competition in Reading, Recognition in Reading, Reading for Grades, Social Reasons for Reading, and Compliance. The independent variable was book format. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Results displayed no statistically significant difference between the experimental group and control group for reading motivation based on book format.
CHAPTER FIVE: DISCUSSION

Introduction

This chapter will review the methodology for this combination experimental post-test only design and quasi-experimental pretest-posttest control-group design study and provide a summary of the results from the independent t-test and multivariate analysis of variance (MANOVA) analyses. This quantitative research study will be discussed in light of prior research. Limitations are outlined, and the theoretical and practical implications are discussed. The chapter concludes with recommendations for future research and a closing summary.

The purpose of this study was to determine if there was a statistically significant difference in the reading comprehension and reading motivation levels of middle and high school English students when using electronic books compared to using traditional print books. This study investigated two research questions: (1) Is there a statistically significant difference in the reading comprehension of middle and high school English students using electronic books compared to students using traditional print books? and (2) Is there a statistically significant difference in the reading motivation of middle and high school English students using electronic books compared to students using traditional print books?

Review of Methodology

A convenience sample of middle and high school English students (N = 138) at an independent school in eastern North Carolina was randomly assigned to an experimental and a control group. On day one of the research, both groups of students were administered the Gates-MacGinitie Reading Tests® comprehension section. Control group students took the GMRT® using the traditional paper version while experimental
group students took the GMRT® using the online version accessed via Riverside Publishing’s (2012) Testing Interface. No pretest was administered to avoid unnecessary testing as a threat to the internal validity of the study; group equivalence was assumed due to random assignment (Campbell & Stanley, 1963). Data was collected from the GMRT® comprehension section in the form of raw scores and analyzed using an independent t-test. The t-test was used to determine if there was a statistically significant difference in reading comprehension level based on book format.

On day two of the study, research question two was addressed using a quasi-experimental pretest-posttest control-group design. The pretest was administered by having students who participated in the previous day’s GMRT® assessment provide responses to the Motivations for Reading Questionnaire. Data analysis for the pretest was conducted using a t test that demonstrated the two groups did not significantly differ in terms of motivation to read prior to implementation of the intervention. On day three, a posttest MRQ was administered to a sample of 54 GMRT® participants. A control group of 27 students read an excerpt from John Swanson’s (2009) book, *Chasing Lincoln’s Killer – The Search for John Wilkes Booth* in paper form while an experimental group of 27 students read the excerpt using Lenovo X220 tablets. Data collected from the Motivations for Reading Questionnaire posttest was analyzed using a one-way multivariate analysis of variance (MANOVA). The MANOVA was used to investigate the differences in means of the 11 dependent variables: Reading Efficacy, Reading Challenge, Reading Curiosity, Reading Involvement, Importance of Reading, Reading Work Avoidance, Competition in Reading, Recognition in Reading, Reading for Grades, Social Reasons for Reading, and Compliance. Prior to analysis, data was tested to ensure
conformity to the assumptions of sample size, normality, outliers, linearity, homogeneity of variance-covariance, singularity, and multicollinearity. There were no major concerns related to the violation of any assumptions;

**Summary of Results**

An independent $t$-test was used to investigate research question #1: Is there a statistically significant difference in the reading comprehension of middle and high school English students using electronic books compared to students using traditional print books? Results indicated there was not a statistically significant difference in comprehension based on book format. Students in the experimental group did not display significantly different levels of reading comprehension when compared to students in the control group. Results provided statistical support for full transition to electronic testing within the research population’s school as groups displayed no statistically significant difference in raw scores. Given the importance of comprehension as a foundational skill essential to the understanding and success of students in any academic discipline, these results have wide-ranging implications for the research school. The fact that students performed as well in the electronic format suggests that students at the research school would not be adversely affected by the implementation of either electronic texts or electronic testing. Since academic achievement will not be adversely affected, the school now has a statistical basis upon which to implement further electronic transitions.

A MANOVA was used to investigate research question #2: Is there a statistically significant difference in the reading motivation of middle and high school English students using electronic books compared to students using traditional print books? Results indicated there was not a statistically significant difference in motivation based on book format. Students in the experimental group did not display significantly
different levels of reading motivation when compared to students in the control group. It must be noted that observed power for the MANOVA was .59, indicating a 59% probability that failing to reject the null hypothesis was correct. Results provided statistical support for continued transition to the electronic format. While motivation was not improved using electronic books, neither was it harmed. Thus, the transition to electronic books and textbooks possible with the school’s implementation of a 1:1 tablet program will continue to be a valid option based on other factor such as textbook costs and sustained academic achievement.

**Relationship to Prior Research**

The purpose of this true-experimental posttest-only control-group design study was to determine if there was a statistically significant difference in the reading comprehension levels of middle and high school English students when using electronic books compared to traditional print books. The purpose of this quasi-experimental pretest-posttest control-group design study was to determine if there was a statistically significant difference in the reading motivation levels of middle and high school English students when using electronic books compared to traditional print books. Through my search of the literature, using databases such as ERIC and Education Research Complete, I was unable to locate research that specifically studied the effect eBooks have on the reading comprehension and motivation levels of middle and high school students. Thus, research to make such a determination for students at the middle and secondary levels was needed.

Research conducted at the collegiate level indicated little effect on academic performance. A University of Florida trial allowed undergraduate psychology students to choose either traditional or electronic texts. The electronic text group reported spending
less time in their reading, yet displayed no statistically significant difference in the grades received for the course (Shepperd et. al., 2008). Another study conducted at a university in Virginia compared the use of eBooks and traditional books on undergraduate student learning in an educational history course. While results reported higher psychomotor learning levels for students using eBooks, no difference in actual learning between the groups existed (Rockinson-Szapkiw & Holder, 2011). The current study’s retention of the null hypothesis that middle and high school English students using traditional print and electronic books will not display statistically significant different levels of reading comprehension as measured using the Gates-MacGinitie Reading Tests® supports previous results indicating no change in academic achievement based on format.

Research at the elementary level has displayed electronic books to improve reading motivation. A study of kindergarten students using electronic books displayed increased motivation to read (Korat et. al., 2009; Moody, 2010; Shamir& Korat, 2007; Shamir, 2009). A study of second grade students who read a story using an e-reader also displayed increased motivation when compared to those students who had read traditional print versions (Larson, 2010; Rhodes & Milby, 2007). Results of a meta-analysis of studies using electronic books with K-5 students indicated the technology to be significant in terms of reading motivation (Zucker et. al., 2009). The current study’s retention of the null hypothesis that middle and high school English students using traditional print and electronic books will not display significantly different levels of reading motivation as measured using the Motivations for Reading Questionnaire does not support generalizing these conclusions for students beyond grade 5.
Research has begun to be conducted on reading using the electronic format at the middle and high school levels (Fisher et al., 2011; Mardis & Everhart, 2011). Previous studies, however, have relied upon researcher generated assessments or student surveys in making determinations of effect. The current study’s use of the Gates-MacGinitie Reading Tests®, a validated instrument for measuring reading comprehension, provides full statistical support for making the determination of effect of format on reading comprehension.

**Theoretical Implications**

The results of this study provide support for the theory that schema dictate level of reading comprehension regardless of the text format. Piaget referred to an organized pattern of thought used to explain experiences as a scheme (Piaget, 1952; Shaffer, 2002). Rumelhart (1982) referred to schema as the building blocks of cognition, and schema theory expanded this meaning to include the importance of general knowledge and concept understanding in reading comprehension, specifying that most reading difficulties can be traced to insufficient prior knowledge (Anderson et. al., 1984). Schema theory is based on Goodman’s (1967) psycholinguistic model, which places the ability to anticipate that which has not been seen as vital to reading comprehension (Goodman, 1967). This research supported schema theory in that the format of the text had no effect on reading comprehension. The students’ raw scores on the GMRT® comprehension section were based on their ability to access prior knowledge to process the unknown and make inferences regarding meaning, and were not affected by format.

The use of schema in understanding reading is further explained using Rosenblatt’s (1995) transactional theory of reader response. According to Rosenblatt, each reader considers the material through the lens of their individual experiences, and
works to construct personal meanings as they interact with the text (Keene & Zimmerman, 1997; Miller, 2002). It is during this transaction between the reader and the text that comprehension occurs (Kucer, 2001; Rosenblatt, 1978). This study provides support for the transactional theory of reader response in that format had no effect on comprehension. The students’ raw scores on the GMRT® were dependent upon their interaction with the text, and their ability to construct personal meanings as they interacted with the passages, not on format.

Noyes and Garland (2008) discussed how developments in screen technology lessened the impact of reading difficulties, and noted improvements in the transaction using the improving technology involved in the electronic format. This research provides support for this viewpoint in that the current study utilized tablets to access Riverside Publishing’s (2012) Testing Interface. This newer technology resulted in not only improvements in the transaction using the electronic format, but equivalence in the transaction as measured using GMRT® reading comprehension raw scores.

The theoretical framework for this study’s motivational research is based upon Social Cognitive Theory, specifically the role of Bandura’s (1997) ideas regarding self-efficacy in the motivational level for any task. This view of motivation asserts that efficacy beliefs, involving both intrinsic and extrinsic motivation as well as the individual’s purposes for achievement, play an integral role in the decision to perform activities, and the amount of effort exerted in the chosen activities (Baker & Wigfield, 1999; Bandura, 1997; Eccles et al., 1998; Wigfield et al., 1998). This research provided support for this view of motivation as book format was found to have no significant effect on the motivation to read. The motivation each student reported for reading was
based upon their purposes for achievement and the effort they were committed to exerting to reading, and not based upon the format of the reading.

**Practical Implications**

The results of the current study lead to implications for educational practices in the area of school purchasing and testing. Results indicated no significant relationship between either reading comprehension or reading motivation and book format. In this study, middle and high school students displayed no statistically significant difference in reading comprehension or motivation based upon using paper or electronic books. Given these results, middle and high schools in which students are participants in 1:1 computer programs, or have access to sufficient technology, have a statistical determination of standardized testing results using the electronic format upon which to base testing format decisions. The fact that students using online versions of a standardized test such as the GMRT® showed no statistically significant difference in raw scores provides schools capable of making the transition to the electronic testing format confidence in knowing the move will not adversely affect their students’ academic performance. In addition to the testing confidence provided, results allow administrators to fully consider making the transition to the electronic format for educational materials. In an educational environment in which the 2011 Horizon Report projected a one year or less timeframe for school systems to begin widespread use of eBooks (Johnson et al., 2011), and the 2012 Horizon Report followed with a prediction of widespread use of tablet computers within a one-year timeframe (Johnson et al., 2012), this study’s results provide statistical evidence that students comprehend such text in an equivalent manner to traditional paper texts.
Assumptions and Limitations

This experimental post-test only control-group design and quasi-experimental pretest-posttest control-group design study made every effort to limit the threats to internal and external validity. Although this study accounted for participant selection and assignment, setting, and history, the limitations need to be recognized. This study used a heterogenetic sample and all students who returned permission forms were eligible to participate. The results of this study are only generalized to the current sample population (Shadish, Cook & Campbell, 2002; Tebes, 2000). The research school is located in a small city of approximately 60,000 and a county of 100,000 located in eastern North Carolina (U.S. Census Bureau, 2010). The sample was taken from a school that was 88% Caucasian with tuition nearing or exceeding $10,000 per year (Research School, 2011). While 24% of the student body received tuition assistance, there remained considerable restrictions regarding ethnic and socioeconomic generalizations. The sample was drawn from a school in which 82% of 5th grade students qualified for Duke University’s Talent Identification Program, and 69% of 7th grade students qualified to take the SAT through Duke’s TIP (Research School, 2011). The average 2010 SAT score for the population was 1849 while the U.S. average was 1509 (Research School, 2011). While this limits generalizations on a national level, it does not prevent generalizations to the experimentally accessible population (Gall et al., 2007). These results may differ given a population displaying more variance in academic achievement or socioeconomic status, as studies have displayed that one of the most important influences on student achievement is socioeconomic status (Tajilli, & Opheim, 2005). This study was conducted using a high socioeconomic status sample taken from a school in which a 1:1 tablet program had been implemented. Therefore, all students who
participated in the research were already familiar with using tablet computers. Results may differ when using a population for whom the implementation of technology in the classroom environment is not as normal.

The Motivations for Reading Questionnaire was a self-report measure, and it was assumed that participants’ responses were a true representation of their levels of reading motivation. The self-report measure is a possible limitation in that the researcher cannot guarantee students were completely honest, accurate, and free from external influences (Campbell & Stanley, 1963). Participants may have been vulnerable to emotional, physical, and social stresses which may have contributed to their self-reported reading motivation levels (Crockett, Schulenberg, & Petersen, 1987; Cronbach, 1970).

The possibility of cheating, while minor, also presents a limitation. Students were monitored during the data collection process by test proctors, but cheating remains an influence that must be noted given the fact that all students took the same comprehension and motivation assessments.

While it is unlikely that interference occurred during the data collection process, it must be noted that in the event internal or external influences affected student responses, the results may not be an accurate representation of the independent variable used in the study. The internal validity of this study refers to the accuracy of results collected from the research groups (Keppel & Wickens, 2002). Random assignment of the sample population was the major control for many threats to internal validity in the first part of the study (Keppel & Wickens, 2002). Random sampling allowed for participant biases to be equally distributed across the two groups, and decreased the possibility of biases interfering with the results (Shadish et al., 2002). An experimental, post-test only
control-group design prevented familiarity with the testing instruments or peer discussion from influencing results. The experimental, post-test only design offered researcher control for threats and ensured results were valid and accurate representations of the sample population (Shadish et al., 2002). The quasi-experimental pretest-posttest design was used for research question two as random sampling was not possible. MRQ groups used classroom assignment, not individual assignment. A pretest was used to control for threats to internal validity. Pretest results were analyzed to ensure there were no existing group differences prior to implementation of the treatment.

Despite the possibility of limiting influences on data and results, this study attempted to determine the effect of book format on the reading comprehension and motivation levels of middle and high school students. To the best of the researcher’s knowledge, the results are an accurate representation of the research procedures and variables used in this study, which are considered to be reliable, practical, and provide an accurate measure of the effect of book format on the reading comprehension and motivation of the research population.

**Recommendations for Future Research**

The planning process for this study revealed several recommendations for future research. The literature review highlighted the belief of multiple researchers that adjustments to readability features possible using electronic books may alter interaction with the text, and thus affect comprehension (Hancock, 2008; Larson, 2009; Gillani, 2010). An extension of the current research could include additional research questions regarding the use of these features, and data could be collected by inserting researcher-created questions at the end of the research instrument.
Additionally, a study should be conducted to determine individual grade level differences that may exist within a population. Previous research cited within the literature review indicated that electronic books improved reading motivation for K-5 students. This research found no effect on reading motivation for students in grades 6-12. Further research is necessary to determine if such a grade level difference truly exists, and if so, at which grade level the change in effect on motivation occurs.

The review of literature also indicated that despite student acceptance of the electronic format, many students still simply preferred print. The current study could easily be furthered through an additional research question, and an accompanying researcher-created survey to collect student format preferences.

This focus on preference should also be expanded to include teachers. The current study’s use of the GMRT® online and the accompanying Interactive Results Manager (iRM) displayed for the researcher the ease with which results can be obtained via the electronic format (Riverside Publishing, 2012). The provision of tools increasing the efficiency of grading may impact format preference for the teachers involved, and the inclusion of additional research questions could be used make this determination.

An additional recommendation for research involves the time required to finish electronic reading. Research has indicated students are more likely to skim electronic texts, reading in an “F” pattern searching for key words rather than line by line (Woody et. al., 2010). The GMRT® online administrator has access to elapsed time information for electronic test takers. The current study could be furthered by having the paper test administrators record finishing times for a statistical comparison of the two groups. The final recommendation for future research involves the use of the obvious tablet choice,
Apple’s iPad. This study attempted to use the iPad as the device for online GMRT® testing, but the device’s inability to use Adobe Flash forced the researcher to alter the study to include a tablet capable of accessing Riverside Publishing’s (2012) Testing Interface. Research needs to be conducted to determine if the lack of effect on reading motivation found when using the Lenovo X220 tablet is retained when using the much more popular Apple tablet.

Continued research regarding format is critical. As school’s further transition to the use of electronic formats, statistical evidence for technological implementation will guide administrative decisions. The current study represents a step towards our understanding of the effect of the electronic book format on middle and high school students, but more research is necessary to guide how far the technological transition is taken within secondary education.

Summary and Conclusions

The purpose of this study was to determine the effect of electronic books on the reading comprehension and motivation levels of middle and high school students. Results indicated there was not a statistically significant difference in either comprehension or motivation levels based on book format. Students in the experimental group using electronic books displayed similar GMRT® raw scores and similar reading motivation scores when compared to students in the control group using traditional paper materials. Based on the results, electronic books were found to have no effect on the reading comprehension and motivation of middle and high school students. These results suggest the time for transition to the electronic format has arrived. The decreased cost, maintenance, environmental impact, and portability offered using the electronic format, along with a statistical analysis displaying how this transition does not adversely affect
student academic achievement, provides sufficient incentive for schools to make the
electronic transition if they are technologically equipped to do so.
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Rocky Mount Academy. (2011). *Profile.* Retrieved from


September 6, 2012

Casey Wells

IRB Exemption 1395.090612: Do Students Using Electronic Books Display Different Reading Comprehension and Motivation Levels than Students Using Traditional Print Books?

Dear Casey,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects’ responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.
If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

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

(434) 592-4054

Liberty University | Training Champions for Christ since 1971
APPENDIX B

Parental Consent Form

DO STUDENTS USING ELECTRONIC BOOKS DISPLAY DIFFERENT READING COMPREHENSION AND MOTIVATION LEVELS THAN STUDENTS USING TRADITIONAL PRINT BOOKS?

Casey L. Wells, Doctoral Candidate
Liberty University, School of Education

Your child is invited to participate in a research study designed to explore the effect of electronic books on the reading comprehension and motivation levels of middle and high school students. They were selected as a participant because of their enrollment in an English course at the research school. We ask that you read this form and ask any questions you may have before agreeing to participate in this study.

This study is being conducted by: Casey L. Wells, Doctoral Candidate at Liberty University.

Background Information

The purpose of this study is to determine if there is a statistically significant difference in the reading comprehension and reading motivation levels of middle and high school English students when using eBooks versus traditional print books. Given the increasing popularity of tablet computers and eReaders, there is a significant shift from the traditional print book format to the electronic book format occurring in our society. As these devices are increasingly incorporated in middle and high school settings, their effect on reading comprehension and motivation requires further examination.

Procedures

If you allow your student(s) to participate in this study, their participation will require two sessions and a total of 55-60 minutes. Both sessions will occur during their regularly scheduled FLEX period. During session one, students will be administered the Gates-MacGinitie Reading tests, a 35 minute test of reading comprehension. Students will be randomly assigned to take the test using either the paper format, or through an online version accessed using a Lenovo X220 tablet computer. During session two, all students will take the Motivations for Reading Questionnaire, a 15-20 minute survey to determine their level of reading motivation.

Risks and Benefits of the Study
The risks involved in this study are no more than what any participant would encounter during a normal school day. If your student participates, the assessments will occur during a normal FLEX period, thus no additional time is required, and no other classes will be interrupted.

The benefits of this study include the opportunity to help establish the effect of the electronic book format on academic performance at the middle and high school levels. Few studies have attempted to make this determination, and this research will begin to address how this technological transition is affecting student performance at this level.

**Compensation**

Students will not be compensated for participation in the study.

**Confidentiality**

The records of this study will remain private. All data will be collected anonymously, and published reports will include no information that makes it possible to identify a subject. Research records will be stored securely and only the researcher will have access to the records. Names of participants will not be used. Summaries of findings will use only group designations, noting the comparisons between the traditional print group and the electronic group. Upon completion of the study, the researcher will make results available if requested.

**Voluntary Nature of the Study**

Participation in this study is voluntary. Your decision will not affect your student’s current or future relations with the researcher, Liberty University, or the Research School. If you decide to allow participation, your student is free to not answer any question or withdraw at any time without affecting those relationships.

**Contacts and Questions**

Provided below are the names of the committee members overseeing this project:

Dr. Amanda Rockinson-Szapkiw, Committee Chair  
Assistant Professor, Liberty University  
aszapkiw@liberty.edu

Dr. David E. Holder, Committee Member  
Assistant Professor, Liberty University  
deholder@liberty.edu

Dr. Daphne O’Brien, Committee Member  
Teacher, Research School  
dobrien@liberty.edu

If you have any questions or concerns regarding this study, please contact the researcher at clwells2@liberty.edu, or any of the committee members at the email addresses listed above.
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, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at fgarzon@ liberty.edu.

Parent Consent/Student Assent Forms

*Please sign and return this form to the student’s homeroom teacher.*

**Statement of Consent**

I have read and understood the above information. I have asked questions and received answers. I understand that all data will be secured at all times by the researcher, and consent to allowing my student to participate in this study. I understand that I may withdraw my consent and discontinue my child’s participation at any time.

Signature of Parent or Guardian: ___________________________ Date: __________

Signature of Investigator: ___________________________ Date: __________

**Student Assent Form**

I, _______________________, understand that my parents/guardians have given me permission to participate in a study regarding the effect of electronic books on reading comprehension and motivation. I am participating because I want to. I have been told that I can stop at any time if I so desire. The researcher is Casey L. Wells who is currently a doctoral candidate with Liberty University.

_______________________________
Student Signature

_______________________________
Date

_______________________________
Researcher’s Signature

_______________________________
Date
APPENDIX C

School Approval Letter

August 30, 2012

To Whom It May Concern:

I, Beth Covolo, grant permission to allow Casey Wells to conduct a quantitative study examining the effect of electronic books on the reading comprehension and motivation of middle and high school students at [Redacted]. I understand that the information gathered would be for research purposes only, and the identity and identifying information of all participants will be kept confidential.

Sincerely,

[Signature]

Beth Covolo
Head of School
APPENDIX D

Gates-MacGinitie Reading Tests

The Gates-MacGinitie Reading Tests © was used as the instrument for measuring reading comprehension. Due to the instrument being copyrighted, the instrument was purchased from Riverside Publishing.


Motivations for Reading Questionnaire

1. I like being the best at reading.

2. I like it when the questions in books make me think.

3. I read to improve my grades.

4. If the teacher discusses something interesting I might read more about it.
5. I like hard, challenging books.

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6. I enjoy a long, involved story or fiction book.

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7. I know that I will do well in reading next year.

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8. If a book is interesting I don’t care how hard it is to read.

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9. I try to get more answers right than my friends.

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10. I have favorite subjects that I like to read about.

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11. I visit the library often with my family.

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12. I make pictures in my mind when I read.

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13. I don’t like reading something when the words are too difficult.

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14. I enjoy reading books about people in different countries.

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15. I am a good reader.

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16. I usually learn difficult things by reading.

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17. It is very important to me to be a good reader.

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18. My parents often tell me what a good job I am doing in reading.

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19. I read to learn new information about topics that interest me.

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20. If the project is interesting, I can read difficult material.

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21. I learn more from reading than most students in the class.

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22. I read stories about fantasy and make believe.

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23. I read because I have to.

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24. I don’t like vocabulary questions.

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25. I like to read about new things.

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26. I often read to my brother or my sister.

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27. In comparison to other activities I do, it is very important to me to be a good reader.

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28. I like having the teacher say I read well.

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29. I read about my hobbies to learn more about them.

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30. I like mysteries.

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31. My friends and I like to trade things to read.

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32. Complicated stories are no fun to read.

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33. I read a lot of adventure stories.

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34. I do as little schoolwork as possible in reading.

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35. I feel like I make friends with people in good books.

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36. Finishing every reading assignment is very important to me.

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37. My friends sometimes tell me I am a good reader.

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38. Grades are a good way to see how well you are doing in reading.

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39. I like to help my friends with their schoolwork in reading.

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40. I don’t like it when there are too many people in the story.

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41. I am willing to work hard to read better than my friends.

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42. I sometimes read to my parents.

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43. I like to get compliments for my reading.

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44. It is important for me to see my name on a list of good readers.

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45. I talk to my friends about what I am reading.

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46. I always try to finish my reading on time.

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47. I am happy when someone recognizes my reading.

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<thead>
<tr>
<th></th>
<th>Very Different From Me</th>
<th>A Little Different From Me</th>
<th>A Little Like Me</th>
<th>A Lot Like Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

48. I like to tell my family about what I am reading.

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49. I like being the only one who knows an answer in something we read.

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50. I look forward to finding out my reading grade.

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51. I always do my reading work exactly as the teacher wants it.

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52. I like to finish my reading before other students.

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53. My parents ask me about my reading grade.

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