UNDERSTANDING HIGH SCHOOL STUDENTS’ EXPERIENCES WITH
MULTITOUCH DIGITAL TEXTS

by

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A DISSERTATION

Presented to the Faculty of
The Graduate College at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Doctor of Philosophy

Major: Educational Studies
(Instructional Technology)

Under the Supervision of Professor David W. Brooks

Lincoln, Nebraska

December, 2014
ABSTRACT
UNDERSTANDING HIGH SCHOOL STUDENTS’ EXPERIENCES WITH MULTITOUCH DIGITAL TEXTS

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University of Nebraska, 2014

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This research study examined how high school students viewed the introduction of electronic books into the curriculum. The transition from printed text to digital text is ongoing and much of the research being conducted is interested in looking only at the components of these books: hypertext (i.e., the embedding of links into the text itself), interactive multimodal learning environments and the experience of onscreen reading. To date, research into how students and teachers perceive the use of digital text, especially text that is more advanced than hypertext is lacking. This study was phenomenological in nature, seeking to understand the beliefs and attitudes towards multitouch books from the student point of view. The sample was 18 students in a U.S. History class and their teacher at an urban, Midwestern high school. The researcher interviewed participants, examined logs of student access to evaluate student use and observed students and their teacher interacting with electronic books. After analysis five themes emerged: Appearance Matters, Limited Interaction, The Conduit Matters, The Book as a Tool and Students Straddling the Digital and Physical World.
Dedication

This thesis is dedicated to my family, specifically my parents, Mike and Sandy Lee and my aunt, Susan Dolezal. Without their help and support, I would not have been able to complete this work.
Author’s Acknowledgement

The author would like to acknowledge several groups of individuals for their support and help. Without each of you, this dissertation would not be possible.

First, my committee for keeping me focused and providing me the expertise in the areas I was lacking.

My colleagues and friends, Bob Brousek and Nathan Bramley, for allowing me into your department/classroom and for providing many of the resources needed to complete this study. Without your help and cooperation this study would not have been possible.

Dr. Paul Lindgren, for providing me with words of encouragement and motivation to complete this project. You encouraged me to begin my doctoral program. The support for this study through your words and deeds was essential for me to finish it.

Lastly, to my advisor Dr. David Brooks for not allowing me to become complacent in my pursuit of this degree. Thank you for your help and for constantly pushing me to complete this study.
# Table of Contents

Copyright 2014, Matthew J. Lee........................................................................................................i

Dedication ........................................................................................................................................... ii

Author's Acknowledgement .................................................................................................................. iii

List of Multimedia Elements .............................................................................................................. viii

Chapter 1 ........................................................................................................................................... 1

Background of the Problem .................................................................................................................. 1

Purpose Statement and Research Questions ....................................................................................... 3

  Research Questions to be Explored ................................................................................................. 3

  Definition of Terms .......................................................................................................................... 3

Organisation of the Study .................................................................................................................... 5

CHAPTER 2 ....................................................................................................................................... 6

Introduction ....................................................................................................................................... 6

Hypertext and Hypermedia .................................................................................................................. 6

Onscreen Reading ............................................................................................................................... 11

Interactive Multimodal Learning Environments ................................................................................. 13

CHAPTER 3 ....................................................................................................................................... 17

Introduction ....................................................................................................................................... 17

Selection of Methodology .................................................................................................................... 17

Phenomenology Research Design Characteristics .............................................................................. 18

Role of the Researcher and Positioning .............................................................................................. 19

Participants ......................................................................................................................................... 20

Data Collection .................................................................................................................................. 21
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Analysis</td>
<td>22</td>
</tr>
<tr>
<td>Standards of Validation</td>
<td>23</td>
</tr>
<tr>
<td>Triangulation</td>
<td>23</td>
</tr>
<tr>
<td>External Audit</td>
<td>24</td>
</tr>
<tr>
<td>Rich, Thick Descriptions</td>
<td>24</td>
</tr>
<tr>
<td>Ethical Considerations</td>
<td>24</td>
</tr>
<tr>
<td>Summary</td>
<td>25</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>27</td>
</tr>
<tr>
<td>Introduction</td>
<td>27</td>
</tr>
<tr>
<td>The Participants</td>
<td>29</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>38</td>
</tr>
<tr>
<td>Introduction</td>
<td>38</td>
</tr>
<tr>
<td>Appearance Matters</td>
<td>40</td>
</tr>
<tr>
<td>Appearance of the Multitouch Book Versus Other Forms of Digital Text</td>
<td>40</td>
</tr>
<tr>
<td>The Multitouch Book is Designed for Today</td>
<td>42</td>
</tr>
<tr>
<td>Appearance Makes for Easy Understanding</td>
<td>44</td>
</tr>
<tr>
<td>A Few Negatives for Some</td>
<td>46</td>
</tr>
<tr>
<td>Limited Interaction</td>
<td>47</td>
</tr>
<tr>
<td>Interactivity as an Add-On</td>
<td>50</td>
</tr>
<tr>
<td>Most Used Features</td>
<td>52</td>
</tr>
<tr>
<td>Interactivity Elements Receiving Little Use</td>
<td>57</td>
</tr>
<tr>
<td>The Conduit Matters</td>
<td>60</td>
</tr>
<tr>
<td>Technology Problems</td>
<td>60</td>
</tr>
<tr>
<td>Challenges to Reading on a Screen</td>
<td>63</td>
</tr>
</tbody>
</table>
A Strong Dislike of Traditional Textbooks........................................................................65

The Book as a Tool........................................................................................................68

No Universal Definition of Reading ..............................................................................68

Usage Fits with What is Assigned..............................................................................70

How Students Viewed the Book..................................................................................75

Students Straddling the Digital and Physical World ..................................................77

Liking the Idea of Technology.....................................................................................77

One Foot in the Physical World.....................................................................................79

One Foot in the Digital World.......................................................................................81

Summary.......................................................................................................................83

Chapter 6....................................................................................................................85

Review of Findings.......................................................................................................85

How do students feel their approaches to reading have changed since the
incorporation of multitouch books?.............................................................................86

How do students view the process of reading with multitouch books?.......................86

What are student’s beliefs as to the impact of multitouch books on reading
comprehension?............................................................................................................87

What aspects of multitouch books do students view as helpful to learning?..............87

Implications..................................................................................................................87

Limitations...................................................................................................................89

Recommendation for Future Research........................................................................91

Conclusions..................................................................................................................92

Works Cited..................................................................................................................94

Appendices.................................................................................................................98
Appendix A: School District Consent ................................................................. 99
Appendix B: IRB Approval Letter ........................................................................ 100
Appendix C: Parent Consent Form ...................................................................... 102
Appendix D: Student Assent Form ...................................................................... 104
Appendix E: Demographic Questionnaire ......................................................... 105
Appendix F: Semi-Structured Interview Questions ......................................... 106
Appendix G: Class Announcement .................................................................... 107
Appendix H: Study Reminder ............................................................................. 108
Appendix I: Code Frequency Tables ................................................................. 109
Appendix J: Letter From External Auditor ....................................................... 111
List of Multimedia Elements

Table 4.1: Summary of Participant Demographics........................................28
Figure 5.1: Web of Main Themes..............................................................39
Figure 5.2: A Sample Page from a Multitouch Book..................................43
Figure 5.3: Differences in Presentation- PDF versus Multitouch Book.........45
Figure 5.4: Sample Page of Interactive Features.......................................48
Figure 5.5: Sample Usage Data Graph....................................................73
Chapter 1

INTRODUCTION

Students’ lives are becoming increasingly more digital. School districts are also transitioning to more digitally orientated learning, investing heavily in technology and expecting a return on that investment through increased achievement scores and cost savings on other items. One example of this transition is the movement from printed text to digital text. Such a shift causes many changes for students and teachers. This study will explore what the shared experiences are for students introduced to a digital textbook.

Background of the Problem

Students in the modern classroom have access to and engage with an increasing number of new technologies. Recent data shows 97% of classrooms have one or more computers and the overall computer to classroom ratio in United States public schools is 5.3:1 (U.S. Department of Education, National Center for Educational Statistics, 2010). Further, the U.S. Department of Education (2010) reported other technologies such as LCD projectors, interactive whiteboards and digital cameras have also become pervasive. Outside of school, teens likewise are immersed in technology more than ever before. Cellphone, tablet and laptop ownership have all increased to the point where 93% of teens either have a computer or have access to one at home (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). With this increasing amount of technological access, many researchers have classified this generation of students as “digital natives” who are fundamentally different from previous generations (Prensky, 2001). Schools have responded by increasing their purchase of digital curriculums and implementing one-to-
one initiatives (White, Ringstaff, & Kelley, 2002). A key part of this implementation is often the use of the electronic book.

The concept of digital textbooks has been around since the mid 1970s, but the increasing prevalence of student access to technology has triggered the need to study the impact of electronic books (Kropman, Schoch, & Teoh, 2004). Researchers employing both quantitative and qualitative methodologies have begun to look at electronic text and its impact on student learning, albeit from different points of view. Quantitative researchers have focused on key characteristics of electronic text (i.e., hypertext and hypermedia) while qualitative researchers have only recently begun to examine the lived experiences of those that use electronic books. The basic research provided by the quantitative tradition on hypertext and hypermedia has stayed relevant in the face of rapid technological change, however the experiences of students have changed dramatically over the past decade.

The presentation of digital text has evolved from static displays of text to hypertext (Landow, 1992) to multimodal learning environments (Shepperd, Grace, & Koch, 2008). One incarnation of digital books presents the user with a digitized facsimile of print text (Kropman, Schoch, & Teoh, 2004). Other iterations present text in hypertext format whereby students are able to click on links in the text and be taken to further information about that topic, enabling non-linear access to information (Dillon & Gabbard, 1998). Another, more recent iteration of digital text has been popularized by Apple Inc. in their 2012 introduction of multitouch electronic textbooks (Apple Inc., 2012). These multitouch books combine the experiences of the traditional display of text
with the abilities of hypertext to allow for exploration and multimedia. However, exploration of students’ experiences with this new development is lacking.

**Purpose Statement and Research Questions**

The purpose of this phenomenological study is to describe the experiences of high school students who utilize multitouch digital textbooks at an urban Midwestern high school. It is the goal of this study to explore the essence of the use of multitouch books in the secondary classroom, especially to determine if the experience has changed dramatically compared with findings gleaned from previous research. I utilized an empirical phenomenological approach and based the analysis of data on the methods developed by Moustakas (1994) to answer the question: how do high school students experience digital multitouch textbooks?

**Research Questions to be Explored**

**RQ1:** How do students feel their approaches to reading have changed since the incorporation of multitouch books?

**RQ2:** How do students view the process of reading with multitouch books?

**RQ3:** What are students’ beliefs as to the impact of multitouch books on reading comprehension?

**RQ4:** What aspects of multitouch books do students view as helpful to learning?

**Definition of Terms**

**Hypertext and Hypermedia:** Traditionally, the terms hypertext and hypermedia refer to two separate, but related concepts involving digitized content hyperlinked together. Hypertext referred to the linking of textual content where as hypermedia generally referred to images, sound and other non-text items. For the purposes of this
study, the terms hypertext and hypermedia will be used interchangeably to represent any form of information that has been broken up into chunks or nodes that can then be accessed in a non-linear method (McKnight, Dillon, & Richardson, 1991).

**Multitouch:** In this study, the term multitouch will refer to the ability of users to use more than one point of contact to interact with the electronic book via the touchpad on their computers (Wikipedia). This multitouch ability allows users of the electronic book to perform actions such as swiping a finger across a page to turn it, moving two fingers apart to zoom in and pinching fingers together to zoom out.

**Ebook:** Ebook is a generic term for any electronic representation of text that is presented to students on a screen. The interactivity of these digital books can vary in nature from static images of text, to rich hypermedia experiences that include many digital manipulatives.

**iBooks:** The trademarked name for the computer software used to view multitouch books on a Macintosh computer. Apple released the *iBooks* software for the computer in 2013.

**One-to-One:** A program gaining in popularity whereby a school district or state provides a laptop or other device to each student in a grade level or school. In many cases students are allowed to take these devices home, thus having access to the information on the device twenty-four hours a day.

**Multimodal Learning Environment:** Multimodal environments are learning environments where both verbal and non-verbal modes of presentation are utilized (Moreno & Mayer, Interactive Multimodal Learning Environments, 2007). This could
include the incorporation of voice-overs to text, the incorporation of video instructions along with written definitions, as well as words describing an illustration.

**Organization of the Study**

This dissertation is made up of six chapters. Chapter One provides a brief overview of the topic background, the purpose of the study and the research questions to be explored. Chapter Two presents a review of the literature related to multitouch electronic books, including a focus on hypertext and hypermedia, interactive multimodal environments and the experience of on-screen reading. Chapter Three describes the rationale for utilizing a qualitative approach, along with a detailed description of methods used to discern the essence of reading a digital book. Chapter Four contains descriptions of the studies participants. Chapter Five features a description of central essence of the phenomena of using a multitouch book including a description of what the participants experienced along with how they experienced. Lastly, Chapter Six will discuss conclusions and implications of the study as well as suggestions for future research.
CHAPTER 2
REVIEW OF SELECTED LITERATURE

Introduction

The research to date on multitouch books is limited due to their relatively recent introduction into the educational environment. In contrast, the research surrounding the core concepts used by multitouch books has a much richer literary base. The concepts incorporated into a multitouch book can be broken down into three main categories: hypertext/hypermedia, onscreen reading and multimodal learning environments. The cognitive research on each of these concepts shows positive and negative implications for learning.

Hypertext and Hypermedia

The concept of hypermedia is not new, nor is its role in education. In 1945, Vannevar Bush published an essay, entitled “As We May Think,” laying out his vision of a method to transform how users approach consuming knowledge by redefining how users select information. Instead of utilizing indexes or numbering systems, his system would be based on associations between nodes of information. He envisioned a machine known as the memex to supplement a human’s memory and allow an individual to quickly search for a particular item (Bush, 1945). Bush’s idea for organizing and searching inspired many later researchers and engineers to develop what Ted Nelson would coin “hypertext” (Nelson, 1967). As technology evolved, the ability to link information grew to support non-textual media; Nelson later added the term “hypermedia” to our vocabulary. Today, hypertext and hypermedia refer to the linking of nodes of information through hyperlinks (i.e., highlighted and selectable and actionable...
portions of text) allowing users to access various nodes in a non-linear fashion (McKnight, Dillon, & Richardson, 1991).

The ability to rapidly access vast amounts of interlinked information on demand has motivated educators to try to incorporate it into the classroom (Antonenko & Niederhauser, 2010). Implementations of hypermedia in education can be seen in the use of digital textbooks, online databases, digital tutoring systems and forms the basis of the Internet. Schools are increasingly going digital and looking for ways to individualize education for each student. Hypermedia is playing a key role in that transformation.

Proponents of hypermedia cite several key advantages. These advantages include on-demand access to content, self-paced reading, increased student engagement and the similarity of how hypertext works compared to the workings of the human mind (Dillon & Gabbard, 1998). Landow (1992) also argued that hypermedia forces the user to take a more active role in the learning process with the learner seeking out and selecting what information should be read next. Research has shown these benefits also come with a downside. The inherent nature of this task of exploration (i.e., selecting one node and then having to make a conscious choice as to what node to select next) introduces demands upon the reader (Dillon & Gabbard, 1998). A better understanding of why this is the case requires an understanding of cognitive load theory.

Cognitive load theory states a student’s working memory can be overwhelmed by the mental processing needed to understand content when it is combined with the mental processing needed to cope with the method in which the content is presented (Cooper, 1998). With this in mind, current research has identified three types of cognitive loads: intrinsic, extraneous and germane. Intrinsic cognitive load is the mental effort that is
required by the content itself. This type of load is generally regarded as being fixed and is a function of the complexity of the content as defined by the amount of element interactivity required (Paas, van Gog, & Sweller, 2010). Extraneous load is caused by element interactivity that is not essential to the task required of the learner (Paas, van Gog, & Sweller, 2010). Schnotz and Kurschner (2007) summarized that extraneous load is a product of inefficient lesson design which requires students to utilize working memory capacity to process irrelevant elements. Extraneous load can be reduced using effective instructional design (Cooper, 1998). Germane cognitive load on the other hand is defined as the use of working memory resources used to process elements that contribute to learning (Paas, van Gog, & Sweller, 2010). Tasks contributing to germane load use working memory resources to construct schemas. These schemas ultimately allow for increased efficiency in completing tasks with high intrinsic load (Sweller, 2005).

These three types of cognitive load are additive, meaning they each compete for a learners working memory (Schnotz & Kurschner, 2007). For example, if the introduction of increased germane load does not come with a corresponding reduction in extraneous load, a learner’s working memory will still be exceeded. Similarly, if learners are asked to complete a task in which intrinsic load is high, there will be little overhead available for any non-relevant information (i.e., extraneous load). In education, tasks that are new to the learner (i.e., accessing content for the first time) impose higher cognitive loads because the learner does not have pre-existing schemas to draw from, causing each new bit of information to be processed separately. This increased element interactivity can exceed the learner’s working memory, causing learning to suffer. To help alleviate this
Lee

problem, instructional materials should focus on reducing extraneous cognitive load and increasing germane cognitive load as long as the total does not exceed the users overall capacity (Sweller, 2005).

Antonenko & Niederhauser (2010) examined the influence of different types of hypermedia on cognitive load. In their study, it was found cognitive load increased with the use of hypermedia due to the requirement that the individual interacting with the text had to decide which node to access next. This confirms the results of a previous study by Recker and Priolli (1995) who examined how hypermedia and students’ ability levels are related. It was found lower level learners were overwhelmed by hypermedia and were not able to take advantage of its many features. Students interacting with hypermedia did not understand the availability of additional nodes for exploration (the idea of “you don’t know what you don’t know”).

Recker and Priolli (1995) continued this exploration by giving students explicit cues about additional information. Lower level students responded with high levels of achievement whereas it had no effect on higher-level students. Antonenko & Niederhauser (2010) expanded on this through embedding leads (i.e., short preview of information displayed to the user before clicking on a link) into the hypermedia in an attempt to reduce extraneous cognitive load. It was found that leads used in pop up “tool tips”, rollover previews and other just-in-time information increased comprehension and reduced extraneous load (Antonenko & Niederhauser, 2010). Any increase in extraneous load reduced the amount of overhead available for reflection.

These reductions in extraneous cognitive load were deemed important for reading comprehension as constant monitoring and self-reflection is required for success. Further,
if students are presented with a hypermedia without adequate pre-existing schemas, they will not understand how to incorporate new knowledge into their existing schemas without proper guidance. Students of higher ability levels presumably have greater amounts of background knowledge and know what areas need to be filled in.

Understanding learning and hypertext was also the subject of Dillon and Gabbard’s (1998) study. They compared comprehension between hypermedia and traditional print media. It was found in general, there was no significant difference in comprehension between hypermedia and print media. Closer examination however, led to several important conclusions. Dillon and Gabbard (1998) found certain types of tasks are well suited for hypermedia. These tasks, coined as “reading to do”, played to the main features of hypermedia. Tasks that required quick access such as looking up definitions of words, finding and comparing visual details and searching for specific details benefited from the quick access provided by hyperlinks and the inherent ability of digital text to be searched. Those tasks that required deeper thinking, termed “reading to learn” showed a different result. When students were asked to read long passages of text and synthesize the content, hypermedia was shown to be less effective compared with traditional print-based media. It was hypothesized the increased cognitive load of hypertext hindered the ability of participants to understand and synthesize the information presented to them (Dillon & Gabbard, 1998).

As shown, the research on hypermedia indicates positive and negative outcomes on learning. Hypermedia can be beneficial to learning when individuals are presented with search and find tasks and when presented with leads to preview content. Conversely, if students are presented with tasks that are poorly constructed or force the user to process
multiple nodes of information, learning suffers. The cognitive effects of hypermedia are not the only factor in student learning, the experience of reading on a screen can also play a key role.

**Onscreen Reading**

It has been shown reading text on a screen is inherently unique and any attempts to force print text into the new paradigm will fail (Berg, Hoffmann, & Dawson, 2010). As opposed to printed books, students’ today view screens as a window into a reality centered on the computer and not just a method of presenting information (Introna & Ilharco, 2006).

Although grounded in the physical world, the digital world is itself unique. Berg, Hoffmann & Dawson (2010) set out to study how these two worlds differ through an examination of students’ use of digital text. They identified four reading strategies employed by students that are unique based on the medium they are consuming. When students used printed text, they tended to read them sequentially. Digital text, tended to be read by accessing small chunks of information and not necessarily in a particular order. Students also found printed text to be more tangible which contributed to a reported feeling of familiarity and comfort. Text read on a screen was reported to be unfamiliar and foreign. Berg, Hoffmann, & Dawson (2010) also found when students tried to utilize techniques they had found to be successful with reading in physical books they were unsuccessful with ebooks. Conversely, students associated anything presented on the screen to be interactive and expressed frustration at the lack of capabilities of the digital text used at the time (i.e., static representations of paper text).
Hernon, Hopper, Leach, Saunders, & Zhang (2006) examined how students interact with digital text and found a fundamental difference from that of paper text. Students reported when reading text on a screen they were much more likely to browse or scan the content as opposed to reading through entire chapters. To students, ebooks are something that was to be used to find short bits of information, not something to be read from cover to cover (Hernon, Hopper, Leach, Saunders, & Zhang, 2006). Supporting this finding is Bauerlein’s (2008) essay on online literacy. He found when presented with text on a screen, readers utilize an “F” pattern where they read through the first few rows completely, but quickly began to skim, reading less and less of each following line. This pattern has also been described as the butterfly effect (Bezdan, Kester, & Kirschner, 2013). Students have expressed this reading pattern in their own way, by reporting a feeling of disjointedness when using digital text (Hernon, Hopper, Leach, Saunders, & Zhang, 2006). Bauerlein (2008) claimed this effect lead to a shallower understanding of the text and a lack of flexibility with interpreting the information.

Additional research has been conducted into college students’ experiences with onscreen reading. Rose (2011) examined the essence of onscreen reading for college aged students and found a number of similarities with the previously discussed research. Student participants also reported feeling a disconnect between paper text and digital text. Rose found students were distracted by the amount of scrolling required, which would take them away from the text and cause them to focus on the screen itself. Research participants in Rose’s study echoed the findings of Bauerlein (2008) and Hernon, Hopper, Leach, Saunders & Zhang (2006) by stating they preferred to use search functions to find key words and felt they were more “efficient” at reading when using digital text.
The experience of onscreen reading is even more pronounced with younger students. In a study of South Korean elementary students, Seomun, Lee, Kim et al. (2013) reported students felt high levels of stress when assigned online readings. Students were overwhelmed by the medium and could not focus on the content. They reported fear of having the computer fail, unfamiliarity with how to deal with errors and an increase in the amount of distractions they had to overcome to focus on the onscreen reading. When things did not work as planned, students reported feeling frustrated and a sense of helplessness (Seomun, et al., 2013).

Even though the majority of research shows onscreen reading is experienced negatively by students, they tend to view themselves as more efficient consumers of information. When reading on a screen students praise the ability to quickly search for and scan large amounts of text (Rose, 2011). Students also praise onscreen reading for its convenience. Part of the positive experience of online reading is not having to carry around heavy printed texts because students access ebooks and read from screens they are already carrying with them (Hernon, Hopper, Leach, Saunders, & Zhang, 2006). The experience of using electronic books and onscreen digital text is mixed.

**Interactive Multimodal Learning Environments**

Interactive multimodal learning environments are another component of the modern ebook. These environments combine two different modes to present information to the user in an interactive way (Moreno & Mayer, 2007). Modes consist of the codes used to represent information, exemplified by verbal and non-verbal methods. Multiple modalities have shown to be effective in dealing with cognitive load issues with the result of increasing learning. The brain’s independent auditory and visual channels can be
leveraged in a multimodal environment to expand effective working memory (Moreno, 2006). This expansion can free up cognitive space that will be needed by the increased cognitive load required by the interactive elements themselves, while allowing for deeper processing.

Moreno & Mayer (2007) explored the impact of these multimodal learning environments when combined with user interactivity. As defined by Moreno & Mayer (2007), interactivity is the ability of an environment to respond to the commands of the users and can be created using one of five methods: 1) Dialoguing, which is the process by which the learning environment and the learner interact in a way that exchanges information; 2) Controlling, which is when the learner is given the means to decide the pace of presentation; 3) Manipulating, that describes the interactivity where the learner can engage the learning environment by moving objects around on the screen, setting the rules of a simulation and changing the viewpoint of a presentation; 4) Searching, which is the act of providing the learning with a method of finding information based on input (usually text based); and 5) Navigating, which allows the learner to explore the learning environment through the implementation of menu structure. This helps the learner select the content that is presented to him/her. Each of the interactive methods can be found in multitouch books, with the exception of manipulation.

Expanding on Moreno & Mayers’s (2007) work was Domagk, Schwartz, & Plass (2010). In addition to the Moreno & Mayer’s (2007) five types of interactivity, Domagk, Schwartz, & Plass (2010) also included guidance and feedback. Guidance and feedback was defined as the ability of the learning environment to direct the learners cognitive processes (Domagk, Schwartz, & Plass, 2010). They noted an interactive multimodal
Learning environment is a dynamic process through which the learner progresses, rather than a static feature (Domagk, Schwartz, & Plass, 2010). Interactive systems allow the creation of learning environments that stimulate learning. For example, the learning environment can provide feedback that becomes more detailed as a user repeatedly takes a quiz or the system can present hints that help users navigate through the environment (Domagk, Schwartz, & Plass, 2010). Moreno & Mayer (2007) also found advantages in interactive multimodal environments. Through incorporating controlling into the presentation of text and videos, subjects were able to reduce cognitive load by eliminating the need to hold multiple chunks of information in working memory. This was accomplished by breaking information up into smaller chunks in which users could replay at their own pace until mastery was achieved and they could move on. Without the ability to interactively control a presentation, learners have to both process and look for meaning within larger amounts of content as it automatically advanced, overloading working memory (Domagk, Schwartz, & Plass, 2010).

Research into the components of multitouch books in the areas of hypermedia, onscreen reading and interactive multimodal learning environments all point to a view of multitouch books that is mixed as to their effectiveness and perception as an educational tool. Hypermedia enables students to dynamically access vast amounts of information, but at the cost of increased cognitive overhead (Dillon & Gabbard, 1998). Further, when presented on a screen (as all hypermedia is) students tend to alter their reading patterns and adopt reading methods which lead to a disjointed understanding of the text (Hernon, Hopper, Leach, Saunders, & Zhang, 2006). Recent innovations such as interactive multimodal learning environments have been developed to try and increase
comprehension and reduce cognitive load (Moreno & Mayer, 2007). These environments have been found to be effective for learning. What is lacking in the research is how a digital multitouch book, incorporating hypertext and multiple modalities is perceived from a student point of view.
CHAPTER 3
CONCEPTUAL FRAMEWORK AND METHODOLOGY

Introduction

This study seeks to examine the lived experience of using a digital, multitouch textbook as a high school student. Information gathered through observations, analysis of usage data and semi-structured interviews was used in order to provide answers to the central research question: how do high school students experience digital multitouch textbooks?

Four sub questions will also be explored in order to obtain a more detailed understanding of the essence of the phenomenon. These questions include:

RQ1: How do students feel their approaches to reading have changed since the incorporation of multitouch books?

RQ2: How do students view the process of reading with multitouch books?

RQ3: What are students beliefs as to the impact of multitouch books on reading comprehension?

RQ4: What aspects of multitouch books do students view as helpful to learning?

In order to provide answers to these questions, a qualitative approach based on the research of Moustakas (1994) was used.

Selection of Methodology

Qualitative research focuses on coming to a richer understanding about the phenomenon in question, through the perspective of those involved (Van Maanen, 1979; Merriam, 2009; Creswell, 2013). Research questions that involve examining complex systems where individual variables cannot be isolated are an area in which qualitative
research excels (Creswell, 2013). Further, researchers should employ qualitative methods when there is a mismatch between traditional statistical analytical methods and the research problem and when researchers are trying to give voice to groups that historically have not been able to express themselves (Creswell, 2013). Research to date has focused on individual components of multitouch books (i.e., hypermedia, onscreen reading and interactive multimodal environments) but not on the experiences of those combined. Also underreported is the experience of an essential element of the learning process, that of the student. Quantitative studies have reported the outcomes of highly abstracted experiments, but the attitudes and experiences of those involved have not had their voices heard. Because of this, and the multitude of variables involved in multitouch books, qualitative research provides tools to holistically explain this complex issue in ways not available to purely quantitative researchers.

**Phenomenology Research Design Characteristics**

When seeking to examine several individuals’ common perceptions and experiences with a particular phenomenon, a phenomenological approach is recommended (Merriam, 2009). Specifically, this study utilized an empirical phenomenological approach where the research seeks not to interpret the experiences of the participants, but rather present the fullest, richest description possible (Creswell, 2013). To achieve this, the researcher suspends his prior beliefs and separates out his prior experiences through a practice known as bracketing (Moustakas, 1994). Bracketing allows the researcher to focus their findings on the experience of the participants, rather than an interpretation of the researchers personal beliefs. Analysis with this approach consists of examining data to develop a textual description of what the participants
experienced and a structural description of how they experienced it. Combined, these two descriptions create the description of the overall essence (Creswell, 2013). This study’s research question fits particularly well with the outlined method by seeking to describe fully the experiences high school students have had with multitouch books.

**Role of the Researcher and Positioning**

The role of the researcher in this study is to present a rich, thick description of the lived experiences of students who use multitouch books in the classroom. To do this, the researcher must both understand the reports of the research participants and understand how the researcher’s own background and beliefs influence his interpretations (Creswell, 2013). Following the advice of Creswell (2013) and Moustakas (1994) care was taken to bracket, or isolate, the researchers past experiences with technology in order to present the essence of the multitouch book experience from only the point of view of those participating in the study.

The primary researcher is a male in his early thirties who is an employee of the school district selected for the study. His current role is that of a technology integrationist whose job it is to identify new technologies and develop the best methods for their use in the classroom. As such, he holds a belief as to the positive value and effectiveness of technology in the learning process. He has conducted workshops promoting the use of technology including specifically the use of interactive media. Although not currently a classroom instructor, his prior position with the district was that of a social studies teacher. Because of that, some of the study’s participants had previous experience with him as a classroom teacher.
Participants

Participants in this phenomenological study were selected on the basis of criterion sampling. According to Creswell (2007) criterion sampling ensures the sample will contain only those individuals that have had experiences with the phenomenon in question. While qualitative literature has not established a minimum sample size, this study followed the recommendations of Polkinghorne (1989) and sought to recruit 15-20 individuals according to the following criteria. Participants must have been enrolled in a U.S. History course and each participant must have utilized a multitouch book as their primary text in their class. The sample was drawn from a population of students enrolled in a selected teacher’s class at an urban Midwestern high school.

High school students have been chosen as participants for this study because of the increased amount of interest directed to age group by school districts interested in creating their own text and by vendors interested in entering this space. Although interest is high among these two groups, research into how students perceive multitouch books is lacking. This study seeks to contribute to the literature through giving this group a voice and describing their lived experiences using multitouch books.

Students at this Midwestern high school were selected for this study due to the large amount of reading typically required of students in their courses and prior technology classes. Students at the research site are part of a one-to-one laptop program where they are assigned MacBook laptop computers they have access to twenty-four hours a day.
Data Collection

The researcher provided a selected teacher’s students an ebook for use on their laptops at the beginning of the spring academic semester. After a brief (5-10 minute) introduction of how to access the book, time was spent (20-25 minutes) introducing the students to the many features of the multitouch book. This introduction included how to navigate the text, how to use the multimedia tools (e.g., videos, 3D Models, audio recordings) and how to take notes using the software. At the end of the semester, the researcher collected data in three ways: using semi-structured interviews, classroom observations and usage data generated by device management software installed on each computer.

The semi-structured interviews took place during participants open time at the selected high school. In these interviews, demographic data was collected first to help the researcher describe the participants (see Appendix E). Next, the investigator employed a semi-structured interview protocol (see Appendix F). These interviews allowed the participants to describe their personal experiences with using a multitouch book in their own words. These interviews were recorded and transcribed for analysis using the structured model promoted by Moustakas (1994).

Classroom observations took place three times over the course of the collection period. Each observation was scheduled during a class period in which the students were assigned a task requiring research and the use of reference materials. Assignments observed included students completing ‘word webs’ in which they had to define and provide examples of content specific vocabulary, work time in which they were tasked to gather and organize research for an essay and the completion of a task were students had
to answer several comprehension questions using the text. In each situation, the researcher was in the learning environment in which these activities took place, allowing him to observe how students interacted with the multitouch book. Field notes containing the researchers observations were kept for later analysis and corroboration with the participants interviews.

Lastly, the researcher had access to usage data from the student’s laptop computers. Using the Casper management system, data was collected on how often and how long the students had the iBooks application opened and actively engaged with. The multitouch book is the only media available to be opened in this application, allowing the research to make inferences on the amount of usage the multitouch book received. Also available to the researcher through the iBooks software was the participant’s interactions with the text. These interactions include any highlights or digital margin notes created within the application. Through these three separate forms of data collection the researcher was able to triangulate the experience of students using multitouch books.

**Data Analysis**

Moustakas’ (1994) phenomenological data analysis techniques were used to analyze the collected data (and see Creswell, 2013). The researcher will identified and bracketed his prior experiences with ebook before any data was analyzed. This allowed him to focus on the experience of the participants and not his own. The researcher then examined the three types of data collected (i.e., interviews, observations and usage data). Interview transcripts and field notes were coded to help identify significant statements. Each significant statement was treated as having equal worth, with the goal of such coding being the development of a comprehensive unique list (Creswell, 2013).
All coding and analysis was completed using MAXQDA software. This software allowed the researcher to code each statement made by participants, as well as inserting memos describing significant statements made by the research participants. After the initial coding of the interview transcripts, the significant statements were grouped into larger thematic units. The researcher then examined these thematic units and developed a textual description using *in vivo*, or participant quotes along with the researcher’s analysis of the phenomenon. This textual description will help describe “what” the participants experienced in using ebooks (Moustakas, 1994). After “what” the participants experienced had been gleaned from the data, the researcher developed an understanding of how the experience happened through creating a structural description of the phenomenon (Creswell, 2013). In this instance, the researcher attempted to put the experience of reading ebooks into a wider context of the school environment in which such reading takes place. Finally, the researcher combined the textual and structural descriptions to present the final essence of using multitouch books.

**Standards of Validation**

In order to present the most authentic representation of the shared experience of using a multitouch book possible, Creswell (2013) recommends using several validation strategies. This study will rely on three: data triangulation, peer review and the use of thick, rich descriptions.

**Triangulation**

One of the techniques used in this study’s design is triangulation. Triangulation involves the use of multiple sources and methods to authenticate the report (Creswell, 2013). Qualitative research traditionally relies on interviews and observations as the
primary form of data collection. This study uses both semi-structured interviews in which participants express from their own perspectives their experiences with multitouch books and participant observations. Themes identified from these two sources were corroborated with data gained though the *Casper* system and the *iBooks* software.

*External Audit*

Additionally, a university faculty member whose specialty is qualitative analysis methods conducted an external audit of the researcher’s conclusions. This allowed for an external check of the research process (Creswell, 2013). Additionally, this check forced the researcher to answer questions about the methods selected and the development of codes and themes.

*Rich, Thick Descriptions*

Lastly, the researcher attempted to employ thick, rich descriptions in his presentation of the phenomenon. This allows the reader to see the context of the study and provide for transferability provided a similar context (Creswell, 2013). Further, the goal of these descriptions is to allow for a more detailed understanding of what it is like to use a multitouch book in a high school setting, from the perspective of a high school student.

*Ethical Considerations*

An important aspect in any study is the wellbeing of the study participants. It is believed by the researcher the risks to participants were minimal. This study was conducted in a commonly accepted educational setting in which students were familiar and comfortable. Permission was sought from the school’s classroom teacher, building principal and district administration. Informed consent forms (see Appendix C) were
obtained from students’ parents and students were informed and given assent forms (see Appendix D). Further, this study did not involve sensitive subjects that might cause students emotional stress.

In this study, the primary ethical risk was maintaining the anonymity of the underage participants. To mitigate this, all data was coded and participants given pseudonyms. Another consideration is providing equal educational opportunities for all students in the selected classrooms. In order to provide for this, all students in the selected course were provided with use of the multitouch book regardless of their status as a study participant or not.

Participants were offered two tokens of compensation in exchange for their participation. First, during the interviews, food and drinks was available for students to eat, as some interviews were conducted during times allotted for lunches. Second, upon completion of the interview participants were given a $10 iTunes gift card. The combination of food and a gift card seemed to be enough to offer compensation, but not so much as to coerce students into participating in this study.

Summary

The purpose of this study was to examine the lived experiences of high school students who use a multitouch book. A phenomenological method was employed in order to present the shared experience from the point of view of the research participants. A sample of 21 students was selected from a Midwestern high school. Semi-structured interviews, classroom observations and usage data from the multitouch books were used to collect data. After collection, data was analyzed in accordance with Moustaches’
(1994) phenomenological model. Triangulation, an external audit and thick rich
description strategies were utilized to help verify the accuracy of the data.

The results of this study will help to expand the field of research related to a
growing field in education – that of electronic books. With students and school districts
increasingly looking to go digital, a better understanding of the perceptions of students
will help stakeholders make more informed decisions about this trend. One of more
interesting questions this research sought to answer was to determine whether the
combination of interactive multimodal learning environments with hypermedia in book
format improved students’ experiences as compared with traditional onscreen reading.
Chapter 4

DESCRIPTION OF THE STUDY’S PARTICIPANTS

Introduction

This study was conducted at an urban, Midwestern high school during the spring semester of 2014. Twenty-one students originally volunteered to be participants, but due to scheduling conflicts and technology issues, three failed to complete all parts of the study. The remaining participants each took part in a 20 to 30 minute interview, conducted during the participant’s independent study time. This in-person interview took place in an empty classroom at the school to have an environment in which the participants would be comfortable. Additionally, the participants were observed three times in a classroom setting and each allowed the researcher to examine their computer usage data. To get a better understanding of each research participant, background information was collected through a demographic information form the participants completed prior to the interview process (see Appendix E).

Eighteen students (11 females and 7 males) completed all aspects of this study. Table 1 shows a summary of the research participants. To gauge students’ perceptions of their academic performance, each participant was asked what grade he/she expected to receive in the U.S. History class. Participants were also asked to rate on a scale of 1-5, how comfortable they felt with using their computer. A response of a ‘1’ signified participants were uncomfortable using their computer and a ‘5’ indicated they felt extremely comfortable using their computer. Lastly, participants were asked how often they used their computer for reading (as defined by the students themselves). On this
scale, a 1 indicated they never used their computer for reading and a 5 indicated they used their computer for reading “all the time”.

These individuals, as a group reported feeling extremely comfortable using their computers. Each participant had at least three years of being assigned a school issued laptop computer to take home, with most students having four years. This indicated comfort level did not necessarily coincide with using their computers for reading. As a whole, the group did not spend an overwhelming majority of their time reading on the computer. For these students, classroom-reading assignments typically still came from paper books and the computer was used for reading sports, news and social media posts.

Below is a brief introduction to each student.

**Table 4.1: Summary of Participant Demographics.**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Gender</th>
<th>Age</th>
<th>Expected Grade</th>
<th>Computer Comfort</th>
<th>Use Computer for Reading</th>
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</thead>
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<tr>
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<td>A</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Darla</td>
<td>F</td>
<td>16</td>
<td>A</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Hadia</td>
<td>F</td>
<td>17</td>
<td>A</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Kelsey</td>
<td>F</td>
<td>17</td>
<td>C</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Anna</td>
<td>F</td>
<td>16</td>
<td>A</td>
<td>5</td>
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<tr>
<td>Charlene</td>
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<td>A</td>
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<tr>
<td>Shelley</td>
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<td>B+</td>
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<tr>
<td>Daryl</td>
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<tr>
<td>Kevin</td>
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<td>David</td>
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</tr>
<tr>
<td>Akia</td>
<td>M</td>
<td>16</td>
<td>D</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Don</td>
<td>M</td>
<td>17</td>
<td>B+</td>
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<tr>
<td>Renee</td>
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<td>A</td>
<td>5</td>
<td>3</td>
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<tr>
<td>Mark</td>
<td>M</td>
<td>17</td>
<td>A</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Lindsay</td>
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<td>17</td>
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<tr>
<td>Sandy</td>
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<tr>
<td>Luke</td>
<td>M</td>
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<tr>
<td>Rachel</td>
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<tr>
<td><strong>Mean</strong></td>
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<td><strong>4.7</strong></td>
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<td><strong>3.5</strong></td>
</tr>
</tbody>
</table>
The Participants

Bonnie

Bonnie is a 17 year old female who is in the 11\textsuperscript{th} grade and considers herself a strong student. She indicated an above average comfort level with using her computer and expressed a preference for learning new ways of doing things by employing a trial and error strategy. During my observations of Bonnie, she often engaged in multiple activities at once (i.e., checking email, checking her grades, watching videos on the internet) and required prompting by the instructor to focus on the task at hand. She occasionally uses her computer for reading and considers the amount of time spent looking at the screen to be average. While she does not read novels on her laptop, she does engage with social media and news and sports websites.

Darla

Darla is a 16 year old junior who places a high value on her education. She works hard, many times completing extra assignments just to make sure she understands the topic. She is a dutiful student who always follows the teacher’s directions even when her classmates become distracted. Because of this, she expects to receive top grades. Darla considers herself a digital native that is comfortable and fluent with the computer, although she is just starting to make the switch from reading printed content to reading digital content. She likes the idea the digital reading is “wrapped around technology” which makes the content available to her whenever and wherever she wants to access it.

Hadia

Hadia comes from an immigrant family from the Middle East. English is her second language. She is 17 years old and is a hard worker in the classroom. Although she
considers herself to be very comfortable with the computer, Hadia was often unaware of many of the features of her computer. She rarely sought out new features of her computer, preferring instead to rely on her classmates to show her what they were using. Hadia occasionally grew frustrated when attempting to try out these new features, but likes the idea of what technology can provide her.

**Kelsey**

Kelsey is a 17 year old junior who is quiet in class, but active online. She readily admits to becoming distracted when trying to complete assignments using her computer, but works hard and expects to receive average grades. Partly because of the ease of getting distracted on the computer, she only sometimes uses the computer for reading (mostly short text and social media). Instead, Kelsey prefers to read long passages on paper. For Kelsey, reading is a time consuming task. She spends a considerable amount of time trying to understand what she is reading. When presented with a deadline (i.e., having to finish an assignment by the end the class period), she will resort to skimming the text, looking for words that stand out.

**Anna**

Sixteen-year old Anna is a model student in her U.S. History class. During my observations she would consistently listen for directions and then begin to work on her task immediately. She considers herself a good student and expects to get an ‘A’ in U.S. History. Anna also feels comfortable using her computer, but chooses to stick with the tools and workflows she was shown rather than seek out new ways of doing things. When presented with a new way however, she would readily adopt it if it worked better for her. One thing that she has not adopted is using her computer for all of her reading. She only
occasionally uses her computer for reading, with most of it being the multitouch book in U.S. History class.

**Charlene**

At seventeen, Charlene is a dedicated student. She would always listen to her teacher’s directions and immediately begin her assignments, often completing them before the end of the class period. She is comfortable with computers and does a considerable amount of reading using her MacBook. Charlene stated that her onscreen reading consist mostly of looking at social media and other short form articles. She prefers to read longer pieces of text on paper. Charlene lives a blended lifestyle between the digital and physical world. One example is when given a task that could be completed with only her computer (i.e., complete an online worksheet), she would often write out her answers on paper before typing them up for submitting. Other times, her workflow was reversed. She would highlight and interact with the text on the screen before ultimately re-writing her notes on paper.

**Shelley**

Shelley is a 17 year old junior who is academically minded. She expects to receive an above average grade in her U.S. History class. Shelley works hard on her studies and appreciates anything that can help her save time in completing assignments. Shelley is extremely comfortable using her computer and often can be seen to combine multiple applications together to help her complete tasks. She appreciates the flexibility afforded by digital texts, especially the ability to highlight, search and have the text presented in multiple formats. While she does not user her computer for reading all the
time, she does spend an above average amount of time reading all types of text on her screen.

**Daryl**

Daryl is an extremely confident student. He is 17 years old and is extremely comfortable and familiar with his laptop. Daryl uses his school computer along with his personal tablet and cell phone for reading every day, but not necessary for school related tasks. Due to technical issues with his computer, Daryl had the ability to use the multitouch book, a scanned PDF copy of the print book or the print book itself. When presented with these three options, Daryl chose to use the PDF most often. He has extensive personal experience with multitouch books that he reads for pleasure. Daryl puts value on finding the shortest version of the material that will give him the information that he needs. During my observations of Daryl, he rarely completed his assigned tasks during the class period in which they were assigned. Often times, he would state he preferred to complete his work outside of class. When he was working on his assignment, he would also multitask by rapidly changing between his reading assignment, email and web videos. Once he was asked to leave the classroom because he became a disruption to other students.

**Kevin**

Seventeen year old Kevin is a male who is just beginning to explore the world of digital reading. He reports an extremely high comfort level with his computer, but generally sticks to basic computing activities. The value of digital for Kevin is not the additional features that interactive text could provide, but rather the removal of having to carry and keep track of a physical textbook. Kevin’s preference for on-screen reading was
limited to short-form text (i.e., a textbook section or chapter) or social media. He still prefers to read longer pieces such as novels in physical form. For Kevin, reading on his computer takes place occasionally and mainly in the context of assigned school work.

David

David is a 17 year old male junior who feels he should be receiving top marks in his U.S. History course. David is very task driven and will do what it takes to complete an assignment, but no more. He considers his comfort level with computers to be about average and sometimes needed to ask others in his class for help getting parts of his computer to do what he wanted. David splits his time reading between his computer and printed materials, but expressed a preference for reading class materials off of his computer.

Akia

Akia is a 16 year old male student. He works hard when under the supervision of a teacher, but still struggles academically. He expects to be on the borderline between passing and failing the semester of U.S. History. Contributing to Akia’s struggles is his self-professed dislike of reading. He readily admits he does not like books. Akia only reads what is assigned to him and does not read for pleasure. He expressed a preference for digital text because of two key factors – not having to pay for lost physical books and the ability for the textbook to be read aloud to him. For Akia, the ability to listen instead of read was a major feature of digital. In my observations of Akia, he would begin working in earnest on his assignments when in proximity of the teacher, but had a habit of becoming distracted by the computer when required to work independently.
Don

Seventeen year old Don places value on his relationships with his peers and would often become more focused on keeping up those relationships rather than complete in-class assignments. He utilized many features of his computer to communicate with his friends while he was working on assignments – often keeping up multiple desktops and responding to message prompts. However, Don does place a value on his education and expects to get above average grades in U.S. History. He preferred to complete assignments outside of class time during independent study time when he was alone. Don reported he often, but not all the time, used his computer for reading multiple types of text – web pages, class text in the form of PDFs and multitouch books.

Renee

Renee, 17, is a practical student who looks for the most efficient way to complete her assigned tasks. She feels extremely comfortable with her computer and is willing to try new things. Renee likes the idea of using her computer for reading, but still uses a combination of print and digital books. She has used the iBooks software previous to the class and felt comfortable with the many features of it. Because of technical issues with her computer, Renee had access to both the multitouch version of the U.S. History text and a scanned PDF version of the text. She used both digital versions but eventually decided on the scanned PDF as her text of choice. Renee stated she liked the idea and the features of the multitouch book, but after using both, viewed the scanned PDF as a more efficient way to consume the text. Renee preferred the more ‘web-like’ vertical layout to the horizontal ‘book-like’ layout of the multitouch text.
Mark

U.S. History is a class 17 year old Mark does well in but is not passionate about. He works hard and expects to receive an ‘A’ at the end of the semester for his efforts. Mark feels comfortable using his computer for many tasks, including reading. He found it easy to discover the basic features of the multitouch text, but chose not to search for more advanced features. His favorite features were the ability to scroll horizontally and the elimination of having to carry a physical book. If Mark had his way, all of the texts assigned to him by teachers would be presented to him in a multitouch format.

Lindsay

Lindsay is 17 years old who in the past has struggled in school. She feels comfortable using her computer and uses it quite often, during class and out of class time. She has a tendency to become distracted by content on the Internet and would often have trouble focusing on her work. This was readily apparent in my observations and through my conversation with her. Lindsay views school as a series of tasks to complete and uses her computer to accomplish those. If something was not required (e.g., exploring videos or doing further research on a topic) she “thought it would take up too much time” and generally skips doing it. Lindsay seldom uses her computer for reading and only accesses assigned texts when specifically told.

Sandy

Seventeen year old Sandy is a motivated student and expects to get an ‘A’ in U.S. History class. She works hard and tends to stay focused and often completes assignments before the end of the period. Sandy does not rush her work however. She spends an above average amount of time reading and re-reading sections of text to make sure she fully
comprehends it. Sandy is comfortable with her computer and uses it extensively for reading. She values the ability to have information presented in multiple ways on the computer and enjoys not having to carry around a physical book. Sandy has not yet given up physical texts through. She still finds them better for reading novels and likes how there is a physical indication of how many pages remain in the book.

**Luke**

Luke completes the majority of his homework assignments in U.S. History class and expects to get an above average grade in the class. Luke feels extremely comfortable using his computer. During this semester he experienced computer problems about half way through the semester and had to use a scanned PDF copy of the textbook. Including U.S. History class, Luke only occasionally reads on his computer. He often finds himself distracted by the features of the multitouch book and expresses a preference for something simpler that would allow him to get to the text he needed to read quicker.

**Rachel**

Rachel is a shy student who is very deliberate in the way she completes her assignments. She expects to earn an ‘A’ for her work in U.S. History class. Rachel is extremely comfortable with her computer and when given the opportunity, she prefers to use it to complete her assignments. When using her multitouch textbook, Rachel takes time to read through each section, occasionally clicking on links to learn more about the people or events being described. Rachel is an avid reader on her computer and print. She prefers to complete academic style reading on her computer where she can interact (e.g., search and highlight). She also feels having a digital copy of a History book was especially helpful, because thick history texts intimidate her. However, when Rachel is
reading for fun, or reading a long novel for an English class, a physical copy of the book is preferred.
Chapter 5

THE SHARED EXPERIENCE OF USING MULTITOUCH BOOKS

Introduction

The essence of these high school students using the multitouch book appeared primarily through examining data gathered through participant interviews. Each semi-structured interview (see Appendix F for a list of questions) was recorded and then transcribed by a department at the researcher’s institution. Each theme that showed itself during the analysis process was also reflected in the researchers’ observations of students and in the data collected from the participants’ computers. Throughout the analytical process 1,092 significant statements from research participants were examined and categorized using 92 specific codes (see Appendix I for a table detailing these codes and the frequency in which they appeared). These codes were subsequently organized into larger thematic categories that were in turn combined together to form the overall themes. Figure 5.1 shows the relationship between the categories and the themes.
Figure 5.1: Web of Main Themes
As shown, five overall themes have emerged from the analysis process: Appearance Matters, Limited Interaction, The Conduit Matters, The Book as a Tool and Students Straddling the Digital and Physical world. Each theme and its related categories is discussed below.

**Appearance Matters**

“I don’t know how to explain it. The e-book looked just--looked smoother than it would on paper” – David

The first theme that appeared was the importance of appearance. Many participants in this study had prior experience with some form of digital texts, mostly static PDF textbook pages or web-based hypertext sites. This was the first time the majority of them had access to a multitouch book and they did not know what to expect. As one participant, Hadia, put it, “The look was important too, yeah. Especially, I feel like when friends, people first open the book, they’re like, ‘Whoa!’ That’s what a lot of people said. And they look nicer than expected.”

**Appearance of the Multitouch Book Versus Other Forms of Digital Text**

As previously mentioned, participants who had prior experience with digital texts most likely utilized either PDF documents, or Web-based hypertext. Those formats present information in a portrait (i.e., vertical) orientation. Particularly in the case of PDFs, information is static and not able to be re-sized, enlarged or made more accessible. Multitouch books on the other hand, present information in a landscape (i.e., horizontal) orientation. Graphics and text are presented in a high-resolution format. This native, high-resolution format allowed students to zoom in on images to see fine details and
expand the view of a page to full screen to make it easier to read without sacrificing
quality or pixelating the text, images and/or video. This was important to the participants.

In David’s words, “It [the multitouch book’s appearance] was good, because I
could read every word clearly, but on the math book [a PDF] it’s, it’s like blurry, or some
things are too small, like exponents, like--you just like can’t tell what it is.”

Don also found the multitouch book’s high-resolution display to be beneficial:

“It’s easy to read. Like everything’s kind of just, um, what’s the word, like, I
don’t know, it’s just like bright and easier to [read], some of those like Kindles
and stuff they’re hard to read sometimes like the letters just like seem pixilated
sometimes.”

Another aspect to the native high-resolution format of the multitouch book is that of
accessibility. Many of participants discussed how they could make the book adapt to their
needs. The iBooks software used by participants allowed them to approach the textbook
in a way and in a format they felt was more “user friendly” compared to other forms of
digital text. One participant (Lindsay) described the book as, “more inviting” to use,
while another (Daryl) stated:

“… And I don’t know, I just feel like [multitouch] ebooks are a lot more user
friendly, you can -- you can customize the book to how you want it, if you want it
dimmer [you can], if you want the text bigger, if like -- if like your eyesight isn’t
quite as good, you can make the text bigger, smaller, if you want.”

Perhaps Hadia sums up the experience of the participants the best. “If something looks
nice, I’ll give more attention to it. The content is important, but I feel like if the content is
not delivered in a good way, I really won’t pay that much attention to it.”
The Multitouch Book is Designed for Today

A common thread throughout my interviews and observations with the student participants was the positive impression and feeling of being ‘modern’ and ‘current’ while using the multitouch book. Said Hadia:

“I absolutely loved the [multitouch] ebook way more than [a textbook], because like the textbook is just basically like one of, like a twenty year old book or whatever, and it had, it doesn’t have all that new information that the ebook probably has, and it doesn’t give you, whatever, like probably things have changed. I feel like the [multitouch] ebook would be more up-to-date, more current, and it just has like that new feel to it…it’s like basically saying that a textbook is a flip phone and then the [multitouch] ebook is like a smart phone. There you go. That’s the type of reaction.”

Another participant, Anna, described how the multitouch book’s modern appearance made her more likely to engage with the text:

“Like, um, it’s more bright. It’s like the fonts great and, like, the pictures make it good and everything just, like, pops out so you, like, look at it, like, ‘Whoa, that’s cool.’ It’s almost, like, a poster. So it, like, wants you to read it and, like, then the PDF just, like, ‘Ew, this is a reading. Let’s do this,’ but this one’s like, ‘Oo, this looks, like, cool, like, high-tech’.”

This feeling of using a ‘modern’ tool transcended participants’ personal beliefs about the effectiveness of using a multitouch book, as well, as the individual participants’ personal preference about how they best consume information. Participants who both liked and disliked the multitouch book all felt that it was a more ‘modern’ and inviting tool to use.
Figure 5.2 shows a screen capture of a typical page in the multitouch book. The information is presented along side of graphic and multimedia elements. Large amounts of white space are present and the text is larger than a typical textbook. Scrolling is done horizontally as opposed to vertically. In the participant’s mind, the multitouch book differentiated itself from other tools by having an open, landscape (i.e., horizontal) layout.

The landscape layout of the multitouch book allowed for a new method of presenting information and required a new form of advancing pages. PDFs and web pages typically require scrolling vertically or require a click to request a new page to load. Participants generally viewed the traditional web or PDF based presentations of content consumption as antiquated. Said Anna about a PDF compared to the multitouch book, “…it just reminds me of, like, 2001, like, now I feel like we’re need to…do better
things and this is…[a multitouch book, is an] advancement and it’s like cool and, like, trendy [laugh]…” Shelly also echoed the idea of disliking vertical scrolling and the static nature of previous versions of digital text:

“Well, the PDF book, you just, like, scrolled up and down through and you couldn’t highlight anything and it was just kind of just all text and maybe one or two pictures on it, and the [multitouch] ebook it, like, obviously, like flipped a page like a book and you went through and highlighted whatever you want…”

Further, participants felt more positive about the contentious scrolling nature of the multitouch book compared to the click and load method of web pages. As described by Mark:

“…this one [the multitouch book] was a little bit snazzier too. It just had little things like when you turn the page its kinda cool how it slides over, like that one [a webpage] you had to reload like you’re clicking on a new link or something to take you to a new page. It [the webpage] would load up the new page instead of just having it.”

Appearance Makes for Easy Understanding

Participants, in addition to viewing the multitouch book as ‘clean’ and feeling more ‘modern,’ also felt like they better understood the content presented. They described how the presentation and layout of the multitouch book made it easier to understand compared with other textual sources such as web pages and PDF documents. Figure 5.3 shows the difference between the same content presented in a traditional PDF format (on the left) and the new multitouch book format (on the right).
The content of each of the screen shots is identical. The image on the left is the traditional PDF layout, whereas the image on the right is formatted for the multitouch textbook. In this format, more white space is given around the text and the content is broken up into smaller chunks spread out over multiple pages. Rachel explains how the use of white space aids in making her feel less intimidated:

“The sheer fact that what I said earlier, that reading it, it seems a lot easier to do than having like all this intimidating text, it’s kind of spaced out and it seems open, not as intimidating. So it’s a lot easier to read, and as you read, you comprehend more...you don’t feel intimidated...”

She continues and describes how in addition to the openness, the chunking of text makes her feel less intimidated as a reader:
“Well, yeah, like that factor that it was, that it didn’t seem as intimidating to read. That was one thing I was, really liked when I first started using it, is that it didn’t have like one long page of just full plain text. I really don’t like that, because then halfway through it’s like, ‘This is taking forever... when am I gonna finish this?’ Just having like shortened text on each page on the [multitouch] ebook, it helps a lot more just reading it and trying not to feel intimidated, or like hopeless, trying to get the reading done.”

Rachel’s feelings were far from unique. The vast majority of participants echoed the same ideas of increased approachability, an increase in understanding afforded by the layout and appearance of the multitouch book. When comparing it to the PDF, Sandy said, “on the PDF, like, it’s all crammed onto one page, like, the pictures and the extra stuff and, like, with the textbook it’s, like, laid out better.” Other participants used words like “Fresh” and “Concise” to describe a similar experience.

*A Few Negatives for Some*

While the appearance of the multitouch book was a positive for the vast majority of the participants, the switch from print and traditional forms of digital text did bring with it some negatives. Most notably, while most students praised the layout and the horizontal scrolling, some had a difficult time adjusting to it.

The chunking of text and the resulting increase in scrolling was hard for some participants. Students, such as Renee, remarked about the perceived increase in length of reading. For them, even though the amount of text was comparable across all forms of the textbook, more page turns were equated with more reading. This resulted in negative feelings towards using the book, and a wish to use other forms of the text that would
result in a perceived reduction in the amount of reading students were asked to complete. For the same reasons, but with almost an opposite conclusion, several students held the belief the multitouch text appeared to be too simplistic and did not contain as much information as print books. During my observations of the participants completing in-class assignments using the text, comments about how those using the printed book (due to technology problems such as a dead battery) had more information available to them. Unfortunately, the student did not explain why he felt that way to the teacher, but from my observations of both texts, the large amount of spacing in the multitouch book can create a feeling of disconnection between the header and the content that follows. Perhaps this student needed more visual clues as to how sections were related to each other.

Lastly, multiple students discussed a learning curve with the user interface of the *iBooks* application. Although students received a brief training when they received their multitouch book, a learning curve was still present. Some students, such as Kelsey, experienced frustrations with the user interface, “I was, I’m still like trying to discover it. It’s still really confusing, but I’m just kind of hitting all the random buttons, just trying to, ‘Oh what does this do? I’ll figure it out,’ kinda thing.” I observed this type of trial and error behavior on several occasions during my classroom observations, from Kelsey and a three other students.

**Limited Interaction**

“Um, I think I was just trying to get the reading, like, done [laugh] so I could move onto my other homework. I think if I had, like, more time and didn’t have as more--as much homework but it’s just, like, then I’d be able to watch it [the videos] more.” - Shelly
The second theme that appeared is that of limited feature use. A key differentiator between multitouch books, other digital text and print books is the interactive environment that is created through the implementation of several tools and multimedia elements. Upon receiving their multitouch books, participants received a short training session on the variety of interactive elements and multimedia components contained within the multitouch book.

Figure 5.4: Sample Page of Interactive Features

![An image from Charlene’s multitouch book showing several of the interactive features.](image)

Figure 5.4 shows a sample page out of Charlene’s multitouch book. In this figure, the left third is known as the notes panel. Here, student’s highlights, notes and underlines appear, organized by topic. Each of these items is a hyperlink back to the original content. In the top left corner of this section is a button (“Study”) that creates flashcards based off of the content students have selected. The right two-thirds of the figure is the multitouch book’s content area. Above, Charlene has highlighted text using two different colors, and on the
right is a video that can be viewed by clicking on it. To better understand students’ usages of these features as well as others, it is necessary to present a brief overview of what features were available to them:

*Highlighting Tool / Text Markup*- The highlighting tool allowed students to mark up the text using one of five different colors or add an underline to the selected text. Markings would then be aggregated together in the notes panel for later review. Clicking on each item will take the user to that spot in the text.

*Notes*- Notes are an added feature to the highlighting and text mark up tools. When a user highlights or underlines text, they are presented with the option to add notes to the text. These notes will then be searchable and be able to be used as flashcards.

*Video and Audio*- Videos and audio files are located throughout the text. These elements are activated through clicking on the triangle play symbol. Audio is embedded locally with the book, while video is streamed from the History Channel Website and requires Internet access.

*Text to Speech*- When text is highlighted within the multitouch book, students have the ability to have that text read back to them. The *iBooks* application uses the computers default text to speech voice, which may be quite robotic sounding.

*Flashcards*- Items that have been saved into the ‘Notes’ panel can be used to generate flashcards. On one side of the digital card is the information that was highlighted or selected from the text and the other is information the user recorded as a note.

*Search*- The multitouch books contain a book-wide search tool. Users can search for terms located within the text as well as page numbers.
Quizzes-At the end of each chapter in this book is a short quiz. Each quiz is made up of five multiple-choice questions and students can complete it as many times as they would like. Feedback is given to students in the form of a right/wrong icon that appears next to their answer.

Hypermedia (Images and Text)- Many elements in the multitouch book are actually hyperlinks. Vocabulary words can be clicked on and the user will be taken to a definition, images can be clicked to have a description appear and some chapters contain charts that are links to new information.

Each of these tools contributed to the interactive nature of the multitouch book. Combined, they make for an interactive, multimodal learning environment provided students choose to engage and interact with them. Participants in this study expressed little interest in using all the features, preferring instead to select one or two and ignoring the rest. As a whole, they viewed the feature as an add-on to the written text, rather than an essential part of the learning environment.

Interactivity as an Add-On

The interactive features of the multitouch book are one of its defining features, setting it apart from other forms of digital and print text. It is these features that hold the potential to transform learning in the classroom. For this study’s participants, however, an extensive use of multiple features was not a reality. For them, with the exception of the text markup tools (highlights, underlines, notes) and searching, features were simply an add-on to be engaged with only if there was extra time or the topic held a particular personal interest to them.
One of the main reasons participants viewed these features as an add-on was that they did not see the value in engaging with them. Some, such as Luke, viewed the interactive elements as ‘irrelevant’ and ‘not that important’ instead choosing to focus his efforts on the text itself. Other participants such as Lindsay actively choose not to engage with interactive elements because, “Like I didn’t know if it like had anything to do with what I was looking for to, like, help me better understand what the reading was about. I didn’t know if it did that or not.”

Along with not understanding the value of the features as a learning tool, was a lack of awareness on the part of the participants as to how to effectively use the features. Even though all participants received a brief training on how to use the multitouch book, many were still hesitant to explore on their own, instead relying on either their teacher or their friends to show them the more advanced features of the book. Others simply forgot what was demonstrated. One student, Anna, shouted out in joy, “Wow! How did you get different colors?” after seeing a peer use the highlighter tool on her book. After she was exposed to this tool the second time, she became an avid user of multi-color highlighting. Several other students remarked about how they wished for extra, more hands on guidance on how to take advantage of the multitouch book’s features.

With participants viewing the multitouch book’s features, especially multimedia and hypermedia, as an add-on, it is important to understand what did cause many of them to engage with these elements. Rachel’s response was typical for the group, “I guess the topic, what the reading’s talking about, if it’s something intriguing and I wanna learn more, I usually click on it then [video and audio].” Perceived available time stood in contrast with perceived interest. Many participants expressed a feeling of simply needing
to complete the assignment first. Said Sandy, “Um, well, most of the time I, like, was trying to [complete the assignment], I don’t know, it was just, like, homework. It [the features] was just an extra thing that I didn’t want to do.

Most Used Features

Students as a whole viewed the interactive elements as add-ons. There were a few features that did become integral parts of the experience of using the multitouch book. These features consisted primarily of the highlighter and the search tools.

The highlighting tool was the most popular among students in this study. Nearly every participant reported using this feature and many claimed it was the top reason for enjoying the multitouch book. As Rachel said, “I love the highlighting notes… instead of writing [terms and notes] by hand, [I could] just highlighting them, then coming back and looking at them later.” For her, the highlighting tool allowed her to collect her notes for easy reference later. Nearly every other student who used the highlighting tool mentioned in someway the convenience of having all of the information they felt was important kept in one place. For Luke, this was especially important. He stated he preferred the computer’s way of organizing to his own on paper because he could click on a highlight and then be taken back to the page where that highlight was created.

Organization of notes was just one of many reasons expressed by the participants when they discussed why they liked and how they used the highlighter tool. Several participants reflected on how the highlights would help them save time – both by making the text easier to read and by replacing hand written notes.

For many students, the highlighter tool helped make the text easier to read. During my classroom observations, I observed many of the participants keeping their
place in the reading by using highlights. In a classroom where there were several
distractions, participants would highlight the last sentence they read, making it easy to
come back to. Additionally, participants would use highlighting as a way of changing the
color of the text as a way of personalizing the book. As Charlene said, “I like the ebook
better than [a print text] ‘cause I could personalize it more to myself.”

Activities assigned to the participants generally included some form of note
taking. In my observations, the classroom instruction gave two options to students: they
could take all notes by hand on a piece of paper, or they could use the highlighting tool
and then add their notes digitally in their book. This study’s participants preferred the
latter. Some were driven to this by a dislike of handwriting, “I’m using this, ‘cause I
don’t wanna have my hand hurt after a page of notes”, while others found it easier to read
on-screen than their own handwriting, “‘Cause sometimes your [handwritten] notes don’t
make sense…I’ve had that happen, where it’s like I’ve written a note down, and later I
come back and it’s like, ‘What did I even mean by this?’”

When students used the highlighting feature to take notes, a small minority of
them developed a system that took advantage of the system’s ability to use multiple
colors of highlighting. Student’s were not shown a specific system to use, but rather
developed one on their own or learned from a classmate.

One student, Kelsey, developed a system with each color representing a different
type of data (i.e., one color for definitions, one for dates and another for key people) most
students simply used colored highlights for organization. As Shelly put it during a
conversation with the researcher:
“Shelly: Um, well, every single chapter, I’d just switch colors so then it was easier to find on, like, the side where it kept all of them.

Researcher: So different colors each chapter?

Shelly: Yep.

Researcher: But within the chapter, you’d keep that same color?

Shelly: Yeah, keep the same color. Yep.”

These students wanted an easy way when looking at the notes panel to determine what chapter each highlight came from without the need to look closely at the sub-headings the notes were organized under.

Students who did not use a color-coded system still took advantage of highlighting in multiple colors. These students however, did so more to customize their experience reading their book than for any academic gain. Bonnie stated she would switch colors up each day based on, “whatever floats my boat for that day” and Darla “just [choose] whatever color I really was in the mood for.” Other participants chose to rotate through the available colors with the only limit being, “not having more than four or five, because that would get to be too much.”

What both of these groups of student participants had in common was that many of them did not expend much thought about their highlighting. With the exception of Kelsey, it appeared students either did not know effective uses of highlighting or were unskilled in selecting the most important text to highlight. During my observations, the majority of students tended to highlight everything on a page (i.e., upwards of 80% of visible text being highlighted) or only highlighted words the publisher had already bolded
Lee

55

for them. When asked about this during the interviews, students reflected this reality with their comments. From a conversation with Luke:

“Researcher: How did you decide what to highlight?
Luke: Um, whatever seemed important on the topic.
Researcher: Was there anything that you used to help you decide if something was important or not?
Luke: Um, like bolded words.”

Other participants said they focused on highlighting ‘important’ information, but had difficulty quantifying criteria that made information important. Phrases such as, “Whatever sounded important” and “Bold Words” and “Things that seemed interesting, just random facts” were common across the participants.

After the near universal appeal of the highlighting tool, the next most essential feature for participants was the search tool. This tool allowed participants to go to the pages their teacher assigned them to read, or search for key terms or topics they were to research. Almost every participant used the search tool, but its favorability was mixed.

When using the search tool, participants would type in a search term or a page number and the iBooks software would return a list of results that included a number indicating how many times that term showed up in the text. Upon clicking the term, it would generate a preview of each of the linked items allowing students to decide if they wanted to go to the requested page or try a different term.

Content was covered in class in a different order than it appeared in the book, so the instructor gave assignments by page number. Students also utilized the search tool to
complete tasks such as word-webs where they were required to look up and define key vocabulary.

Participants had positive and negative experience using the search tool. One particular frustration came from the fact most participants did not utilize the embedded leads in the search results and tended to follow trial and error strategies when searching out information. Participants tended to click the first result, believing it was the most relevant. If that turned out not to be the case, they then went down the list. Some expressed frustration at this approach. Said Darla, “[I] typed in the main word or whatever that we were talking about and about 75% of the time it worked…if it didn’t come up…I just quit out of it…” Other student participants were also overwhelmed by the number of results that were returned. Said Kelsey:

“Well, I don’t really like the, where you can go up to the magnifying glass [the search button], because you’ll be typing something and then, you’ll have like four million different things to pick from, and it’s just like, ‘Oh, I don’t know if that’s useful.’ So it’s kind of like, ‘Oh, I guess I’ll test this,’ and it might not be it. So then you have to go back up to the spotlight, and then, so it’s just kind of ’eh.’”

For the other half of participants however, the search tool was a positive feature. Many participants enjoyed the depth of responses generated by the tool, especially when they utilized the embedded leads to help select which results to pick from. Daryl points out in his interview that:

“I liked how you could search for words, you didn’t have to -- opposed to like a book, you’d have to read the entire thing to find what you wanted, where with the search, I could type in what I wanted and it’d go directly to it. I also liked how at
the top it had like key words and -- so it’d be like ten key words, and then in the
text it would have -- it would have like the key word bolded so you could easily
see it. And then, right after it’d say like -- D-Day, and then what it was, and then
it would continue talking about it after that. And it’d show charts and pictures and
just kind of give you a good idea of what was going on.”

Many students reported the search tool allowed them to be more productive on their
assignments by allowing them to quickly and easily find content. One, Don, compared it
to Google, but noted that since it didn’t require an Internet connection, it was a superior
resource. These students preferred searching for information over utilizing the traditional
method of going to a glossary or selecting from a chapter outline – both of which were
available with the multitouch book. Said Darla,

“Um, it’s easier instead of going through to the back and, like, towards the end of
the book or looking in the glossary or whatever, looking for the page numbers just
easier to, uh, look for something. That’s what I liked about it. It’s easier to just,
like, type it in and go to the page.”

*Interactivity Elements Receiving Little Use*

While participants used, and positively rated the highlight and search tools,
several other interactive elements remained relatively untouched. Among these were the
videos, the dedicated notes tool, the review quizzes, and several of the hypermedia
functions.

One intriguing interactive component of the multitouch book was its use of
embedded videos sourced from the History Channel. Students however, tended to view
them as an afterthought. Only a small minority of participants chose to engage with the
videos and an even smaller subset actively sought them out on a routine basis. When asked why they did not engage, the most common answer was that they did not perceive a benefit in doing so. Students liked the idea of having the videos available to them, but stressed the increased amount of time watching the video would take on top of the time to complete to the required readings. For these students, the videos were an add-on, a nicety that was to be used only when there was extra time.

For the handful of students who did choose to engage with the videos, they reported an increase in their level of comprehension of the topic. Said Darla, “I think I learn better from the iBooks because it has more videos and explains more.” Another student, Don, similarly responded that the videos “give a lot of information. They kind of break it down.” For another student, Hadia, videos provided a way to visualize the text and make abstract concepts more concrete:

“Like I hate when you have to imagine stuff, and then you picture it totally wrong, and I feel like the videos helped you envision whatever the text was trying to say, and sometimes the videos gave even more information [than the text itself].”

For these students, the videos were not an add-on, but rather a useful tool to increase their comprehension of the assigned topics.

The second main feature participants chose not to engage with was the end of section quizzes. These five question, multiple-choice quizzes are designed to check for the most basic level of understanding. In general, participants reported they tried the quizzes once during the first chapter reading and then ignored them on subsequent assignments. Similar to the rationale given for not engaging with the videos, participants
felt the quizzes were not worth the additional time they required. Some mentioned the
fact the quizzes only gave right/wrong feedback. This generated frustration for many, as
they either had to go back and search the text for the answer, or resort to random clicking
to find the correct answer. Others reported feeling like Kelsey,

“[When assigned a reading task] I would only get, like I would finish it, but then I
would be, ‘Oh I just read that,’ so what would be the point of taking the quizzes?
Because we would have to do the readings to take a [graded] quiz.”

Similarly, Rachel responded, “just don’t want to do it, really, don’t really feel like taking
them” while Daryl stated, “Uh, no I did not [take the quizzes] because we would do like
the weekly… quizzes in our class.” These reports about the quizzes match up to my
experiences during the classroom observations. During these, I only observed one
student, Darla, attempting quizzes during class time. During our interview, she described
why she took the quizzes by stating she wanted to do everything that she could to ensure
a good grade on the weekly graded assignments. In general, students felt the idea of the
quizzes was a good one, but failed to see benefits for themselves in order to justify the
additional time that completing such an activity would take.

The last of the interactive features that received little use were the hypermedia
elements. Students generally ignored the multitouch book features such as 3D diagrams,
interactive images, and ‘pop-ups’ with extension information. Participants generally
expressed a lack of awareness as to the availability of these features. Multiple students
expressed surprise when asked about their use, stating they might have liked to use them
had they known about them. Overall, most participants tended to settle on one or two
main interactive features (i.e., highlighting and search) and ignored the others.
The Conduit Matters

“Um, right after I got it, the whole computer just, like, ran really slow but then that got better…it might not all be from the textbook but all these issues started, like, after I got the textbook…” - Sandy

The third theme that became apparent is that of the conduit matters. Research participants in this study accessed the multitouch book using their laptop computers (Apple MacBook) and using the iBooks software. The technology used to access the multitouch book was intertwined with the experience of using the book itself. As such, anything related to the use of the computers or related to using a physical book, positive and negative, became part of the experience of using the multitouch book. These experiences included technical problems students had with the computer, challenges they faced with reading text on a screen and a strong dislike of traditional, printed textbooks.

Technology Problems

Participants in this study experienced many technological frustrations impacting their perceptions of using the multitouch book. In order to use the multitouch book, student computers needed to be updated to the latest version of Apple’s operating system (Mavericks). The school building technology support team planned for this update to happen over winter break, between fall and spring semesters. Many students experienced problems with the update process at home and had to wait until school started to perform it. In Lindsay’s words:

“Before [we got the book] we had to download Mavericks [the name of the new system software] and that was, it took like 45 minutes. And for some people it
didn’t work, and they had to download it multiple times or something, so that was a hassle.”

As indicated in Lindsay’s quote, students talked with each other about the update process. When one student experienced a problem with the update, other students internalized the feeling and became more apprehensive about completing the update themselves. Once the update was completed for all students, several glitches were encountered due to the newer version of the software. Several students experienced compatibility issues where documents they had created for other courses were unable to be opened until technology support updated their software. Other students experienced unstable wireless network connections and decreased battery life. Although these glitches were not related to the multitouch book itself, the negative perceptions of the update process for students was part of the overall experience of using the multitouch book.

After students completed the update process, they were given access to download the multitouch book. Each student in the selected teacher’s U.S. History course was assigned an Apple ID and password, along with a redemption code to download the multitouch book from the Apple iBooks Store. These IDs and Codes were used in class by the instructor, using a bar code system, to obscure the credentials from the students to prevent them from sharing / redeeming the book code with a personally created ID and to allow for re-use of the multitouch book in subsequent semesters.

Once the instructor entered the codes, the download process began. The multitouch book file was extremely large (2.03 GB). To try and facilitate timely downloads for students, the technology team installed a caching server. This allowed the book to be distributed over the local network as opposed to the Internet. Additionally,
students were provided access to ‘download stations’ where they could plug directly into the wired network, bypassing any congestion on the wireless network. Despite the steps taken by the building’s staff, the number of simultaneous downloads overwhelmed the school’s network, mitigating the caching server. For some students, “it took like 2 days” to download, while others were able to complete the download in about 45-60 minutes. This experience left students like Renee stating,

“Um, I didn’t like, like however long it took to download on my computer. I thought maybe it would have been easier if it had been pre-installed on our computers so you didn’t have to really mess with that as much.”

Although students were used to waiting for large downloads while using their computers, there appeared to be a difference between waiting for a file that was for entertainment purposes (i.e., a large movie or game) and waiting for a file that was an educational resource. While many students were excited at the idea to try out the new multitouch book, the installation process caused negative feelings about it before it was ever opened.

During day-to-day use, students reported several other technical issues impacting their perceptions of, and their ability to use the multitouch book. Chief among them was a general sense of slowness while using the book. Students like Anna experienced stutters when trying to turn the pages. “Sometimes when I clicked next on the page, it took forever to, like, [laugh] I was, like, ‘Okay, next one,’ and other times it just went right to it, so I never could control [it]...” Other students experienced these delays when using the search tool. From Darla, “Whenever you type into…the search bar, it will take like a minute for it work and then you try erasing it and then back and forth.” For others the problem was even worse. Instead of the computer eventually catching up, it would freeze
and require them to restart their computer. As David described, this would result in student’s loosing any work they had not saved, even in applications outside of the *iBooks* software.

“Uh, like for example I would have some things pulled up and then, uh, I would close it, and then once I opened it again it wouldn’t let me click on anything. So, I, I wouldn’t able to save anything and I would have to force restart it and I didn’t get some of my papers back, that I’d been working on. That’s, that was pretty the big problem, it just kept repeating itself.”

Although these technical problems presented hurdles to the participants, for the most part, students took them in stride. They were a major part of the experience of using the multitouch book, but they were also contextualized by most. Many expressed opinions that a newer computer would fix these problems, and eventual refinements to the deployment process would speed things up. Hadia best describes participants’ general feelings of using the multitouch book on their computers:

“Yeah, like I feel like our computers need to be a little more faster, then the book was like a little more, you know, newer than the computer itself and its software. I don’t know maybe it’s just me. I feel like sometimes the computer like slowed down the book.”

*Challenges to Reading on a Screen*

Another major component to the experience of using a multitouch book is how participants physically viewed the book. Participants viewed the multitouch book from a 13.3” LCD display. For many, looking at a laptop screen was completely different both physically and behaviorally than looking at a printed textbook.
A laptop computer is not a one-task device, and as such participants experienced an increased tendency to become distracted when reading on the computer. When using the multitouch book to complete their assignments, I observed every student switch between the book, their email, and social media. For some, interest dictated their level of engagement and distraction. Said Kelsey, “It depends…If I’m not interested in whatever we’re doing, then I’ll kinds go off on my own and do whatever…Sometimes I’ll be like, ‘Oh, I’m listening to music…I can go on Pinterest.’” Other students found it hard to concentrate even when trying to. Even students who considered themselves high achieving and prided themselves on their academic work were observed becoming distracted by a notification from their computer. Often these distractions were messages from friends or updates from social media. For example, while Sandy was a top-performing student, she would flip back and forth between her textbook and her computer’s messaging application. Other students indicated they had ‘an addiction’ to their social media and messaging accounts. Regardless, participants felt compelled to check messaging and social media apps, or if they were uninterested by the current topic, multitasking was a reality for all students.

Another facet of consuming information on a screen was the physical effects described by many participants. For these students, reading off of a computer screen resulted in dry eyes and headaches. According to Charlene, “I like that it’s like electronic, but sometimes my eyes get really tired.” Luke attributed the cause of his eyestrain to the glare caused by overhead lighting and a shiny screen.

Participants came up with a couple of different ways to try and minimize the effects of reading off of a LCD screen. Some, like Hadia, developed a system where they
would keep their screen brightness low and take many breaks while reading. “Um, I just feel like I would, instead of reading it all at once, like maybe with a regular textbook, I would like read it in chunks.” Others, like Daryl, chose to modify the book itself to try and prevent eyestrain:

“’Cause like when you read like long -- like many pages after pages after pages and sometimes just like the bright white background can -- will give you a headache but… [Referencing changing the display colors] It just kind of like -- it’s a lot easier to read and it doesn’t like kind of just give you that headache from staring at like your computer for an extended period of time.”

For most participants, increased eyestrain occurred mostly when reading long sections of text, not during activities that required only referencing the book or engaging in short passages. As a result, students expressed an interest in using their ebook for short passages and reference activities and printed materials for longer, more in-depth assignments. This duality will be explored further as part of the theme of straddling the physical and digital world.

A Strong Dislike of Traditional Textbooks

The final component to understanding why the conduit matters to participants is that these students expressed a strong dislike for traditional physical textbooks. While participants had mixed feelings in regard to reading on a screen versus print, nearly every participant expressed dissatisfaction with using a printed textbook. This dislike stemmed from the weight associated with a textbook and the realities associated with using a shared book.
The primary reason expressed by participants for disliking physical textbooks was their size and weight. Nearly every student described how his or her backpack was overflowing with items and weighed a considerable amount. Students’ bags contained more than what is typically thought of as ‘school supplies.’ Locker space at this urban Midwestern High School is at a premium, and a sizable minority of students elect to forgo being assigned one. As such, students tended to carry everything they needed for the entire day with them as they moved between classes. Often, this included multiple novels, textbooks, a laptop, a cellphone, chargers, athletic equipment/clothing, resources for classroom projects, and even more. A student might have to travel with these items to a maximum of ten classrooms per day due to the unique scheduling system this high school has in place.

This reality created several problems for students. Some, like Lindsay ran out of space in her backpack for her textbooks and had to carry a stack with her from class to class. For her, the physical size was the largest negative. For others like Kevin, the weight of the textbook was the largest negative. Kevin experienced the physical effects of carrying a heavy bag every day, “Because the textbooks get heavy and they--if you have to carry them around every day that kind of starts to, like, hurt your back and make your backpack really heavy…”

Even if students had room in their bags and did not feel the physical pain of a heavy bag, they still complained about the hassle of carrying multiple items with them from room to room. For all the participants, the multitouch textbook solved these problems, at least for one of their courses. Said Mark, “It was nice to have it on my
computer too instead of having to carry around an extra textbook.” When asked if a reduction of even one textbook was important to them, Lindsay’s response was typical:

“Researcher: So you’d mentioned a couple times that it’s easier than a textbook, it’s lighter than a textbook. Is that important to you?

Lindsay: Yes! Especially the lighter part. Textbooks are so heavy, especially the super thick ones.”

In addition to the physical characteristics of size and weight, participants expressed displeasure at having to worry about keeping a printed textbook clean and free from scuff, tears, and marks (including academic marks such as highlights and annotations). As discussed in the previous theme, one of the only features to receive extensive use by participants was the highlighter tool. From the time they were in elementary school, participants have been told textbooks were a shared resource and they should not mark them in any way, not even with a pencil. Students wishing to take notes or annotate the text using these printed books are required to do so in a paper notebook, increasing the amount of items they had to carry with them. Participants expressed appreciation for the ability to write directly on the multitouch book, both saving them space, as well as saving them from book fines resulting from writing in their book.

In addition to these book fines, participants felt fearful of damaging or losing a physical book. Students were aware of the consequences not only for themselves if they lost or damaged a book, but also the impact that it had on future students:

“And it doesn’t get -- you can’t rip any page book or you can’t get it dirty or ruin it, that’s always good. With like normal books, I mean, some of these books are ten, twenty years old. I mean there’s pages that could be ripped half, that were
ripped in half, people write all over them. I mean, with ebooks they’re just perfect. They never get old and they stay good.” - Daryl

Akia expanded on this sentiment by expressing the realities that loss and damage can have on the classroom, “sometimes students can, like, rip or break books, damage things and so you might not have enough copies for students.” These two students, Daryl and Akia, best verbalized what was a common refrain from participants – a dislike of physical books based on what happens to them over their life cycle. For these students, the personal, always new, never damaged nature of multitouch books made print books seem antiquated.

The Book as a Tool

“Yeah, I guess [I’m] kind of just being a lazy high school student, just trying to get things done quick” - Daryl

The fourth theme is that of the book as a tool. As students engaged with the multitouch book over the course of the semester, their use of the book changed to fit the realities of the assignments and assessments they were given. While each participant said they used their books for reading, there was no universal definition of what reading was. Students tended to view the multitouch book as a task-specific tool and engaged with it in the manner that best helped them complete the assignment.

No Universal Definition of Reading

When talking to students about how they read and interacted with the multitouch book, it quickly became apparent there was no universal definition of what reading was to students. For some, being asked to read a section meant quickly skimming through the text. While for others, reading meant examining each and every sentence multiple times.
Students who viewed reading as quickly skimming often expressed a feeling of already knowing about the events being covered by the text. Participants either had a personal interest in history, coming into class with their own background knowledge, or they felt their previous history classes had taught them the basics of what they needed to know. For these students, skimming was the default mode of reading, only changing if they saw something novel. From Don:

“Um, kind of depends what it’s for. Usually I kind of just usually skim through it then if something catches my eye then I’ll usually read it just like that. The pages don’t have too much text and stuff on it so I’ll either just read it one more time or a couple more times, that paragraph um, and then I’ll highlight what’s needed.”

Many other students also reported the same method of consuming text. Phrases like, “I read the words that stand out” and “I like skimming and the picking out the key points” came up often in my conversations with participants.

Other students however viewed reading as something more than skimming. To them, reading meant spending time examining each and every sentence to ensure comprehension. These participants felt they got confused or missed out on key information if they skimmed, making them unprepared for exams. As Daryl stated:

“I try to read through the entire thing but I really try to focus on like the main points. But I always do read through the entire thing just ’cause you never know if you might need something for a test or something in the future. I guess more knowledge is always better.”

Rachel perhaps best summarizes the thoughts of those who view readings as more than skimming:
“I read the whole thing, I know I’ve tried skimming before. Sometimes it helps, like if you’re in a rush, but for me, I miss key facts if I tried to skim, and it really doesn’t like settle in my brain if I skim over it. It will be like, just reading the words and not having it process in my head, so just reading it out really helps better, because then it actually settles and I understand what’s going on, instead of just like skimming over it really quickly and like after you’re done, be like, ‘What was that about? Like, wait, I’m confused.’ It’s like, ‘What?’ No, so I don’t skim unless I desperately need to.”

These two different definitions of what reading entails begin to give insight into how students viewed the multitouch book. Both groups felt like they were reading for a purpose. They were ‘Reading to Do’ in order to help prepare them for an exam, quiz or to complete an assignment. Each wanted to complete the task by understanding the information, but did not want to spend more time than necessary.

*Usage Fits with What is Assigned*

The types of tasks participants’ were asked to complete heavily influenced their use of the multitouch book. These tasks were often basic and as such, students tended to only engage as long as was required to complete them. As Lindsay said:

“Um, I started off doing that when we first got our, like our first couple reading assignments for the book. I would read the whole thing and take notes over it, but I realized that I didn’t, like I didn’t have to pay attention to every little detail in the book, so…I stopped doing that.”

Tasks assigned to students generally fell into one of three categories: taking notes, completing ‘word webs,’ and reading to answer questions posed by the text. During note
taking tasks, students were told to complete either one page of handwritten notes or the ‘equivalent using the notes feature’ in the multitouch book. For word web assignments, students were given worksheets with several vocabulary words and were asked to complete a graphic organizer where they indicated definitions, related terms, provided historical contexts and used the word in a sentence. Lastly, when given question answering tasks, students were required to answer the comprehension questions posed by the publisher at the end of each chapter by writing them on a separate sheet of paper or in an email. These were different than the multiple choice quiz feature of the multitouch book and instead were identical to the types of questions found at the end of a traditional print textbook chapter.

Each of these assignment types required only a foundational level of knowledge to complete. They most likely would be considered at the knowledge or comprehension level of Bloom’s Taxonomy and required little advanced processing of the content. During observations, many students were able to complete the tasks during the class period. Students discussed how there was very little outside work required for the class, and what was required took no more than “Ten minutes, probably” of reading to complete.

Therefore, participants adjusted their usage habits to fit these assignments. As indicated by Lindsay at the beginning of this section, many students at the start of the semester began investing considerable time in reading their book. As the semester went on and they experienced the types of assignment required of them, time spent deeply engaged with the book decreased. By the end of the semester, with the exception of three
students, they were not ‘reading’ their book, but rather using it as a tool to complete assigned tasks.

To gain a deeper understanding how students opened and read through the multitouch book, log files from their computers were collected, analyzed and compared to in-class observations. These log files contained usage information such as the length of time the iBooks application was open and ‘in focus’, meaning the application was pulled up and was being actively engaged. For example, if a student had the book and a word processing application tiled on their computer screen and was typing notes, the system would count the word processing application as being in the forefront. This is because the student was actively typing into the word processing window and looking at the book in the background. As such, only time spent actually engaging in the book (e.g., highlighting, searching and turning pages) was counted in the logs.

An additional caveat to consider when examining the usage data was a peculiarity in the management system. Once a day the system would send out a notification that the student’s computer was submitting an inventory report. This was designed as a courtesy to let users know what their computer was doing and many students chose not to acknowledge, or click on, the computer system’s message. Due to a bug in the system, if the message was not clicked on, no data would be sent back until they did so. As such, these log files need to be considered in the context of my observations and the reports of the students themselves.

Figure 5.5 shows a sample day for one participant, Anna. The pie chart represents the percent of time the student spent actively engaging each of the applications. As shown on this day, Anna spent the majority of her time with Word (1 hour, 11 minutes),
Messages (55 minutes), followed by a web browser (Safari), iBooks, and a note taking application (Sickies).

**Figure 5.5: Sample Usage Data Graph**

![Sample Usage Data Graph](image)

A sample day of computer usage data from Anna’s computer. Note the top apps, a word processor (Word), a messaging app (Messages) and a web browser (Safari).

The data contained in these logs serves to reinforce how students described using their multitouch book. As a group, participants engaged with the iBooks software in a way more similar to how they would engage with reference materials, compared to how they would read a book. Few students displayed extended periods of constant engagement. Overall, the average time spent per week actively engaged with the multitouch book was 4.98 minutes (n=18, SD=4.93), with the total time for the semester averaging 69.76 minutes (n=18, SD=69.06) per student.

During each of the three observation periods, I noted how students were interacting with their multitouch book while they were completing their assignments. I observed many students typing into digital sticky notes or word processing documents with the multitouch book pulled up in the background, but still readable. They would
switch over to the book only to advance a page before returning to the other application. These students were interrupted frequently. They would often respond to social media requests and other web-based messages by having them pulled up along side the book. The data supports these observations. For this group of participants, the applications that received the most time being actively engaged with were Web browsers students used to access social media, word processing applications / notes applications and messaging applications.

In addition to their indirect engagement of the book, participants expressed an attitude of engaging with the resources only long enough to complete the assigned tasks. Reasons given by participants for this attitude included a dislike of the course content, an overwhelming amount of homework from other courses, needing to socialize with peers, and a general sense of wanting to finish all of their homework quickly. The following exchange between Renee and myself was typical,

“Researcher: So you are saying you were looking for just a quick way to get what you needed and get out?

Renee: Mmm hmm, Yes.”

Others participants were more descriptive. From Bonnie, “I mean, if it’s required, I'll do it completely. I'll read the whole chapter but if it’s not I'll probably just do the required parts of it.” Shelly explained her typical usage of the multitouch book:

“I kind of just, like, when I read, I just kind of highlighted and I just had to be done I had other homework to do [laugh]--I was just like, ‘I’ll just highlight, read it, and just get done with it quick.’”
Each of these participants spent the minimum amount of time required to complete their assigned task, while maintaining the academic marks they were comfortable with. They viewed the multitouch book as a way to help them save time.

Participants made several remarks about the increased efficiencies they experienced as a result of using the multitouch book. For some, this was due to the ability to type their notes and have them organized in one place. Anna remarked, “like, [my digital notes were] neat and nice and typed out and not my chicken scratch, I can hurry up and get this homework done.” Other students described the time saved by only having to open their computer to get access to their notes as opposed to having to take out a book, notebook and a pen. Although it might sound trivial, the convenience and small time savings was important to how students understood how they should use the multitouch book.

*How Students Viewed the Book*

Students’ usage habits with the multitouch book, as typified by Bonnie, Renee and Shelly above, indicate students viewed the multitouch book not as a textual resource nor as an interactive learning environment but rather as a reference that was to be used only to complete a specific task.

As a reference source, participants held a favorable view of the multitouch book. Participants valued it as a trusted source of information and remarked about its convenience. As Mark stated:

“Well ’cause I knew that the textbook would be accurate, like you can’t always rely on *Wikipedia*… and I don’t even think I need a wi-fi to use the book too, but uh at one point I just realized like oh I guess it, its about the same speed to go to
Wikipedia as it was to go to the book and so the book was more reliable than that.”

Others also praised the ease at which they could get to needed information using the search feature. Compared to online search engines, several students commented on the similarity of how the search functions worked but expressed praise for the lack of advertisements. As voiced by Mark, the multitouch book received high marks for its perceived accuracy of content. For David the multitouch book fit his criteria of an accurate source: “it, it just seems because it’s like an actual textbook and not like Wikipedia or anything else like where people can just put anything.” Participants grew up in a school system that heavily discussed online validity with students. Rather than having to check out the validity of online resources many preferred the multitouch book, as they considered it an automatically reliable source. As Sandy put it, “…it’s, like, a credible source and, I don’t know, I mean, it’s a textbook. We’re using it for class, I’m assuming that it’s a credible source.”

Perhaps the most telling aspect of how students viewed the multitouch book was their belief it was an assignment specific tool. During conversations about how they used the multitouch book, students described only using it to help with completing the three main types of homework assignments. For students, the book was not a universal resource; rather it was a tool that allowed them to complete one specific part of their coursework.

Participants such as Charlene expressed this by indicating she only accessed the multitouch book on Sunday night to complete the note taking assignment before class started on Monday. A few students indicated they reviewed their digital notes and
highlights as a means of test preparation, but the vast majority preferred to use lecture notes and other resources instead. Other participants also backed up these statements. For most, engagement with the multitouch book spiked the day a homework assignment was given or on the weekend before an assignment was due, but not in the time period immediately before an exam or quiz.

In total, participants viewed the multitouch book as a tool, something that was to be used to help out with a very specific set of assignments. While each student defined what constituted reading for themselves, all adjusted their usage of the book to minimize the amount of time they spend completing their reading assignments.

**Students Straddling the Digital and Physical World**

“I don’t know I just really, I like technology, but I don’t really like technology, I just don’t like how everything is going to technology, ’cause it’s kind of just like, mmm, I don’t know. I still wish some things were normal.” - Charlene

The final theme in understanding the experience of using a multitouch book is that of straddling the digital and physical world. While many often assume students are digital natives who instinctively gravitate towards technology; this is not necessarily the case. For these participants, the idea of using technology and appearing technologically advanced was important, their actual preferences for how they accomplished tasks was more pragmatic.

**Liking the Idea of Technology**

Regardless of personal preferences towards the use of the multitouch book, participants expressed a belief that they should be using it. Part of this opinion was their belief that since the content of the multitouch book and print book were equal, the
newness of the multitouch book made it superior. Participants noted a feeling of being on the cutting edge when using the multitouch book and felt like utilizing technology was an important advancement. Darla described it as, “Something different, something new.” Bonnie explained why she felt the multitouch was a positive advancement:

“Mm, I just like it generally. I mean, I think it’s really good (laugh). I mean, technology is kind of what kids are leaning towards instead of, like, a big, hand-held book, so I think having online textbook is going to help kids get their homework done more often since they’re always on the computer playing games or listening to music.”

Several other students also echoed the opinion that “kids like technology” and textbooks should embrace the medium. Students believed since they have a laptop computer, more of their required reference materials should take advantage of them. As Charlene put it, “I think a lot more classes should do it, just ’cause it’s a lot easier since [the school] is known for their laptops, it’s a lot easier for students to just have that than carry around a notebook or something. Like that, so I think they should do that.”

As a complement to the belief that ‘kids like technology,’ was a feeling of pride in being part of a new wave of technology. The multitouch book is a relatively new development in terms of educational technology. Students wanted to believe they go to school in a district that is high tech and cutting edge. This particular district has historically been on the leading edge of technology integration and prides itself in having the best tools available for students to use. Participants appeared to have internalized this message and expressed their own sense of pride in having the newest tools to use. Anna best summarized this sentiment: “’Cause it just looks clean and it shows [the school] is
high-tech and cool and that we, like, have the best stuff and we don’t have old books and stuff and we keep up with, like, technology.”

**One Foot in the Physical World**

Although students expressed a belief in the importance of being viewed as ‘high tech’ they themselves have been reluctant to fully embrace an all-digital lifestyle and learning environment. Participants felt technology was important, but so were many components of the physical world. Many felt they learned better when they wrote things out by hand and several expressed a need for the tactile feedback given by using physical books.

Throughout this study, multiple participants chose to take notes by hand instead of taking notes in the multitouch book. In discussion, each student stated a belief that they learned and retained more information when they handwrote notes compared to typing them. Although some could not verbalize why they felt this way, “I don’t know, I just kinds feel that way”, others could. Bonnie for example:

“Um, well, I've learned that writing things down helps kids memorize things better and so that worked for me, too, because I'll remember, “Oh, I remember writing about this and this is the information that it had on it,” instead of saying, “I remember reading this but I don’t remember what section it was. I don’t remember, like, what else was on that section or…”

Another student, Lindsay, expanded on this by stating her previous teachers taught her writing on paper makes it easier to remember:
“Well, all the teachers, all my teachers say it helps you remember it better if you write it down, which is why sometimes teachers make you take hand notes rather than typing, ’cause it helps you remember better if you write it down.”

Still other students felt highlighting text in their multitouch book was not sufficient for them to remember items. Instead of typing their own thoughts into the book to make connections to the text, many found it easier to simply write the information that they would have highlighted into their notes.

Students also were reluctant to give up on the tactile feedback afforded to them when using physical media. For these students, print books have a particular “feel” to them that cannot be replicated with a computer. In Hadia’s words, “if you took away like novels and stuff and made them eBooks, that really kinda takes away the whole feel for it, like being able to hold your book in your hand.” It appeared students were more sensitive to the issue of tactile feedback when it came to reading long form pieces as compared to reference text. Courses such as Literature and English were often cited as ones where students would not like to see print books replaced with digital, multitouch texts. Other students viewed print books as more intimate and enjoyed the ability to read the text in more physical locations due to not having to have a laptop computer propped up in front of them.

As previously mentioned, participants experienced physical symptoms such as eyestrain caused by reading from a computer screen. Because of this, several students preferred printed text stating that it was easier to read and that they could read for longer periods of time before they got tired. In addition, having their book separate from the computer was positive for some. As Rachel said:
“Especially, doing homework too, because and it’s not like scrolling through, having my big hunky chunky laptop right here and then my paper here. It’s like textbook, and sometimes I can have my textbook in my lap, right? It’s [the textbook] just a lot easier.”

While many participants enjoyed the look and feel of the multitouch book, there was a small minority that preferred the layout of traditional books and the scanned PDF versions of them. For these students, the added features of the multitouch book were not appealing. They preferred the text be presented all at once instead of being split over many pages as in the multitouch book, allowing them to better see how the content was organized. This helped them make connections between chapter headings and the details that would follow. Lastly, some participants expressed an apprehension for using digital resources that stemmed from practicality. “I mean if your computer dies, you don’t have the book… there is [sic] some places you can’t bring your computer where you could bring a book.”

One Foot in the Digital World

At the same time students discussed the advantages of print media, they also expressed a strong belief in the advantages of utilizing digital resources as a part of their classwork. While participants felt print textbooks were better suited to extended reading, digital was the preferred method to access resources to complete typical school activities such as creating posters, worksheets and conducting research for essays. During these activities, the amount of sustained reading time is relatively short. Students valued the ability to use the search function to quickly access relevant information.
Participants also believed utilizing the digital multitouch book provided an advantage due to its ease of access. For these students, convenience mattered. As David stated:

“Um, it’s easy, it’s always there when you need it, it just or if you have a laptop you just, or if you have your school laptop you can just go on it, like, like you have to check out a book usually if you wanna get information like that, but if you have a laptop then, you just get on it whenever.

These students enjoyed being able to quickly access the text on a device they almost always had with them. Further, participants valued the ability of the multitouch book to hold their notes and the reference text. As Sandy said:

“…it’s just, like, all you need is your computer and, like, you don’t have to have internet or anything and, like, you don’t need like pen and paper to write the notes down, like, it’s easy to take notes on it because you just, like, write them right on the book and then you, like, highlight the stuff and you don’t have to write anything down, like, physically write anything.”

Lastly, in addition to comments about not having to visit the library to check a book out, comments about not having to rely on wireless networking and the Internet were common. While not common, the wireless network at the participants’ school did experience downtime. When this occurred, students would be unable to utilize search engines like Google or Bing or use other forms of digital text hosted in online learning management systems. These disruptions had the potential to bring any research they were doing to a halt. Not having to rely on the Internet was a comfort for those using the multitouch book. Don described the feeling of the group by stating, “That’s pretty
convenient. Usually if you want to read something you have download it to your computer or if you want to read it without wi-fi or you just have to find some wi-fi or Internet connection.”

**Summary**

With one foot in the physical world and one foot in the digital, participants are living a hybrid life style. Liking technology, but still seeing advantages with using traditional physical media, they latch on to the ideas and possibilities of what the multitouch book could do for them. However, they themselves do not always take advantage of them.

Overall, most participants held a positive view of their experiences using the multitouch book. For many, like Hadia, this was their first experience using a multitouch book. It took a while for these students to understand the difference between the multitouch book and other forms of electronic text:

“’Cause like, you know, we always hear about like, oh you can read books online, you like, you just like, you know like how you just scroll through like a regular textbook, just like online though, but it’s totally different from that. So it has videos, it has images, it has like stuff that regular textbooks would never have. And like, we didn’t know that until, you know, we saw the book and went through it.”

These students also expressed a desire to have more, explicit training on how to use the many features of the multitouch book. For them, it was not apparent how to effectively engage with the text nor did they want to spend the time exploring on their own. Throughout a semester of using their multitouch book, most students experienced some
form of technical glitches associated with the computer. While this impacted their perceptions of it, most still held to the future potential of what the multitouch book could do. Anna spoke to this:

“’cause it took me, like, a long time to download it, like, and it was just a hassle, I guess, for everyone and it like, I mean, it was worth it once you finally got it downloaded but the process the to download just, like, took forever, like, you can’t control that but it was just, like, slow.”

In general, students favored the appearance of the multitouch book, with its horizontal scrolling and clean layout, but declined to engage with the interactive multimedia features contained within it. Reading the book on the computer was inexplicably linked to the book itself with many students enjoying the convenience reading on a computer afforded them, but disliking reading on the screen. Further, participants felt the multitouch book was simply a tool dedicated to only helping them complete a subset of their coursework in the quickest way possible. Lastly, while using the multitouch book, participants experienced being stuck in two worlds -- the physical and the digital. They are living their lives with one foot in each while they look to a digital future.
Chapter 6

REFLECTIONS AND IMPLICATIONS FOR FUTURE RESEARCH

The goal of this phenomenological study was to better understand the lived experience of students who used a multitouch book. Chapter 4 presented a description of the research participants and Chapter 5 discussed the five themes that appeared after analysis of participant usage data, observations and semi-structured interviews. This chapter serves to provide not an interpretation of the study, but rather reflections on the research findings and processes and its implications on further research.

Review of Findings

An empirical phenomenology approach was used to explore the essence of using a multitouch textbook. Its goal was to answer the central question of how do high school students experience digital multitouch textbooks. To help answer the central question, several research sub questions were also developed.

**RQ1:** How do students feel their approaches to reading have changed since the incorporation of multitouch books?

**RQ2:** How do students view the process of reading with multitouch books?

**RQ3:** What are students’ beliefs as to the impact of multitouch books on reading comprehension?

**RQ4:** What aspects of multitouch books do students view as helpful to learning?

These research sub questions can be divided into two groups. Research questions one through three revolve around the idea of ‘Reading’ and understanding of how students approach reading using a multitouch book. Question four sought to explore student
opinions on using the book as part of their course work. The following section will seek to summarize these results.

*How do students feel their approaches to reading have changed since the incorporation of multitouch books?*

Students in this study did not report or indicate a dramatic change in their reading habits using a multitouch book compared to a print book. Instead, students’ preexisting opinions on what constitutes reading (i.e., skimming versus reading deeply) transferred from one medium to another. In this instance, the technology simply exaggerated the already existing tendencies of students. Those students who reported a belief in completing assignments as quickly as possible found the multitouch book a convenient tool to help them become more efficient. Search functions, hypertext and organizational cues all contributed to this feeling. Students who viewed reading as a task involving close analysis of the text using a print book, also expressed the same belief with multitouch books. These students found the multitouch book’s text markup features and bookmarking tools to be advantageous to their style.

*How do students view the process of reading with multitouch books?*

While participants’ approaches to reading did not change with the introduction of the multitouch book, the processes of reading did. Participants changed their style of accessing and ‘learning’ information because of the technology tools present with the multitouch book. The utilization of search and hypermedia elements was a contrast to the utilization of an index or table of contents in a printed textbook. Participants struggled with finding a workflow that was best for them. Throughout the semester, students would switch between attempting to go all digital (i.e., reading and note taking using only the
multitouch book) and using a blended approach (i.e., digital reading and physical note taking).

*What are student’s beliefs as to the impact of multitouch books on reading comprehension?*

Research participants struggled with the impact of the multitouch book on their perceived comprehension. Many expressed a belief they learn best when they wrote notes on paper as opposed to typing notes. Others indicated the ability to quickly access their digital notes made it so they did not have to remember as much on their own, since they could look things up quickly. Most however, felt the layout and appearance of the multitouch book increased their ability to understand and remember the content being presented. It was less intimidating and allowed for struggling readers to engage with shorter blocks of text at one time.

*What aspects of multitouch books do students view as helpful to learning?*

Students tended to ignore many of the multimedia features of the multitouch book, preferring instead to focus on the text markup tools (i.e., highlighter, underline and ‘add a note’) and the navigation tools. Participants also viewed the advantages of digital text such as portability and customizability as helpful to them. Features such as movies, 3D diagrams and quizzes went relatively unused. Participants reported while they liked the idea of having those features available, they saw them as add-ons and not beneficial to helping them understand the text.

**Implications**

Understanding the student experience of using multitouch digital text has many implications for teachers, curriculum supervisors and even publishers. Previous research
from three different perspectives (hypermedia, onscreen reading, and multimodal learning environments) each attempted to predict the experience of students using the multitouch book. Many of the reported student experiences were consistent with this prior research. Students in this study did not have experiences contrary to the established literature; rather their experience was one of choosing to ignore many of the elements that have been extensively researched. In this, they experienced the same effects the control groups in those studies experienced.

As discussed previously, participants tended to view the multitouch book as a tool to help them accomplish a designated task. In doing so, they accessed short snippets of text they found using the search tools. Participants did not view the text as something to be read from cover to cover. This type of usage pattern was similar to that described by Berg, Hoffmann, & Dawson (2010) in their study of information retrieval strategies between print and digital books as well as research by Hermon, Hopper, Leach, Saunders & Zhang (2006) in their look at ebook use by students. The physical effects of eyestrain as reported by Seomun, Lee, Kim et al. (2013) were also reported by many participants when talking about glare coming off of their computer screens.

The creators of multitouch books included many features that have the ability to transform static text into a hypermedia rich, interactive multimodal learning environment. Tools such as the search feature and roll-overs/pop ups included embedded leads as described by Antonenko & Niederhauser (2010). These leads or short previews of the upcoming link, are designed to decrease student cognitive load and increase understanding. Participants in this study however, tended to skip over them, preferring
instead to use a trial and error strategy to explore search results. The result was an increased feeling of getting lost in the text due to an increase in cognitive load.

Students also chose to ignore many of the features that made the multitouch book a multimodal learning environment. Very few students utilized multiple interactive elements as described by Moreno & Mayer (2007) and Domagk, Schwartz & Plass (2010). In general, students utilized only searching, navigating and controlling and chose to ignore other such as manipulation and guidance and feedback. Whereas utilization of these features can have substantial learning gains, students viewed them as non-essential add-ons to the learning process and chose to ignore them.

The reality of students avoiding the most beneficial aspects of the multitouch books presents a problem for their creators. The main attraction of utilizing multitouch books is their ability to create a rich, interactive environment for students to explore content. If students do not engage in the text the way the publisher designed it, many of the learning advantages of using a multitouch book disappear. Students primarily enjoyed the multitouch book’s appearance, the convenience a digital file can bring and the tools of searching and highlighting. These are each features that previous digital text (i.e., PDFs and web pages) had and do not represent the dramatic technological advance promised by multitouch technology.

Limitations

This study was, at its core, a phenomenological study designed to give a voice to the student experience of using multitouch books. As such, the primary form of data collection was semi-structured interviews. To help ensure the validity of the data, interview data was combined with researcher observations and computer usage data to
triangulate the shared experience. When viewing the experience presented in this study, three main limitations need to be considered – that of the types of assignments given to students, the technological problems associated with the data collection and deployment methods.

One of the compounding factors in examining the student experience of using a multitouch book was the type of assignment given to students by their teacher. This study’s participants were mainly asked to complete lower-level knowledge and comprehension-type assignments that did not necessarily require deep reading. As such, the experience for these students using the multitouch book may be drastically different from other students who have been assigned assignments that require a different level of understanding from the text. It could be that students simply used the book to the level that was required by the assignments they were given.

Secondly, there were many technological issues associated with the deployment and the data collection procedures. The experience of students using multitouch books began with an update of their laptop’s operating system. This update caused several problems for multiple students. The installation of the book also had issues. Due to the size of the book, many students were frustrated with the download time and the restrictions associated with the process. These technical issues related to the deployment of the multitouch book have the potential to impact students’ perceptions. However, while not directly a part of the multitouch book itself, the feelings and experiences of the deployment process are part of the larger experience of using a new, digital technology, such as the multitouch book. In addition to the deployment issues, a glitch in the device management software caused several students’ usage data to be incomplete. This
impacted the ability of the researcher to use this data, in addition to classroom observations, to triangulate data gathered through the interview process. With the primary and secondary forms on data collection (interviews and observations) rich with insights into student usage, the lack of full triangulation should not be seen as a severe limitation to this study.

**Recommendation for Future Research**

The description of students’ experiences presented in this study paints a rich picture of how students engage with multitouch books and sets the stage for many future research projects. Of particular interest would be a follow up study looking at the experiences of students in a classroom setting where the types of assignments required a deeper understanding of the text. Would this change how students approached and used a multitouch book? Would students perhaps be more likely to read larger sections of text and engage with more interactive features if a deeper level of understanding were required?

Secondly, while the majority of this study’s participants had previous experience with digital text, they did not have experience with multitouch text. As a result, the experiences and usage patterns displayed by participants was from the perspective of a novice. Would these patterns and experiences change if they were given more time to interact with the text? Would their experience change if they were given more explicit training on how to use the book with subsequent refresher trainings throughout the year?

Lastly, after understanding the perceptions and experiences of students using multitouch books, it would be interesting to compare those experiences with their
performance on exams and assignments. In this, a mixed methods follow up study would be especially appropriate.

**Conclusions**

The prevalence of digital devices in the hands of students has increased rapidly in the past decade. Now, more than ever students are expected to utilize and be proficient with digital tools. Multitouch books promise to combine the best aspects of digital learning into one easily approachable package for students. This study sought not to try and evaluate its effectiveness as a learning tool, but rather to present the experience of using the tool from the perspective of a student.

Utilizing a phenomenological approach, 18 students were selected and participated in all aspects of this study during the spring semester of 2014. The data gathered from participants included: the researcher’s notes from classroom observations, usage data from participant’s computers and a semi-structured interview. Interviews were transcribed and analyzed. A list of codes was developed and from those codes, several larger categories were developed. These categories distilled themselves into five themes. These included *Appearance Matters, Limited Interaction, The Conduit Matters, The Book as a Tool and Students Straddling the Digital and Physical World.*

Students’ experiences within these themes generally echoed the established literature about multitouch books. An important result of this study was that the participants chose to ignore many of the main features of interactive environments. Instead, they choose to view the multitouch book as a reference that was similar to traditional web pages and PDF documents. More research needs to be conducted on the
impact this attitude may have on student learning if multitouch books are to be widely deployed.
Works Cited


Appendices
Appendix A: School District Consent

**WESTSIDE COMMUNITY SCHOOLS**
**REQUEST TO CONDUCT RESEARCH**

Provide the name, title, address, contact information and affiliation for each researcher:

1. Matthew Lee, Technology Integration/Doctoral Student, WCS and UNL, mlee@westside66.org 402-880-5967

2. David Brooks, Professor UNL. dwb@unl.edu 402-613-5592

3. 

**Proposed beginning date:** 1/7/14  
**Planned completion date:** 5/23/14

**Brief summary** of proposed research, survey instruments, interview protocol, assessment and description of requested participants as described in Board Policy 2235R:

This research study will examine how high school students perceive and experience the integration of a multitouch electronic book into the high school curriculum. Participants (15-25) will be drawn from one teacher’s 11th grade US History sections. All students in this teacher’s sections will receive the multitouch book regardless of their status as participants in this study. Parental consent and student assent forms will be utilized. Data will be collected in three ways: semi-structured interviews, classroom observations and application usage data. Interviews will be conducted during student’s open mods in order to avoid any classroom disruptions.

**Approval by sponsoring or affiliating entity/organization:**

Upon review of the research proposal, I have determined the quality of this project will assist in improving educational practices and services.

University of Nebraska-Lincoln  
Name of Sponsoring Entity  
Signature of Professor

**Review by Assistant Superintendent Westside Community Schools**

Westside Community Schools hereby:

☑ Approves the above Request to Conduct Research  
☐ Denies the above Request to Conduct Research

Assistant Superintendent, Teaching & Learning  
Date  
12/14/13

**NOTE:** “A summary of research results must be sent to the Assistant Superintendent for Teaching & Learning upon its completion and prior to publication or other dissemination. The researcher(s) must obtain permission from the Assistant Superintendent for Teaching & Learning or designee if Westside Community Schools will in any way be identified in released oral or written findings (such as in a research paper, thesis or dissertation conference presentation, or public media report), and the Assistant Superintendent for Teaching & Learning or designee must be provided with all documentation for review prior to release and/or publication to the public.”
Appendix B: IRB Approval Letter

January 30, 2014

Matthew Lee
Teaching, Learning and Teacher Education
19168 Drexel Circle Omaha, NE 68135

David Brooks
Teaching, Learning and Teacher Education
123A HENZ, UNL, 68588-0355

IRB Number: 20140114049EP
Project ID: 14049
Project Title: Understanding Students Experiences with Multitouch Digital Texts

Dear Matthew:

This letter is to officially notify you of the approval of your project by the Institutional Review Board (IRB) for the Protection of Human Subjects. It is the Board's opinion that you have provided adequate safeguards for the rights and welfare of the participants in this study based on the information provided. Your proposal is in compliance with this institution's Federal Wide Assurance 00002258 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46). Your project has been approved as an Expedited protocol, category 6 & 7.

Date of EP Review: 01/23/2014

You are authorized to implement this study as of the Date of Final Approval: 01/30/2014. This approval is Valid Until: 01/29/2015.

We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:
* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;
* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;
* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

For projects which continue beyond one year from the starting date, the IRB will request continuing review and update of the research project. Your study will be due for continuing review as indicated above. The investigator must also advise the Board when this study is finished or discontinued by completing the enclosed Protocol Final Report form and returning it to the Institutional Review Board.

If you have any questions, please contact the IRB office at 472-6965.

Sincerely,

Julia Torqued, Ph.D.
Chair for the IRB
Appendix C: Parent Consent Form

PARENT / GUARDIAN INFORMED CONSENT FORM IRB# __________

UNDERSTANDING STUDENTS’ EXPERIENCES WITH MULTITOUCH DIGITAL TEXTS

You are invited to permit your child to participate in this research study. The following information is provided in order to help you make an informed decision whether or not to allow your child to participate. If you have any questions, please do not hesitate to ask.

Your child is eligible to participate in this study because your child is enrolled in a section of U.S. History or A.P. U.S. History class at Westside High School that was selected by the researcher. Your child will also be asked if he/she is willing to participate.

The purpose of this study is to describe the experience of using a multitouch electronic book on their school provided laptop computers. The results of this study will be to help educators understand the student experience of using electronic books.

Total time involvement of your student will be less than one hour. This study will be conducted at Westside High School. The researcher will provide everyone in the selected course sections access to the electronic book regardless of their decision to participate or not. Additionally, your student’s grade will not be affected by their decision to participate or not participate in this research project.

If you decide to have your child participate, the researcher will interact with them in three ways. 1) Three times during the semester, the researcher will visit a small group session to observe how the electronic book is being used. 2) At the end of the semester, the researcher will conduct an interview lasting no longer than one hour talking with your student about his or her experiences using the ebook in class. 3) Usage data (including how many times the iBook application was opened and for how long) and markings your child may have made in the ebook (including highlights, digital margin notes etc.) will be collected for later analysis.

There are no known risks associated with this research.

There is no direct benefit to your student for participating in this research. However, the results of this study will help teachers and researchers understand a growing field in education, that of electronic books. In return for your child’s participation in this study, he or she will be given two tokens of appreciation. First, during the interview food and drinks will be available for students to eat. Second, upon completion of the interview you child will be given a $10 iTunes gift card.

Please know that the confidentiality of your child’s personally identifying information will be protected to the maximum extent allowable by law. Only the researchers through the information that you provide will know their name and other identifying information. The results of this study will be used for a doctoral dissertation and may by be shared with officials from Westside Community Schools, may be shared at education or technology conferences or may be submitted for publication to relevant professional journals. Neither their name nor any other personally identifying information will be used in any presentation or published work without your prior written consent.
Your child’s rights as a research participant have been explained to you. You may ask any questions concerning this research and have those questions answered before agreeing to have your child participate in the study.

Please contact the investigator:

• if you want to voice concerns or complaints about the research
• in the extremely unlikely event of a research related injury

Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 for the following reasons:

• you wish to talk to someone other than the research staff to obtain answers to questions about your rights as a research participant
• to voice concerns or complaints about the research
• to provide input concerning the research process
• in the event the study staff could not be reached

Participation in this study is voluntary. You are free to decide not to enroll your child in this study. You can refuse to participate or withdraw your child at any time without harming their or your relationship with the researchers or the University of Nebraska-Lincoln (or other institutions or organizations), or in any other way receive a penalty or loss of benefits to which you are otherwise entitled. Please return this form and the one for your student to sign in the self-addressed, stamped envelope that is provided.

DOCUMENTATION OF INFORMED CONSENT

YOU ARE VOLUNTARILY MAKING A DECISION WHETHER OR NOT TO ALLOW YOUR CHILD TO PARTICIPATE IN THE RESEARCH STUDY. YOUR SIGNATURE CERTIFIES THAT YOU HAVE DECIDED TO ALLOW YOUR CHILD TO PARTICIPATE HAVING READ AND UNDERSTOOD THE INFORMATION PRESENTED. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

___________________________________________
Child’s Name

___________________________________________
Signature of Parent                        Date

IDENTIFICATION OF INVESTIGATORS

PRIMARY INVESTIGATOR                      SECONDARY INVESTIGATOR
Appendix D: Student Assent Form

YOUTH ASSENT FORM IRB# ______

UNDERSTANDING STUDENTS’ EXPERIENCES WITH MULTITOUCH DIGITAL TEXTS

We are interested in knowing what it is like for high school students to use electronic books as part of their course work. You are invited to participate in this study because you are enrolled in a U.S. History class and that class has been selected for participation.

Participation in this study involves the following: A researcher will come into your classroom three times during the semester to watch how the ebook is being used. A researcher will also use reports generated by your computer to see how often and for how long the ebook was accessed. The highlights you make in the book and the notes you take in the book will be made available for the researcher to look at. Lastly, you will be asked to take part in an interview lasting less than one hour in which we will talk with you about how you used the provided ebook and what you liked and didn’t like about it. Even if you chose not to participate in this study, you will have access to the multitouch book. Additionally, your grade will not be affected by your decision to participate or not participate in this study.

In return for you participation you will be offered food and drinks during interview and upon completion of the study, a $10 iTunes gift card.

Anything that you do or say on this research project will be strictly confidential. The results of this study will be used for a doctoral dissertation and may by be shared with officials from Westside Community Schools, may be shared at education or technology conferences or may be submitted for publication to relevant professional journals. Neither their name nor any other personally identifying information will be used in any presentation or published work without you and your parent/guardian’s prior written consent.

We will also ask your parents or guardian for their permission for you to do this study. Please talk this over with them before you decide whether or not to participate. If you have any questions at any time, please ask one of the researchers. Please return this form and the one for your parents to sign in the self-addressed, stamped envelope that is provided.

___________________________________________  ______________
Signature of Participant  Date

___________________________________________  ______________
Signature of Investigator  Date

IDENTIFICATION OF INVESTIGATORS

PRIMARY INVESTIGATOR
INVESTIGATOR
Matthew Lee Office: 402-390-3390

SECONDARY
David W. Brooks 402-472-2018
Appendix E: Demographic Questionnaire

Participant ID:

Please answer the following questions about yourself to the best of your ability:

1. What is your gender?
2. What is your age?
3. What grade are you in?
4. What grade do you expect to receive in this class?
5. On a scale of 1-5, how comfortable are you with using your computer? (5 is most comfortable, 1 is least comfortable.)

1  2  3  4  5

6. On a scale of 1-5, how often do you use your computer for reading? (5 is all the time, 1 is not at all.)

1  2  3  4  5
Appendix F: Semi-Structured Interview Questions

1. Since the start of the school year, how often do you use your ebook?

2. If someone taught you how to use your ebook, what did they say? If not, how did you discover how to use it?

3. What do you like about the ebook?

4. What do you dislike about the ebook?

5. In using your ebook, what features did you use?

6. What features of the ebook did you like best?

7. What features of the ebook did you like least?

8. Did you ever find yourself going back to the ebook outside of the required readings?

9. How often do you find yourself needing to re-read sections of the ebook to help with homework assignments?

10. Describe to me how you read your ebook.
   a. How often did you read through the entire chapter?
   b. How often did you search for particular words or phrases?
   c. How often did you insert notes or highlight the text? Why/Why not?
   d. Do you go back and re-read after you take the section quizzes?

11. Which do you like to read more? Ebooks or print books?

12. Does having your ebook help you with tests/quizzes? Why/Why not

13. Is there anything else you would like to add?
Appendix G: Class Announcement

Introductory Script

IRB#____________________

UNDERSTANDING STUDENTS’ EXPERIENCES WITH MULTITOUCH DIGITAL TEXTS

Good Morning/Afternoon, My name is Matt Lee and I’m a doctoral student at the University of Nebraska- Lincoln. I’m here today to talk with you about a study that I’m conducting. Your class has been selected to be part of a study. I’m interested in how high school students experience using a digital textbook on their computer. I would like to know what it is like to read on a computer screen using the newly created ebook that has been installed on your computer. Participating in this study will involve letting the me observe you during class, looking at the highlights and notes you have made in your digital book and sitting down for an interview that would last for no more than an hour.

While there is no direct benefit to you participating in this study, it will provide teachers and researchers with a better understanding of how students interact with digital books and what they like and don’t like about them. As a token of appreciation, food and drinks will be available during the interview and after the interview you will receive a $10 iTunes Gift Card.

I want to let you know that anything you do or say will be strictly confidential. You will have full access to the ebook installed on your computer regardless of your decision to participate in this study.

I have a packet containing consent forms for both you and your parents to look over and sign, along with a stamped envelop for you to mail the files back to me. If you are interested, please mail back the signed forms in the next week.

Thank you.
Appendix H: Study Reminder

STUDY REMINDER

UNDERSTANDING STUDENTS’ EXPERIENCES WITH MULTITOUCH DIGITAL TEXTS

Greetings:

A short while ago, you were offered the opportunity to participate in a study where we are interested in knowing what it is like for high school students to use electronic books as part of their course work. We are still interested in your participation.

Participation in this study involves the following: A researcher will come into your classroom three times during the semester to watch how the ebook is being used. A researcher will also use reports generated by your computer to see how often and for how long the ebook was accessed. The highlights you make in the book and the notes you take in the book will be made available for the researcher to look at. Lastly, you will be asked to take part in an interview lasting less than one hour in which we will talk with you about how you used the provided ebook and what you liked and didn’t like about it. Even if you chose not to participate in this study, you will have access to the multitouch book.

In return for you participation you will be offered food and drinks during interview and upon completion of the study, a $10 iTunes gift card.

If you are interested in this study, please complete the attached forms (consent forms) and bring them back to your teacher.

Thank you,

Matt Lee and David Brooks
Appendix I: Code Frequency Tables

Below are a listing of the five themes developed from the data. Listed below each theme are the codes that it encompasses. Numbers in parenthesis indicate the frequency in which the code appeared in transcripts of the semi-structured interviews.

<table>
<thead>
<tr>
<th>Appearance Matters</th>
<th>Limited Feature Use</th>
<th>The Conduit Matters</th>
<th>The Book as a Tool</th>
<th>Straddling Physical / Digital World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance - Negative (1)</td>
<td>Citation Feature (3)</td>
<td>Access - Everyone could have one (1)</td>
<td>Assignments are Base level (31)</td>
<td>Equal Between iBook and Print Book (2)</td>
</tr>
<tr>
<td>Appearance-Positive (36)</td>
<td>Didn't know that features were there (14)</td>
<td>Addicted to Computer (2)</td>
<td>Book had relevant information (8)</td>
<td>Equal content b/w Ebook and physical book (3)</td>
</tr>
<tr>
<td>Disliked PDF appearance (13)</td>
<td>Don't Know Value of Features (13)</td>
<td>All Devices are the Same 91</td>
<td>iBook saves time (14)</td>
<td>Experienced with Other ebooks(9)</td>
</tr>
<tr>
<td>Format - Negative (10)</td>
<td>Don't Use Features (8)</td>
<td>Comfortable Reading On-Screen (10)</td>
<td>Internet Quicker Than Book (1)</td>
<td>First Time With an iBook (9)</td>
</tr>
<tr>
<td>Format-Positive (28)</td>
<td>Features (4)</td>
<td>Distractions - Computer (9)</td>
<td>Only Do What Is Required (30)</td>
<td>Higher Comfort Level with PDF (1)</td>
</tr>
<tr>
<td>iBook Easy to Understand (24)</td>
<td>Features help learn (1)</td>
<td>Distractions-People (1)</td>
<td>Only read when necessary (52)</td>
<td>iBooks Have Potential (6)</td>
</tr>
<tr>
<td>iBook Easy to Use (4)</td>
<td>Features were just an add-on (22)</td>
<td>Eyes got Tired with On-Screen Reading (12)</td>
<td>Prefer Web for Reference (2)</td>
<td>Mixed Feelings about technology (9)</td>
</tr>
<tr>
<td>iBook hard to use (2)</td>
<td>Highlight - Color System (6)</td>
<td>iBooks are personal (3)</td>
<td>Reading (2)</td>
<td>Overall Prefer Print Books (2)</td>
</tr>
<tr>
<td>iBooks don't have as much information as print books (6)</td>
<td>Highlight - No Color System (7)</td>
<td>iBooks Convenience (28)</td>
<td>Reading is More than Skimming (15)</td>
<td>PDF Easier to Use (1)</td>
</tr>
<tr>
<td>iBooks Hard to Find What is Important (1)</td>
<td>Highlight - Not A lot of thought (10)</td>
<td>iBooks Easy Access (17)</td>
<td>Reading is Skimming (12)</td>
<td>Prefer / Learn Better Writing on Paper (12)</td>
</tr>
<tr>
<td>Liked iBooks for Long Reading (4)</td>
<td>Highlight (4)</td>
<td>Internet Easier / Quicker than iBook (2)</td>
<td>Used book as a Reference (11)</td>
<td>Preferred PDF Appearance (6)</td>
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<tr>
<td>Overall Preferred iBooks (29)</td>
<td>Highlight Negative (10)</td>
<td>Like Online Reading for Schoolwork (8)</td>
<td>Used Book for Review (6)</td>
<td>Print Books Are Easier (3)</td>
</tr>
<tr>
<td>Preferred PDF Layout - Vertical (12)</td>
<td>Highlight-Positive (66)</td>
<td>Like Print for Pleasure Reading / Long Reading (23)</td>
<td>Viewed iBook as assignment-specific (11)</td>
<td>Tactile Feel with Books is Important (3)</td>
</tr>
<tr>
<td>Usability Problems (3)</td>
<td>Hyperlinks - Positive (11)</td>
<td>Like the idea of using technology (11)</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>iBooks Customizable (15)</td>
<td>Physical Books Too Heavy (23)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interest decides what to engage with (25)</td>
<td>Technology Problems (84)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notes - Negative (6)</td>
<td>Worried about physical media (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notes - Positive (19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature</td>
<td>Usefulness</td>
<td>Count</td>
<td></td>
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<tr>
<td>---------------------------------</td>
<td>---------------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Popups / Roll Overs</td>
<td>Useful (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Print to Voice</td>
<td>Positive (7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put thought into highlighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
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Appendix J: Letter From External Auditor

External Audit Attestation for Matthew J. Lee

Wayne A. Babchuk, Ph.D.

August 19, 2014

Audit Attestation

Mr. Lee requested that I complete a methodological audit of his qualitative Ph.D. dissertation research study titled “Understanding High School Students’ Experiences with Multitouch Digital Texts.” Officially, the audit was conducted from May-August 2014. However, Mr. Lee had taken two research courses from me prior to this time and directly relevant course assignments served as the basis for some of the work reviewed here (more below). The audit was part of the validation strategies used in establishing the trustworthiness and accuracy of the research. I provided input on aspects of research design and implementation with special attention devoted to data collection and analysis procedures and findings. I was initially given Chapter 1 (Introduction), Chapter 2 (Review of the Literature), Chapter 3 (Research Methods), and Chapter 4 (Description of the Participants). Later, Mr. Lee provided coded themes and Chapter 5 (Findings and Analysis), Chapter 6 (Implications and Conclusions), and Appendices. The Appendices included School District Consent Form, IRB Approval Letter, Parent Consent Form, Student Assent Form, Demographic Questionnaire, Semi-Structured Interview Questions, Class Announcement, Study Reminder, Code Frequency Tables, and Letter from External Auditor.

Audit Procedure

The audit procedure consisted of the following steps:
1. Initial meeting to invite me to serve as an auditor for his dissertation research and discuss my role and our mutual responsibilities in this process

2. Ongoing discussions of the research design and formulation of the purpose statement and central and sub-questions

3. Review of participant quotes and initial open coding procedures

4. Review of emerging codes and themes

5. Ongoing discussions of findings, analysis, and the writing of the manuscript

6. Read initial and subsequent drafts of thesis chapters and provided input to Mr. Lee as the project progressed with a particular focus on consistency in purpose and fit between purpose statement, research questions, sample selection, and data collection and analysis

7. Read first, second, and final draft of the completed dissertation

8. Submitted audit attestation draft for Mr. Lee’s review and input

9. Signed and submitted completed audit attestation to Mr. Lee

Initial Meeting

Matthew Lee was a student in two qualitative research courses I taught: EDPS 900K: *Qualitative Approaches to Educational Research* (Fall Semester, 2013), and EDPS 935: *Seminar in Qualitative Research* (Spring Semester, 2014). In EDPS 900K, he developed a preliminary research design as part of the course requirements titled “Understanding Students’ Experiences with Multitouch Digital Text: A Research Proposal.” In EDPS 935, he further refined this design and conducted a pilot study titled, “Experiences with Multitouch Digital Texts: A Pilot Study.” These were both outstanding A+ efforts and served as the basis for this Ph.D. dissertation research design and implementation.
Following completion of the second course, Mr. Lee invited me as an external auditor for this dissertation research. I agreed and we began to correspond following the second course and worked through the summer.

**Research Design and Formulation of the Research Question and Sub-Questions**

Beginning in May, 2014, and finalized in August, 2014, Mr. Lee and I corresponded via email regarding various aspects of his research design. As a follow up to the course assignments discussed in the last section, we reviewed his identification of a research problem, literature review, formulation of the purpose statement, central questions, sub-questions, purposive sampling techniques, selection of research methodology (and sub-approach) and its appropriateness to answer the research question(s), strategies of data collection and analysis, findings, validation strategies, and the writing of the manuscript.

**Data Collection and Analysis**

Mr. Lee provided me with two research proposals in the qualitative methods courses, several versions of his dissertation as it progressed, and a list of emerging codes and themes. On this basis, I was able to easily track his progress and choices he made throughout his research. I reviewed his emerging findings and themes and checked the consistency and accuracy of these themes with the data and purpose statement/research questions. I also paid careful attention to the participant quotes he chose to support his themes and how their fit with the conclusions he reached. I also read his literature review and how he integrated this into her research project. Because Mr. Lee had submitted two detailed research proposals/designs to me and presented them to the class, I had a head start on this audit. By the time I started reviewing his dissertation chapters I was familiar
with the choices he was making and the process by which he was proceeding. All of his work was performed at the highest level.

**Conclusion**

Having reviewed the material outlined in this audit, I submit the following conclusions:

The process of this study was consistent with its research design and the assumptions inherent in qualitative research practices. Mr. Lee was fully transparent in describing all aspects of the research process and systematically developed and implemented a research plan that allowed him to effectively explore his research questions and extend the literature in this area. His emergent themes and analysis are consistent with the assumptions of the qualitative paradigm and address the essence of the phenomenon of his study. Upon review of the final draft of this manuscript, I conclude that the goals of the research were met, the research design and its implementation was empirically sound, consistent, and effective in addressing the purpose statement, and the trustworthiness of the study was established. There is support from the data for the emerging themes and his conclusions are consistent with them and augment the literature in this area.

Attested to by Wayne A. Babchuk this 19th day of August, 2014.

Wayne A. Babchuk, Ph.D.

Assistant Professor of Practice

Quantitative, Qualitative, and Psychometric Methods (QQPM)

Department of Educational Psychology

University of Nebraska-Lincoln