

**STUDENT PERCEPTIONS OF DIGITAL TEXTBOOK FEATURES AND THEIR
EFFECTS ON COMPREHENSION OF MATERIAL PRESENTED
IN A DIGITAL TEXTBOOK FORMAT**

A Doctoral Dissertation Research

Submitted to the
Faculty of Argosy University, Phoenix Campus
College of Education

In Partial Fulfillment of
the Requirements for the Degree of

Doctor of Education

by

Lori Trujillo-Cole

March 2016

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ABSTRACT

This research study analyzed information about graduate student perceptions of digital textbook technology. This quantitative study focused on non-causal, descriptive, and correlational research to identify student perceptions concerning digital textbook features, and how these perceptions related to students' perceived comprehension of learning materials. An online survey questionnaire was structured to address the areas being studied. Data collected were the age and gender of the student, student use of print textbooks, digital textbooks or both formats, the Use of Features Scale, which measured student use of search and highlighting features, the Rate of Understanding Scale, which measured student perceptions of the feature usefulness, and Digital Textbook Preference Score, which measured student preference for and choice of digital over printed textbooks and their perceived usefulness of the single-page display feature. Gender data were dummy-coded (with zero for male and 1 for female) for correlation testing using continuous variables. Frequency charts and graphs were used in descriptive procedures, and the bivariate Pearson Correlation coefficient was used to test for and measure any associations between these variables. Data analysis using correlational testing revealed no correlation between the Use of Features Score and age or gender. Data analysis showed a significant correlation between the Use of Features Score and the Rate of Understanding Score, and showed a significant correlation between the Use of Features Score and the Digital Textbook Preference Score. Further research using different locations, institutions, and various students including undergraduate students, K-12 students, and students with learning challenges is recommended.

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DEDICATION

This research project is dedicated to my sister, Donna, who I miss every day, my parents Don and Carol Trujillo and to my mother-in-law, Pam Cole.

CHAPTER ONE: INTRODUCTION

Digital textbook technology is expanding rapidly to become a permanent addition to the educational landscape and it could become a very valuable asset to support and enrich the student learning experience. The expansion of digital reader technology, such as tablets, has been instrumental in the push to expand digital book (e-book) technology and Amazon has revealed that the sales of “their e-books (now) outperform (the sales of) their print books” (NMC Horizon Report, 2013, p. 16). As digital textbooks are becoming more available in educational systems and especially in hybrid and online learning environments, it is important to examine the effectiveness and benefits of this technology for student learning. To be beneficial, digital textbook technology needs to be embraced by students. Falc (2013) discusses how many students favor digital textbooks (e-textbooks), which often are lower priced than their traditional printed counterparts, and prefer using digitally stored information, which lessens the need to carry around heavy printed textbooks (Falc, 2013). Students also seem to prefer to “have choices (of digital and printed textbooks) available to them that fit their needs and preferences” for studying (Falc, 2013, p. 10). Lepi (2012) reports that “of the 91% of students who said they failed to complete required reading before classes, about half (46%) reported they would be more likely to complete their reading if it was in a digital format” (Lepi, 2012, Infographic, Time to hit the ebooks).

There are many additional student preference factors to consider in examining digital textbook technology, including content interaction, perceived value, affordability, and usability (Stone & Baker-Eveleth, 2013). As the availability and student preferences for digital textbook technology continue to expand, the performance of this technology

and its features need to be assessed as these could be “the key determinant of (student) satisfaction” as well as the acceptance of this technology (Philip & Moon, 2013, p. 287). Student acceptance of this technology might be crucial to supporting student comprehension of materials presented in a digital textbook format.

This study explored student responses toward specific features in digital textbooks, and examined student perceptions of their comprehension of the materials they are reading while using features of digital textbook technology. The findings from this study might contribute information toward the advantages and disadvantages of this developing technology, and might further the insight on the usability of specific digital textbook features and how these features might shape student learning experiences using this technology.

Problem Background

For a long time, traditional printed textbooks have been a learning resource for higher education students. “Traditional textbooks are hard-copy books produced by publishers that students typically purchase, or rent, from bookstores or online vendors” and the newer “electronic equivalent of a traditional textbook is a traditional (digital) e-textbook” (Lindshield & Adhikari, 2013, Introduction and Literature Review, para. 2). As digital textbook technology has expanded, the “old, bound volumes” of traditional printed textbooks are still a mainstay with many institutions now offering both versions to their students (Kolowich, 2012, para. 1).

One of the advantages of digital textbooks is that they can be designed and used to support multiple learning styles. “Traditional (printed) textbooks, like any standardized learning technology, are much more accessible to some learners than others”

(Office of Educational Technology, n.d., Serving the Underserved, para. 6). Digital textbook technology developed from the idea of needed accessibility with the mandated NIMAS, National Instructional Materials Accessibility Standard, in 2006 (Office of Educational Technology, n.d.). NIMAS stipulated “that all U.S. textbooks be available as a “digital source file”” that could be transformed into various formats to meet the differing learning needs of students (Office of Educational Technology, n.d., Serving the Underserved, para. 7). Examples of various digital formats include braille text, audio text, and large format text versions.

Within the broader context, acceptance and integration of digital textbooks by students is an important issue to be examined. Rickman, Von Holzen, Klute, & Tobin (2009) bring to attention the concern for the amount of time needed to fully integrate digital textbook technology by discussing the question of how much digital technology is controlled by administrators and faculty who are reluctant to introduce digital textbooks into the classroom (Rickman, Von Holzen, Klute, & Tobin, 2009). Another issue considered in this study is the impact of digital textbook feature usage on literacy and cognitive skill development as digital textbooks become commonplace in the educational system. Displaying a single page at a time in a digital textbook could affect cognitive skills as the student could feel less focused on the overall theme of the reading, and their cognitive reasoning could be challenged while trying to connect concepts across extensive reading in the digital format (Shepperd, Grace, & Koch, 2008). Comparing the cognitive skill success rates of older students versus younger students using digital textbooks is another angle to be examined.

Another consideration of this study is the ease and impact of digital access as digital textbooks become available through online libraries and other sources as they are created. Becker (2011) finds demand-driven acquisition (DDA) to be a critical force behind publishers and bookstores working hard to meet the needs of students in the form of quick and affordable digital textbooks (Becker, 2011). As of 2011, Barnes and Noble opened its College Textbook stores on over six hundred college campuses, focusing on sales and rentals of digital as well as traditional textbooks. These college campus stores are fully integrated with student registration services, allowing textbooks to be immediately available to students as soon as they register for their courses. Barnes and Noble's NOOK study digital software (which is available at no charge) and multiple versions of NOOK tablets continue to be popular educational study aids (Becker, 2011).

The development of digital textbooks could increase student involvement with the subject matter, meaning that students might devote more time and attention to the subject matter if they are more engaged with the technology they are using (Astin, 1999). Students "are (becoming) more sophisticated and more tech-oriented" with each passing year, and engaging these tech savvy students through the use of digital textbooks and features becomes essential in order to keep students fully involved with their learning experiences (Anderson, Boyles, & Rainie, 2012, p. 16).

Purpose of the Study

The way students approach and absorb information for studying has evolved around technology. For instance, "during lectures, students will Google additional information on the topic", which utilizes the Internet, and students "often will purchase the e-book version of a resource suggested by the teacher" rather than purchasing the

traditional printed version (Anderson, Boyles, & Rainie, 2012, p. 30). Many students are very comfortable with a digitally delivered information environment. Digital textbooks are born from this environment and appeal to students on many levels. Thomas (2007) discusses positive attitudes about the environmentally friendly aspect of digital textbooks, and notes the ability to highlight and easily turn pages as a determining factor in student selection and satisfaction of the digital device (Thomas, 2007). Specific features of digital textbook technology, such as the “search, copy, and paste” functions, “instant access”, and multimedia with interactive functions could add to the appeal of this technology to students (Philip & Moon, 2013, p. 288). The many different digital devices available to students expand the options to accommodate different learning styles and challenges (such as limited vision or hearing) through the chosen device, while the interactive content available in digital forms, such as with the iPad, the internet, interactive quizzes, and presentations allows for expanding access to learning and teaching styles (Underwood, 2010).

The purpose of this research study was to explore student responses toward specific features of digital textbooks, and to examine student perceptions of their comprehension of the materials they are reading while using features of digital textbook technology. Examining the broader perspective on how digital textbook technology is evolving and how it is integrated into higher education institutions, along with focusing on student responses to specific digital textbook features and information comprehension directed the goals of this research study.

Research Questions

RQ 1: Is there a correlation between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student?

H₀ 1: There is no correlation between the Use of Features Score and the age of the student.

H_A 1: There is a positive correlation between the Use of Features Score and the age of the student.

RQ 2: Is there a correlation between the Use of Features Score and the dummy-coded (with female coded as one and male coded as zero) gender of the student?

H₀ 2: There is no correlation between the Use of Features Score and the dummy-coded gender of the student.

H_A 2: There is a positive correlation between the Use of Features Score and the dummy-coded gender of the student.

RQ 3: Is there a correlation between the Use of Features Score and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)?

H₀ 3: There is no correlation between the Use of Features Score and the Rate of Understanding Score.

H_A 3: There is a positive correlation between the Use of Features Score and the Rate of Understanding Score.

RQ 4: Is there a correlation between the Use of Features Score and students' preference for using digital textbooks (Digital Textbook Preference Score)?

H₀ 4: There is no correlation between the Use of Features Score and the Digital Textbook Preference Score.

H_A 4: There is a positive correlation between the Use of Features Score and the Digital Textbook Preference Score.

Limitations

The study analysis might not address all the possibilities from the information gathered. This could be a limitation if some of the information gathered is unexpected yet relevant to the study and there is no allowance for analysis of this additional information.

The student participants might or might not be completely truthful in responding to the research questions, and there is no way to know completely the accuracy of their responses. This could be a limitation because an inaccuracy of student participant responses could skew research findings.

The sampling of students is random and there is no control over who chooses to participate in the study. For instance, there might be more participants responding in certain age groups, certain race groups, certain socioeconomic groups, or in gender groups, and this could be a limitation if these statistics inadvertently skew the research findings.

The students sampled might or might not be truly representative of a larger population due to the limits of sampling one university in one area of the country. This could be a limitation if the findings do not represent truly the overall target population for the study.

The student participants might be unavailable to respond during the time frame for collecting information, even if they express interest in participating. This could be a limitation in producing a smaller amount of participants than expected or planned for, and could skew the findings and/or invalidate the extrapolation of the findings to a larger population.

The student participants might not have current enough technology to access the digital textbook features that are being studied. This could be a limitation if the findings do not represent truly the students' experience with the feature technology.

Delimitations

This study focused on one university, which is located in one part of the United States. The delimitation of choosing a single university in one part of the United States allows for a realistic sampling of student participants that could be relevant to the overall population of the university.

The university chosen for the study is a non-profit public university that is part of the University of Pennsylvania system. Choosing a university with a smaller recent (spring 2015) graduate student population of 967 students allowed for a more focused, doable, and controlled research study. Choosing a larger private or public university is more challenging in terms of the logistics in gathering the population of participants needed to extrapolate accurately the findings to the overall population of that university, and so the delimitation is choosing a university with a smaller graduate population.

The delimitations concerning the participants in this study included both male and female students, students of ages 18 and older, and students with experience using both traditional printed textbooks and digital textbooks. Exclusions were anyone under the

age of 18, any students without both digital and traditional textbook experience, and any undergraduate students. Specifying an age range to adults over the age of 18 excluded any minors for this study.

The delimitation of specifying participants with both digital and traditional textbook experience further supported the accuracy of the findings in the research study. Assessing information gathered from students with both traditional printed textbook as well as digital textbook experience allowed the study participants to answer comparative study questions more accurately.

The survey technique for this study was an online questionnaire. Delimitations of using this survey technique included the following: the online questionnaire was an opportunity to collect data from different student demographics (age, gender, digital textbook experience, etc.), collect data on student perspectives about digital textbooks and features, and collect data on student perceptions of their comprehension of the material presented using digital textbook technology.

Additionally, an online questionnaire was an economical and time efficient way to gather data from participants while it allowed the participants to respond at their leisure during the survey period of time. The delimitation of allowing student participants to take the online questionnaire at their leisure allowed the participants to be less stressed and possibly more thoughtful and forthcoming in their responses. This might have added to the accuracy of the information that was gathered.

Definition of Terms

Digital devices are computers (laptops and desktops), smartphones, digital tablets, and any other devices that are able to access digital textbooks from the Internet (PC News Encyclopedia, 2014).

Digital textbook features are defined as function features available within the digital textbook and include search, cut, copy, and paste features, along with additional audio and video components, hyperlinks to additional information, sidebars, and interactive graphics, such as figures and maps (Shepperd, 2008).

Digital textbooks are defined as “an educational or instructional book in digital form” and these textbooks could be accessed on digital devices with Internet access (PC News Encyclopedia, 2014, Definition of e-textbook).

Hybrid learning environments consist of “traditional, face-to-face class time with online and out-of-class course work”, while online learning environments consist of only online class interaction available over the Internet (University of Washington Bothell, 2014, Definition of Hybrid Learning).

Online questionnaires also are known as online surveys and are “usually created as Web forms with a database to store the answers and statistical software to provide analytics” (Techopedia, 2015, Online Survey, para. 1).

Student perspectives are viewpoints of students based on their “experience and personality” (Cambridge Dictionaries Online, 2015, Perspective, para. 1).

Importance of the Study

The findings from this study might contribute information to the advantages and disadvantages of the developing technology of digital textbooks and their features. The

findings also might further the insight on the usability of specific digital textbook features and how these features might shape student learning experiences using this technology. This insight also might contribute information for consideration of future design applications of features in digital textbooks.

Student perceptions about digital textbook features, such as the search feature, could add to the existing knowledge of students' attitudes about digital textbook technology. For example, if students feel less focused on the overall topics of the reading due to the difficulty of searching out topics in a digital textbook, they might develop a negative attitude toward digital technology because of this experience (Thomas, 2007).

Examining the student participants' ages and their digital textbook feature usage experience could provide data about age groups that tend to use (and want to use) these features, and might allow for predictions of digital textbook feature usage among certain age groups. Likewise, examining student participants' genders and their digital textbook feature usage experience could provide data about gender preferences toward digital textbook features, and might show correlations of digital textbook feature usage among genders. Examining student participants' feedback about specific features of digital textbook technology and their perceived comprehension of the material presented in this format could show correlations between the technology and students' understanding of materials presented in a digital textbook format. The data from this study could provide valuable insight into the benefits of further innovation and expansion of digital technology features that are used in the higher education arena.

Areas for future study consideration could be to explore the digital textbook feature topic in larger educational institutions or groups of institutions in other areas of

the country, and to explore this topic in educational institutions in other countries.

Exploring this topic in K-12 educational institutions is another area that could provide valuable insight into the use of digital textbook technology. Comparative studies (using this topic) of all female to all male educational institutions, and studies of private versus public educational institutions that are relatively same size also could provide valuable information on the impact of digital textbook features and technology on students.

CHAPTER TWO: REVIEW OF THE LITERATURE

Introduction

Technology is impacting the educational landscape as deeply as it is impacting the modern learner (Beetham & Sharpe, 2013). Digital textbook technology addresses the need to modernize traditional printed textbooks to work with modern technology and engage modern learners who embrace this technology (Anderson, Boyles, & Rainie, 2012). Digital textbook technology harmonizes well with modern classroom technology and fulfills the need to provide learning information that could be shared in a digital format with learners that are “wired, networked, and computer savvy” (Blake, 2013, p. xi).

The History of Digital Textbook Technology

Literature and Textbooks

Modern digital textbook technology traces directly back to the beginnings of literature, books, and textbooks. *The Epic of Gilgamesh* is considered to be one of the oldest pieces of literature. This story “existed in oral form long before it was written down” and “the best preserved (written) version” was written during 1300-1000 BCE, creating one of the first written books (Mark, 2010, para. 4). Taking inspiration from the first written books, textbooks eventually were created. *The New England Primer* is one of the first textbooks used in the United States by the early colonists and it contained patriotic values and catechism topics, which emphasized religious teachings (Reynolds, 1976, p. 274). For a long time, written literature has been a driving force behind textbooks, which are considered to be “a highly adaptable literary genre” that have become “an integral part of (educational) learning activities” (Wakefield, 1998, Abstract,

p. 4). Modern day textbooks benefit from the efforts of these textbook publishers who work to maintain “the effectiveness of textbooks used in the school(s)” (Reynolds, 1976, p. 274). Guasco (2003) notes that “one of the virtues of the typical printed textbook is the narrative thread that binds together a story” and enriches the teaching and learning experiences in the classroom (Guasco, 2003, p. 1460).

The traditional textbook has played an important part in education as “it is a dominant form of (presenting) curriculum material” and it is instrumental in learning as the student “recapitulates, assimilates, and further internalizes what was learnt in class” (Mahadi & Shahrill, 2014, p. 150). For students, textbooks could provide additional study material and promote critical thinking concerning the subject matter that is being studied. For faculty, textbooks could be an instructional tool or guide for “interweaving and coordinating a variety of different learning exercise(s)” and for providing an organized “hub of an integrated learning environment where the students’ experience is the key” (Mahadi, 2014, p. 150).

Digital Textbooks

Digital textbooks were created partially in response to the rising costs of traditional printed textbooks, and there appears to be two significant reasons for the rising costs of printed textbooks. The first reason involves publishers consistently updating the textbook information every three to four years “regardless of whether or not the previous edition need(s) updating”, and publishers continuing to update “even though faculty indicate new editions are justified only half the time or less” (Nicholls, 2009, p. 7). The second reason involves the “enhanced offerings of additional instructional materials such as software and workbooks (that are) bundled into textbooks” (Nicholls, 2009, p. 8).

Both reasons drive up the cost of textbooks for students, thereby increasing the overall cost of their education. Federal and state legislation was enacted in 2007 with the College Opportunity and Affordability Act that attempted to control and reduce the rising costs of textbooks by requiring “publishers to provide more pricing information to professors”, and requiring “publishers to ‘unbundle’ the increasingly common and expensive packages of textbooks, CD-ROMs, workbooks, and Web tools” (Nicholls, 2009, p. 10). The idea behind this bill and others that followed was to allow students to purchase only the parts of the textbooks that they needed for their specific studies and to make faculty and institutions aware of the costs of the textbooks chosen for their classes.

In 2009, the Open College Textbook Act was introduced as a means to “create a grant program for the creation of freely-available, online open college textbooks” that “use an open license”, which “grants the public the right to access, customize, and distribute a copyrighted material” (Nicholls, 2009, p. 11). Many states followed with legislation to regulate the affordability and accessibility of textbooks for students. The “California State Senate produced SB 48: College Textbooks and Electronic Versions” (2009), which was designed to control college textbook costs and promote online textbooks ultimately by making the “textbooks (at public post-secondary institutions) available in an electronic format by January 1, 2020” (Nicholls, 2009, pp. 12-13).

Open access digital textbooks have been created in alignment with the Open College Textbook Act. These digital textbooks typically are “shared at no charge over the internet” and the flexibility of characteristics of digital (open) textbooks compared to traditional printed textbooks is summarized below (Nicholls, 2009, p. 23).

Table 1 Characteristics of Open and Traditional Textbooks

Open	Traditional Textbook
Dynamic	Static
Customizable	Non-
Open content, post-publication peer	Closed content, pre-publication peer
Personalized for local conditions	Standardized content
Targeted in-depth material	Generic
Timely	Dated
Integrate research findings into curriculum	Unlikely so
Addresses multiple learning styles	Assumes a uniform learning style
Low-cost or Free	Costly

Table 1. (Nicholls, 2009, p. 24).

With the availability of e-book (digital textbook) readers, such as Barnes and Noble's Nook and Amazon's Kindle, along with digital tablets like the iPad (iPad, iPadAir, iPadMini 2, 2013), digital textbooks continue to expand rapidly and Amazon has revealed that the sales of "their e-books (now) outperform (the sales of) their print books" (NMC Horizon Report, 2013, p. 16). Though students like the environmentally friendly aspect of digital textbooks, traditional printed textbooks are still a mainstay with many institutions who now offer both printed and digital textbook versions to their students (Kolowich, 2012).

Digital Textbook Features

Digital textbook features, such as easy updating for faculty and publishers as well as electronic notes, zoom in and out features, print on demand, search features, and highlight with bookmark features for students are making this new form of textbook technology popular in many college institutions (Nicholls, 2009).

eBooks are interactive digital textbooks whose interactive features are limited to flipping the pages, content search bars, and the ability to highlight text for note taking or to link to “a dictionary definition” to clarify the highlighted text (Interactive eBooks, 2012, para. 3). Enhanced eBooks contain all of these features as well as integrated “video, audio, and interactivity” features (Interactive eBooks, 2012, para. 4).

Interactive eBooks contain applications (apps) that “enable users to interact with the storyline in sight, sound, and touch” and are available for use on tablets (Interactive eBooks, 2012, para. 6). Examples of the video interaction features are videos embedded into the eBook, while examples of the sound interaction features are audio links. Touch interaction features include dragging fingers on the screen to resize the image and clicking on different areas of the screen to activate a part of an image to enlarge it or activate one of multiple images on the screen to enlarge and view it. These apps are created to allow the user to interact “with the content and storyline”, which could enhance the learning experience (Interactive eBooks, 2012, para. 7).

These newer incarnations of eBook features go beyond activating animation by touching the screen to “adding value through interactivity by using the full capabilities of a touch device to engage the user and enhance the learning and reading experience”

(Interactive eBooks, 2012, Interaction for Value, para. 8). New features are developed continually as these digital textbooks expand in purpose and use by institutions.

Digital textbooks often feature a NUI format (natural user interface), which mimics a printed textbook and has a page turning feature.

Figure 1: Natural User Interface Format

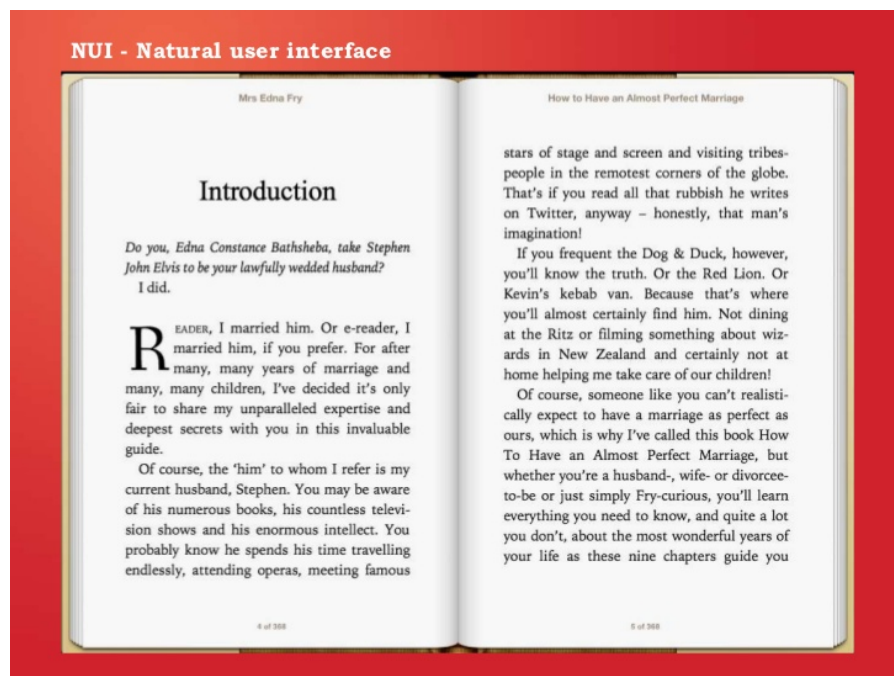


Figure 1. (Itzkovitch, n.d., Slide 8)

Other digital textbook features shown below include section areas that open in additional browser tabs on the interface (Figure 2), content search bars and navigation areas on the webpages (Figure 3), and annotate, bookmark, and highlight features activated by Adobe Flash (Figure 4).

Figure 2: Multiple Browser Tabs on Interface

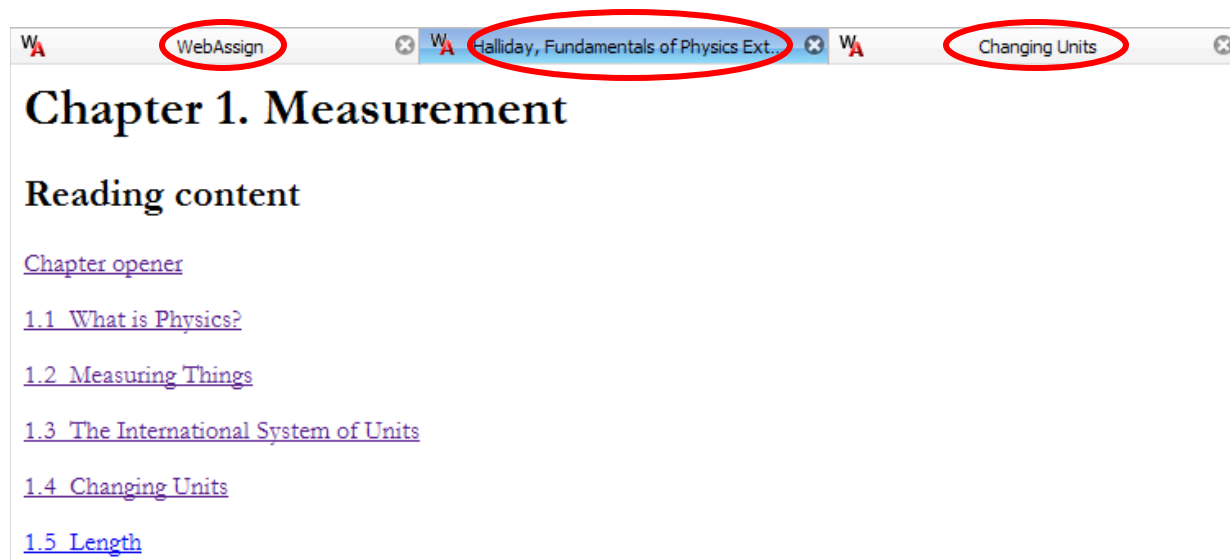


Figure 2 (WebAssign, 2015, eBook Features)

Figure 3: Content Search Bars and Navigation Areas

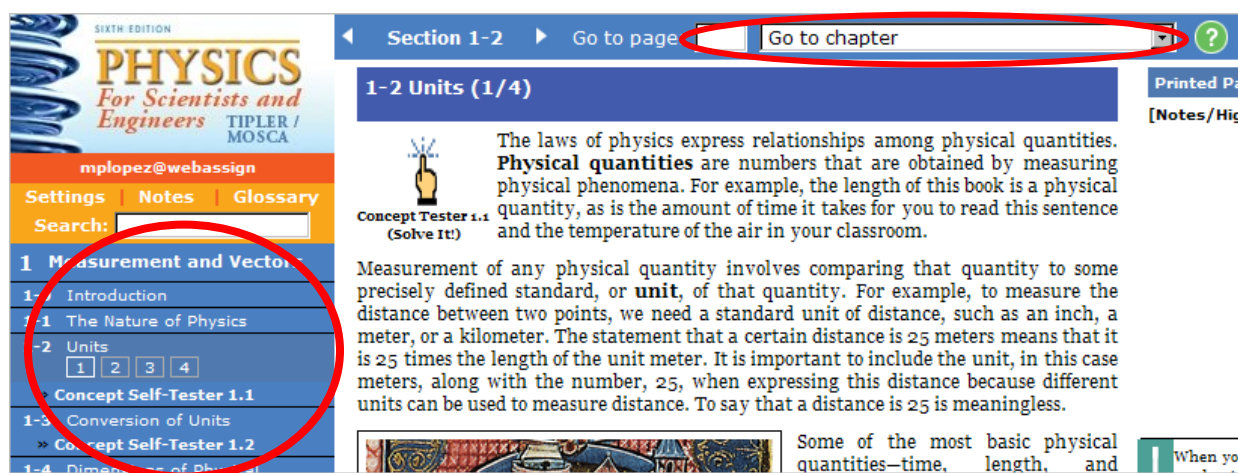


Figure 3 (WebAssign, 2015, eBook Features)

Figure 4: Annotate, Bookmark, and Highlight Features

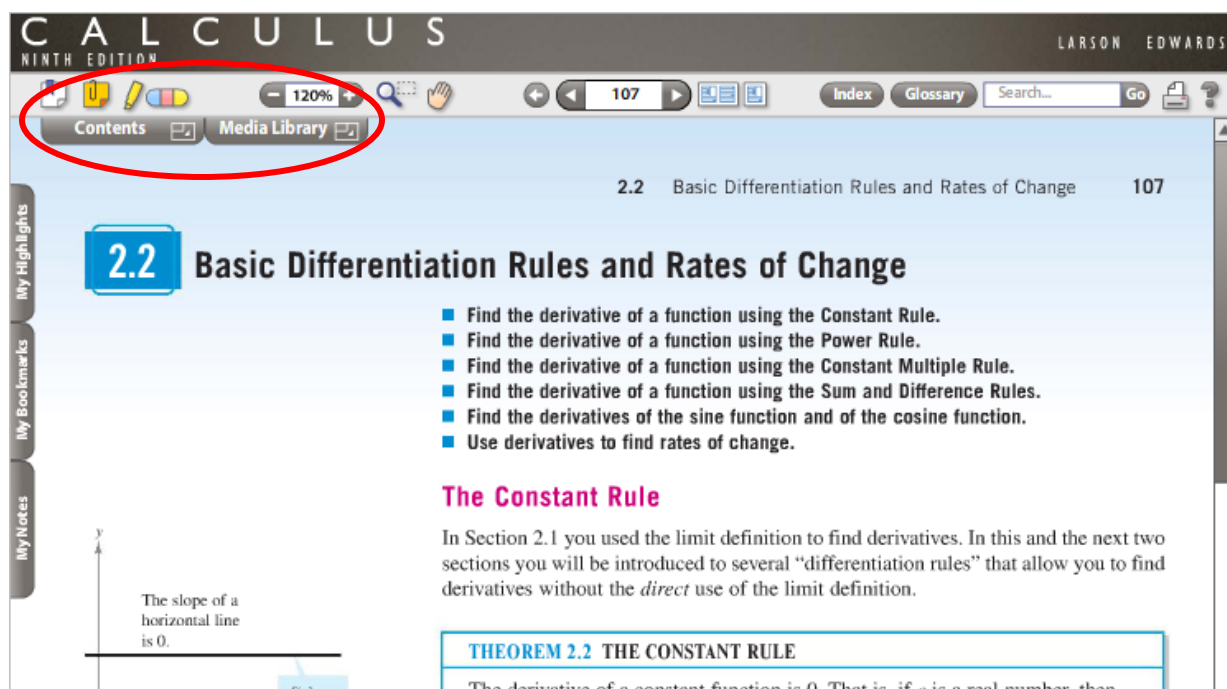


Figure 4. (WebAssign, 2015, eBook Features)

Digital Textbook Publishing

The new face of digital textbook publishing is based on providing more targeted learning materials that are less expensive for students than traditional printed textbooks and are more easily accessible than the printed versions. Additionally, customizable digital handouts and textbooks have grabbed the attention of college institutions, curriculum designers, and faculty as students' technology expertise has increased and their expectations about learning have changed (Guasco, 2003).

Custom Digital Textbooks, Handouts, and Features

Companies, such as XanEdu and better-known publishing companies like McGraw-Hill and Pearson have custom textbook creation options for educational institutions. XanEdu works with institutions and curriculum developers to create custom course materials (digital handouts and digital textbooks) chosen by the curriculum

developers and faculty from multiple sources that could be created to target the specific course learning objectives. Some digital textbook features that this company offers are online and offline access to the materials, quick links in the table of contents (clicking on the chapter title/section navigates the reader to that area), embedded video content, expandable graphics, including charts and pictures, synchronization of the digital handouts and textbooks between devices (syncing between a smart phone, computer, and tablet, for instance), and the offering of enhanced PDF's that are storable on any device for offline access (XanEdu, 2014). XanEdu also offers custom HistoryPacks, which are representative of their course packs. Course packs contain teaching materials for a specific course and could be in the form of either handouts or book formats. Course-pack features “include streaming video, dramatic photography, materials from special collections, timelines, maps, illustrations, graphics, and original documents” (Downes, 2001, para. 10).

McGraw-Hill offers information “from a library of more than 50,000” resources on various topics that curriculum developers could use to create custom course materials (McGraw-Hill Education, 2014, para. 3). Features offered include lessons, discussion question areas, study guides, and charts/diagrams to fit any content. McGraw-Hill has developed “an innovative, adaptive learning system that provides an individualized learning experience for K-20 students based on their unique strengths and weaknesses” called ALEKS, which stands for “**A**ssessment and **L**Earning in **K**nowledge **S**paces” (Belardi, 2015, para. 1). The ALEKS system works on tablet technology and it has had measurable success in student learning. “Student pass rate in a Pre-Calculus course

at Clemson University climbed from 45% to 70% after implementing ALEKS” (Belardi, 2015, para. 1).

Pearson works with different college institutions to offer digital versions of printed textbooks for their classes. For instance, Pearson works with Lamar University in Texas and the digital versions of the printed textbooks are offered in sections so students can order sections of the digital textbook that are specific to what they are studying, thus saving them money and providing only what they need for the class (Pearson Digital Library for Counseling for Lamar University, 2015).

Student Learning Theories and Digital Textbooks

As digital textbooks are becoming more available in educational systems (especially in hybrid and online learning environments), it is important to examine the effectiveness and benefits of this technology for student success. Digital textbook technology must address different learning theories to be accessible to all students.

While there are multitudes of learning theories, some theories are particularly responsive to digital textbook technology and features. Theories, such as connectivism, behaviorism, cognitivism, discovery learning, and problem-based learning or PBL could adapt well to digital textbooks and features for a deep learning experience.

Learning Theories - Using Digital Textbook Technology

Connectivist learning (connectivism) is based on using Internet technology to connect students in a virtual learning environment or lab. In using digital textbooks, the features that foster connectivism include interactive links to Internet resources, as well as embedded videos and links to YouTube videos (Learning-Theories.com, 2015). Bringing these interactive feature options to digital textbooks allows students to connect to the

bigger world around them. These visual features in digital textbook technology also could engage better those visual learners whose comprehension works better with visual components in addition to written material. Visual features could be enticing and engaging for modern students in their learning experiences.

Behaviorism works by shaping behavior through positive and/or negative reinforcement. Positive reinforcement connotes the use of a stimulus, and digital textbook features, such as interactive content, videos, and active hyperlinks could act as the stimulus within the digital textbook format (Learning-Theories.com, 2015).

“Cognitivism uses the metaphor of the mind as computer: information comes in, is being processed, and leads to certain outcomes” (Learning-Theories.com, 2015, Cognitivism, para. 2). Problem solving is part of the cognitive process in learning and digital textbook features, such as interactive exercises could foster learning through problem solving. The Cognitive Theory of Multimedia Learning is based on access to auditory and visual channels to process information in the brain. Digital textbook features that address these channels are audio features that allow students to hear the information in spoken form, and visual features, such as embedded videos, that allow students to see the information in a visual format. Exposure to both of these features could strengthen students’ information processing. This way of processing information is also known as Dual-Coding theory (Learning-Theories.com, 2015). As with other learning theories, learning is strengthened and more easily understood when the new information aligns with prior learned information.

Like cognitive learning, discovery learning is based on problem solving. Discovery learning also involves creative learning applications through “tailored learning

experience(s)” (Learning-Theories.com, 2015, Discovery Learning, para. 2). Digital textbooks could engage students in discovery learning by incorporating interactive applications, such as active Internet links for students to explore concepts independently and interactive areas within the digital textbook that allows students to record their findings and analysis. Also, features based on exploration and problem solving could motivate students.

Similar to discovery learning, the PBL theory also engages students in independent exploration of topics using investigative and problem-solving techniques (Learning-Theories.com, 2015). The digital textbook features applicable to this theory could include links to present scenarios and interactive applications to explore possible solutions to solve the problem. Again, interactive areas within the digital textbook could allow the student to share their analysis and solutions to the problem with their faculty and classmates.

Digital Textbooks and Features -Targeting Teaching and Learning Styles

One of the advantages of digital textbooks is that they could be designed and used to support multiple teaching and learning styles. The National Instructional Materials Accessibility Standard or NIMAS stipulated “that all U.S. textbooks be available as a “digital source file”” that could be transformed into various formats to meet the differing learning needs of students (Office of Educational Technology, n.d., Serving the Underserved, para. 7). Examples of various digital formats that support different learning styles include braille text, audio text, and large format text versions. The more accessible and engaging digital textbooks and their features are to students and faculty, the more likely this technology is to be incorporated into different teaching and learning styles.

Teaching Styles

Rickman et al. (2009) bring attention to the amount of time needed to integrate fully digital textbook technology into the classroom by discussing the question of how much digital technology is controlled by administrators and faculty who are reluctant to introduce digital textbooks into the classroom (Rickman et al., 2009). The reluctance could come from unfamiliarity with the technology or from resistance to updating current teaching practices to incorporate modern teaching and learning styles using technology. Demand-driven acquisition or DDA is a motivating factor behind publishers and bookstores that are working hard to meet the needs of students in the form of quick and affordable digital textbooks (Becker, 2011).

Critical thinking skills are an “essential capacity of citizens in a healthy democratic society, and postsecondary educators are uniquely qualified to cultivate this capacity among students” (Kurfiss, 1988, p 8). With today’s tech savvy students, faculty is confronted with the challenges of engaging and holding the attention of their students. Students often gravitate toward learning presentations that are “immediately easy” and they could resist learning that “is difficult to understand”, complex, and “requires entering the thinking and predicaments of others” (Elder, L.& Paul, R., 2010, Closing, para. 2). While “it is not the (faculty’s) job to entertain students, it is vital to engage them in the learning process” by incorporating the technology that the students use into their teaching styles (Gill, 2013, What you need to know about your teaching style, para. 1). Technology, such as “laptops and tablets, videoconferencing, and podcasts in classrooms play a vital role in today’s teaching styles” (Gill, 2013, What teaching style is best for today’s students?, para. 8).

Digital textbooks offer features to foster the development of critical thinking skills while engaging students and technology, such as applications (apps) that could work effectively with various teaching styles like the facilitator and blended styles. These critical thinking skills could be developed collaboratively through web-based applications and research. For instance, the WRApp is a “web-based research app” being developed, which “allows (faculty) to *connect* in several ways (with their students) through collaborative research” (Carr, 2014, Context, para. 3). This app could be incorporated as a digital textbook feature that could encourage “the potential for researchers to enlist participants, or co-researchers, to collaborate in practice-based enquiry, gathering and sharing evidence and co-constructing meanings” (Carr, 2014, Context, para. 3). This app works with the facilitator teaching style in helping students “develop skills to find answers and solutions through exploration”, and it works well with the blended teaching style by allowing faculty to “tailor their styles to student needs and appropriate subject matter” by building customized digital textbooks (Gill, 2013, What are the different styles of teaching?, para. 4 & 6). Many faculty members use multiple teaching styles (differentiated instruction) to address the different learning styles of their students recognizing “that not all students respond well to one particular (teaching) style” (Gill, 2013, What teaching style is best for today’s students?, para. 1).

Learning Styles

The many different digital devices available to students expand the options to accommodate different learning styles and challenges (such as limited vision or hearing) through the chosen device, while the interactive content available in digital forms on the

iPad, the Internet, interactive quizzes, and presentations allow for expanding access to learning and teaching styles (Underwood, 2010).

Learning styles are defined in seven categories. The first category is the visual/spatial learner that prefers “using pictures, images, and spatial understanding”; the second is the aural/auditory learner that prefers “using sound and music”; the third is the verbal/linguistic learner that prefers “using words, both in speech and writing”; the fourth is the physical/kinesthetic learner that prefers “using body, hands, and sense of touch”; the fifth is the logical/mathematical learner that prefers “using logic, reasoning, and systems”; the sixth is the social/interpersonal learner that prefers “to learn in groups or with other people”; and the seventh is the solitary/intrapersonal learner that prefers “to work alone and use self-study” (Learning Styles Online, 2015, The Seven Learning Styles, para. 1-7). Students often have more than one preferred learning style, though one style might be their strongest or preferred style of learning. Felder and Brent (2005) note that the development of multiple learning styles could benefit students greatly as they learn and prepare for their eventual professions (Felder & Brent, 2005). Developing more than one learning style could bring confidence to students and open up their opportunities for businesses that expect their employees to have developed multiple ways of brainstorming and problem solving.

Digital textbook technology could work with visual learners by providing visual features, such as graphics and videos to support concept understanding spatially. Digital textbook technology also could use audio link features to support auditory learners (as well as visually impaired learners) in understanding learning materials. Written learning materials in digital format could support the verbal and linguistic learning style, and

interactive features of digital textbooks on touch tablets could help the physical and kinesthetic learner as they use their hands to navigate through the digital textbook. The logical and mathematical learner could be supported by visual features, such as graphs and grids along with interactive features like links to online exercises or embedded exercises in the digital textbook. Digital textbook technology also could allow for group activities through interactive links in the textbook to chat areas and group work areas that allow the participants to share learning experiences. Likewise, the solitary and intrapersonal learner could function fully using digital textbook technology to study alone as needed while features, such as interactive links could provide information on all aspects of the subject matter using links to the Internet, the classroom, faculty notes within the digital textbook, and many more features.

Institutional Preferences and Digital Textbooks and Features

The evolution of institutional preferences for digital textbook technology in higher education is still developing. More and more digital textbook technology is becoming available, but students are slow to embrace this technology. Today's millennial students are very tech savvy, yet these "digital natives prefer reading in print" and note that reading on digital devices invites distraction like surfing on the Internet and using social media sites, which "is inevitable and (the student's) comprehension suffers" (Rosenwald, 2015, para. 2 & 6).

Several institutions (such as Indiana University, University of Wisconsin, University of California - Berkeley, University of Minnesota, University of Virginia, and Cornell University) have implemented pilot programs starting in 2009 that require "students to buy the e-textbook in select(ed) courses" and pay for these digital textbooks

through “their bursar accounts” (Abutaleb, 2012, para. 9-10). Students and faculty have mixed reactions to the mandatory digital textbook purchases including an Indiana University professor who discusses missing the feel of a traditional printed textbook and one University of Wisconsin student who finds that the digital textbooks for her classes actually cost her more money than the printed textbooks (Abutaleb, 2012).

A study by Bowker Market Research in 2013 found that more students still preferred printed textbooks over digital textbooks as they perceive “more learning and monetary value (including resale value) in print textbooks” (Greenfield, 2013, para. 7). Conversely, there are “students who prefer digital textbooks to print, (and) the reasons are the price, the ability to search the text, and how easy they are to carry around” (Greenfield, 2013, para. 9). Ultimately, the Bowker Market Research study believes that “publishers and other educational companies drive the shift to digital textbook technology “ (Greenfield, 2013, para. 14). “Don Kilburn, North American president for Pearson, the largest publisher in the world and the dominant player in education, said the move to digital “doesn’t look like a revolution right now”” but looks more like a slow evolution with uneven progress at best (Rosenwald, 2015, para. 9).

Curriculum and Course Design and Digital Textbooks and Features

An important factor in curriculum development includes examining and incorporating the current teaching and learning styles of the institution’s students and faculty. Rosenwald (2015) finds that millennial students maintain a strong preference for printed books and textbooks “for pleasure and learning” even though the “same group’s proclivity (is) to consume most other content digitally” (Rosenwald, 2015, para. 4). Students say that printed textbooks engage them to read more carefully, and they spend a

longer time reading the printed textbook information than reading the same information in a digital format (Rosenwald, 2015).

Considering this information, curriculum developers are turning to digital features to enhance “digital learning environments” that could engage students more successfully (Rosenwald, 2015, para. 23). Features, such as “access to online portals that help walk (students) through study problems and monitor their learning” and search features “to quickly find key words” become significant priorities when designing digital textbooks (Rosenwald, 2015, para. 23-24). Pearson Publication’s curriculum team has designed the MyLab & Mastering series of digital textbooks and features, which “have eclipsed the 50 percent mark, which means it (is now selling) slightly more digital than print materials” (Schaffhauser, 2014, para. 5). Pearson’s REVEL curriculum design offers “text, interactive exercises, infographics, social features, and video segments for students, who could use it on their mobile devices” and allows “faculty the means to track the time students spend on each reading assignment as well as their performance on assessments” (Schaffhauser, 2014, para. 6). The REVEL design has been adopted by 50 institutions as of the fall 2014 semester and it appears to be addressing the affordability issue of digital textbooks as well (Schaffhauser, 2014).

Hybrid and Online Course Structures and Digital Textbooks and Features

An additional challenge of developing digital textbooks and features comes with designing for hybrid and online courses. As digital textbooks are created for these newer learning environments, “administrators must recognize that faculty who are experimenting with new teaching methods and skills need support in the form of resources, time, training, and encouragement” (Kurfiss, 1988, p. 8). MOOC’s (massive

open online courses) are one of the more popular forms of online courses, and with high enrollments and low cost for classes are financially challenging the traditional printed textbook industry and “leaving publishers’ role(s) still unclear” (Button, 2014, para. 9). A challenge for the digital textbook industry is the ability to pirate or steal digital textbook information and this could impact the publishers who develop these resources (Button, 2014). In order to address these challenges, some publishers and institutions are considering moving toward “open-source textbooks, which are free online and available in print” as requested (Button, 2014, para. 12).

Specific to feature design for digital textbooks for hybrid and online learning, students positively respond to “quizzes at the end of the textbook, the social notes components, and the ability to enlarge text and images easily and to view 3-D models and images” (Ross & Johnson, 2012, p. 6). Smart tablets allow “students to use “gesture-based” (features)—swiping the text to scroll, increase/decrease text and images, and follow hyperlinks through the touchscreen interface” and these features helped enhance the learning experience for online students (Ross & Johnson, 2012, p. 5).

Student Preferences and Attitudes about Digital Textbooks and Features

College Student Demographics and Digital Technology

Millions of students are attending colleges in America and many of these students are exposed to digital learning technology. According to the National Center for Educational Statistics, overall college student enrollment demographics “in 2012, (showed) there were about 13 million (college) students under age 25 and 8 million students 25 years old and over” and “both the number of younger and older students increased between 2000 and 2012” (National Center for Educational Statistics, 2014,

College and University Education, para. 5). Additionally, “females are expected to account for the majority of college students: about 12.0 million females will attend in fall 2014, compared with 9.0 million males” and “more students are expected to attend full time than part time (an estimated 13.0 million, compared with about 8.0 million, respectively)” (National Center for Educational Statistics, 2014, College and University Education, para. 2). Enrollments of Black and Hispanic students have increased and “between 2000 and 2012, the percentage of college students who were Black rose from 11.7 to 14.9 percent, and the percentage of students who were Hispanic rose from 9.9 to 15.0 percent” (National Center for Educational Statistics, 2014, College and University Education, para. 6).

College student demographics show an increase in the use of “mobile devices, such as smartphones and tablets (for study) climb(ing) to an unprecedented 81 percent” during 2013 to 2014 and “digital learning tools (have) become a "must-have" for students” (Armitage, 2015, para. 1 & 6).

Content Interaction of Features in Digital Textbooks

To be beneficial, digital textbook technology needs to be embraced by students. Falc (2013) discusses how many students favor digital textbooks (e-textbooks), which are often lower priced than their traditional printed counterparts, and prefer using digitally stored information, which lessens the need to carry around heavy printed textbooks (Falc, 2013). Students also seem to prefer to “have choices (of digital and printed textbooks) available to them that fit their needs and preferences” for studying (Falc, 2013, p. 10). Lepi (2012) reports that “of the 91% of students who said they failed to complete required reading before classes, about half (46%) reported they would be more likely to

complete their reading if it was in a digital format” (Lepi, 2012, Infographic, Time to hit the ebooks).

Students often have a choice of print or digital format when digital textbooks are available. Students choose digital textbooks for convenience “whether it's using a laptop, notebook or phone” as well as for ease of navigation through the digital format (Mann, 2013, para. 4-5). Students enjoy a “more immersive (learning) experience” with interactive digital content, such as “videos, interactive charts, editable formulas, pop quiz, (and) in-depth figures” (The Gadget Masters, 2013, para. 7). Students engage more with “digital textbooks (which) provide more current material than print textbooks” (The Gadget Masters, 2013, para. 9).

Perceived Value, Affordability, and Usability of Features in Digital Textbooks

There are many student preference factors to consider about digital textbook technology including content interaction, perceived value, affordability, and usability (Stone & Baker-Eveleth, 2013). Performance of digital textbook technology and its features could be “the key determinant of (student) satisfaction” and acceptance of this technology (Philip & Moon, 2013, p. 287). In a study at Indiana State University in 2013 with 233 student participants, Jim Johnson found that students who used digital textbooks performed as well academically as students who used printed textbooks (Indiana State University Newsroom, 2013). Johnson notes that both men and women did equally well in their studies using both forms of textbooks (Indiana State University Newsroom, 2013). Even though traditional printed textbooks are preferred still over their digital counterparts, “many (college students) would opt for including a digital component with the textbook if given the choice” (National Association of College Stores, 2015, para. 1).

Digital textbooks could be more affordable than their printed counterparts.

“According to OnlineEducation, E-books are up to 53 percent cheaper than new (printed) textbooks on average” (The Gadget Masters, 2013, para. 4). The addition of digital features allows the students to find access to all of the information for their learning in one convenient location and this could prevent students from having to purchase additional resources (Lee, 2013). Faculty have options for creating custom digital textbooks on specific learning topics and this targeted approach could enhance and focus the student learning experience while saving students money (Schaffhauser, 2014). As digital textbooks are accessible on multiple digital devices, students could choose to use their existing devices rather than have to invest in more hardware (The Gadget Master, 2013).

Digital textbooks and features are intuitive for students who already function well in a digital technology environment. “Integrating technology in education everyday helps students stay engaged” and “today’s students love technology so they are sure to be interested in learning if they can use the tools they love” (Wainwright, 2015, para. 7). Digital textbooks are only as heavy as the digital device on which they are stored, and if the digital textbooks are saved onto the digital device, they are always accessible for students. One Liberty University student notes, “instead of carrying around a bunch of books, you have one device with everything on it” (Lee, 2013, para. 6).

If the digital textbooks are accessed through the Internet, they are subject to Internet availability. Most digital devices have the ability to connect to the Internet and this option allows students to access additional resources (including online digital textbooks and features) instantly as they are studying (Armitage, 2015). By using digital

textbook technology and features, students “will understand the content more because they interact and work with that content in ways they have not been able to previously” (Ben-Achour, 2014, A new model, para. 6). Students know how to navigate the digital textbooks easily to find information using search features (Mann, 2013). Other features allow students to take notes and highlight areas in the digital textbook for further reference and for studying, and students could use the copy and paste features easily to grab information that they wish to reproduce in their assignments. Many digital textbooks have a citation feature embedded into the book for easy citing and referencing.

Student Acceptance of Features in Digital Textbooks

Student acceptance of digital textbook features often depends on the ease of using these features. Digital textbooks could be helpful for people with vision problems as the font sizes can be adjusted for more comfortable reading (Mann, 2013). As a lack of blinking when reading digital textbooks can be an issue, apps such as ProtectYourVision are available, which reminds the reader to take regular breaks and EyePro, which reminds the reader to blink at regular intervals (Scearce, 2015). Rental service features exist for students to rent their digital textbooks for a specified timeframe and this service could “save at least 50% on the price” of textbooks when compared to printed textbooks (The Gadget Masters, 2013, Less Expensive, para. 2). Features, such as free apps, built-in links to internet resources, note-taking, highlighting, video and visual features built into the textbook as well as search features further enhance student acceptance of digital textbook technology.

Students note that eyestrain, also known as computer vision syndrome, is one of the biggest problems with using digital textbooks (Mann, 2013). The causes of computer

vision syndrome include smaller print that forces eyes to strain to read the text, back-lit screens that replicate staring at a bright light when reading, and reading with eyes wide open, which “can lead to dry eye” (Mann, 2013, Computer vision syndrome, para. 6). Eyestrain could cause a loss of concentration and cause students to “fall asleep while reading” (Mann, 2013, Long term impact, para. 2). To combat the problems from eyestrain, students often will print out the digital information so they can read it away from the glare of a digital device (Mann, 2013). Other areas of concern that students express are the costs of digital textbooks and the idea that digital textbooks cannot be resold like printed textbooks, which can be resold. The expense of digital readers and issues, such as “low battery life” are also a concern for students (Mann, 2013, Computer vision syndrome, para. 9). Other challenges to learning using digital textbook technology include the difficulty in linking concepts in the reading as the pages are displayed only one a page at a time. Unlike a printed textbook that can be quickly scanned through by flipping pages, digital textbook technology does not allow quick flipping through pages. Additionally, the time devoted to “reading online is usually spent scanning and skimming, with few places (or little time) for mental markers” as opposed to reading a printed textbook that allows for slower reading, which builds a physical map that organizes the information in the brain and aids in deeper comprehension of the material (Rosenwald, 2015, para. 14).

Summary

There are many varying views and opinions about digital textbook technology and how this technology and its features affect student perceptions, attitudes, and learning experiences. Educational technology continues to shape how students learn and think,

and digital textbooks and features will expand in the future. “A survey released (in 2012) by the Pearson Foundation found that 63 percent of college students and 69 percent of high school students believe that traditional textbooks will be phased out in the next five years” (Lee, 2013, para. 13).

Student preferences and attitudes regarding digital textbook technology might impact their comprehension and organization of the information they are studying. Digital textbook technology offers more learning options than traditional printed textbooks and might help students organize learned information in a way that better adapts to their modern thought processes. “George Siemens describes connectivism as “a learning theory for the digital age”” and digital textbook features, such as embedded links and activities create ways to access multiple areas of information, which allow students to use multiple learning styles while utilizing the connectivist learning theory idea of creating “a network of knowledge sources” that can be accessed as needed (Tracy, 2011, Connectivism, para. 2-3). Using digital technology, students no longer have to memorize all information to build knowledge of the topics they are studying. They only need to know where to access the information they need for building knowledge. Conversely, the idea of having information available instantly using search features in digital textbooks might discourage deep learning habits and replace them with shallow learning habits. According to Heick (2012), “some researchers believe that the brain absorbs digital and printed text differently” and “in one study, students who read printed books seemed to more fully understand material, and did so much faster than another group of students who read the same material in a digital format” (Heick, 2012, para. 10).

As digital textbook technology expands, examining student knowledge and use of these resources could provide information about how and why digital textbooks and their features are used or not used. Examining statistics, such as the age of users who prefer digital textbooks and features could provide information toward any noticeable trends in using this digital technology over printed textbooks. Assessing the preferences and attitudes of students toward digital textbook technology when both printed and digital textbooks are available could provide insight into this area of their learning experience. In a study of the digital textbook technology OER (open educational resources), Lindshield and Adhikari (2013) find that “students are willing to move beyond traditional print textbooks” into digital textbook technology (Lindshield & Adhikari, 2013, Discussion, para. 4).

Student expectations for their education have changed with digital technology and it is critical for institutions and publishers to pay attention to the effectiveness of digital textbook technology on student learning. As successful student engagement and learning is a primary goal of many educational institutions, it is worth examining the relationship between digital textbook technology and the modern student. Findings from studying the impact of digital textbook technology on student engagement and learning could contribute toward more targeted designing of these digital learning tools to further engage students and support their learning experiences. In Chapter Three, research methodology will examine various relationships and correlations of student perceptions of digital textbook features and their effects on comprehension of material presented in a digital textbook format.

CHAPTER THREE: METHODOLOGY

Research Questions

RQ 1: Is there a correlation between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student?

H₀ 1: There is no correlation between the Use of Features Score and the age of the student.

H_A 1: There is a positive correlation between the Use of Features Score and the age of the student.

RQ 2: Is there a correlation between the Use of Features Score and the dummy-coded (with female coded as one and male coded as zero) gender of the student?

H₀ 2: There is no correlation between the Use of Features Score and the dummy-coded gender of the student.

H_A 2: There is a positive correlation between the Use of Features Score and the dummy-coded gender of the student.

RQ 3: Is there a correlation between the Use of Features Score and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)?

H₀ 3: There is no correlation between the Use of Features Score and the Rate of Understanding Score.

H_A 3: There is a positive correlation between the Use of Features Score and the Rate of Understanding Score.

RQ 4: Is there a correlation between the Use of Features Score and students' preference for using digital textbooks (Digital Textbook Preference Score)?

H₀ 4: There is no correlation between the Use of Features Score and the Digital Textbook Preference Score.

H_A 4: There is a positive correlation between the Use of Features Score and the Digital Textbook Preference Score.

Introduction and Restatement of the Purpose

What are student perceptions of digital textbook features and how do these features affect student comprehension of learning material presented in a digital textbook format? Understanding student perceptions of digital textbook features is critical as publishers and educational institutions move forward using this technology (Falc, 2013). With the emerging reality of expanding access to digital textbooks for learning, student perceptions of this digital textbook technology could provide insight into student comprehension of their learning materials as delivered using this technology's features (Falc, 2013). For example, if the students feel less focused on the overall topics of the reading due to the difficulty of searching out topics with the search feature in a digital textbook, they might develop a negative attitude toward digital technology, which could impact their learning (Thomas, 2007). Students' comprehension of learning materials ultimately could impact their progress in their educational studies (Philip & Moon, 2013).

The purpose of this study was to gather information about student perceptions toward the use of digital technology features in a post-secondary educational environment. The digital textbook features examined in this study were the search feature, the highlighting feature, and the single-page display feature. This quantitative study focused on non-causal, descriptive, and correlational research as it sought to identify student perceptions toward these digital textbook features, and also sought to

identify how these perceptions toward digital textbook features related to the students' perceived comprehension of their learning materials.

Descriptive research examined each variable being studied and correlational research examined non-manipulated existing variables, such as student perceptions of specific digital textbook features and student comprehension of materials delivered using these features. Correlational research is non-causal since it does not predict a cause and effect of these variables yet it examines any correlation between the variables being studied (Lomax & Li, 2013). The data from this study could provide valuable insight into the possible benefits of further innovation and expansion of digital textbook feature technology in the educational arena.

Research Design

The research design for this quantitative study focused on non-causal, descriptive, and correlational approaches using information gathered from an online survey questionnaire. Both descriptive and correlational approaches are non-causal as neither approach predicts a cause or effect between the elements being studied. "Descriptive research is used to answer descriptive research questions: *What is happening? How is something happening? Why is something happening?*" (ECS & McREL, 2004, Descriptive Research Questions and Designs, para. 1). The descriptive approach ascertained if and how often students used these available digital textbook features (search, highlighting, and single page display). This approach also took into account the ages and genders of students who used these digital textbook features as well as ascertained which students used traditional printed textbooks and which students used digital textbooks when both versions were available.

“Correlational research design is used to describe the statistical association (or relationship) between two or more variables” (ECS & McREL, 2004, Descriptive Research Questions and Designs, para. 6). Correlational research sought to discover any association or relationship between the student use of specified digital textbook features and their perceived comprehension of the materials presented digitally. This research also examined any relationship between the availability of digital textbook features and the use of these features by students. Correlational research sought to discover any relationship between the age and gender of the students and their use of the digital textbook features, as well as to find any relationship between the availability of digital textbook features and student preference for using digital textbooks.

Participants and Setting

The institution selected for this study is a non-profit public university that is part of the University of Pennsylvania system. This institution is comprised of both undergraduate and graduate students, and has a range of graduate programs including education and special education, counseling, criminal justice, English, history, business administration, physical therapy and physician assistant, nursing, and technology instruction.

The graduate students at this university comprised the participant population that was studied for this research. This participant population consisted of both genders over the age of 18 years. These students attended classes both on-ground and online, and used both traditional printed textbooks and digital textbooks in their studies. The vast majority of the ages of graduate students in this institution fell in the 22 – 29 age range, followed by students in the 30 – 64 age range. An overwhelming majority of graduate students

were females. Participant exclusions were any student under the age of 18, any graduate students without both digital and printed textbook experience, and any undergraduate students.

Sample Size and Sampling Technique

The institution used in this study reported a spring 2015 graduate student population of 967 students with 26 percent male and 74 percent female. The minimum needed was 85 participants with the parameters of a .3 moderate effect size, a .05 p-level of significance and a conventional power of 80%. With the need for a minimum of 85 participants for an overall population of 967 students and the expectation of a one third to one half response rate from potential participants, all graduate students were invited to participate in the study. The researcher sent an email invitation with information on the study, access information to the survey, and access dates for the survey.

Instrumentation: The Survey

An online survey questionnaire was created specifically for this study and addressed the research questions. A pilot of the survey questions was conducted with fellow students and colleagues in advance of the study to ensure that the survey questions clearly addressed the research questions being studied, to ensure that the survey questions were clear and focused, and so feedback on the survey questions was being addressed. The pilot study strengthened the validity and reliability of the survey with respect to addressing thoroughly the research questions.

The survey questionnaire was structured with specific questions designed to address the issues being studied and contained four sections: preliminary demographic questions (PQ), digital textbook feature questions (DQ), comprehension scoring

questions (CQ), and digital textbook preference questions (DP). The PQ questions addressed age, gender, and use of digital textbooks. The DQ questions addressed student use and perception of the search and highlight and single page display features in digital textbooks. The CQ questions addressed student perceptions of the effect of digital textbook features on student comprehension (focus and organization of reading materials presented digitally) and the DP questions addressed student preference for using digital over printed textbooks.

The participants had access to take the online survey anytime during the access period and had their identities protected by the online survey. These options lessened any influence or stress the participants might have felt. Participants had the email, phone, and address contact information of the researcher to ask any questions or express any concerns about the study at any time.

The advantages of using a survey technique included the following: the survey was an opportunity to collect data from different student demographics (age, gender, digital textbook experience, etc.), the survey collected data on student attitudes toward digital textbook features, and the survey collected data on student perceptions of their comprehension of the learning materials using digital textbook feature technology. Additionally, an online automated survey was an economical and time efficient way to gather data from a substantial population of participants who might have been in many different locales. Instead of conducting face-to-face interviews, which would have required a meeting place and set specific times for participants to be interviewed, the online option allowed the participants to respond at their leisure. The researcher used the Survey Monkey online survey site to set up the online questionnaire (Survey Monkey,

2015). Once the email invitations were sent to the graduate students, the professors teaching graduate classes were contacted to share a short announcement with their graduate students reminding them about the emails being sent and the opportunity to participate in a graduate research study.

A disadvantage of the survey technique could be that the responding participants might not have been truly representative of the entire population that was studied. As discussed above, another disadvantage was that not enough participants might have responded to meet the minimum 85 participants needed. Inviting all students to participate increased the odds of having the necessary participants and representing the graduate student population. As the survey questions were designed specifically for this study, a pilot test was conducted before the actual study with participants (fellow students and colleagues) taking the survey both online and in-person. Information from the pilot test determined the time needed to take the survey and provided feedback on the survey questions, and adjustments were made to the survey as needed.

Measures

The variables that were studied were the level of use of specific digital textbook features (search, highlighting, and single page display) as measured by the Use of Features Score, the age and gender of the student participants, the students' perception of their comprehension of digital materials as measured by the Rating of Understanding Score, and student preference for using digital textbooks as measured by the Digital Textbook Preference Score.

Prior to conducting hypothesis testing, descriptive analysis was run on all variables to answer descriptive research questions about each variable and how they

interact with each other. Examining the age and the level of use of the specified digital textbook features provided data about younger or older ages that tend to use digital textbook features and allowed for predictions of digital textbook feature usage among certain ages. Examining gender and the level of use of the specified digital textbook features provided data about gender preferences toward digital textbook features, and gender usage of digital textbook features. Examining student feedback about the specific digital textbook features and students' rating of their ability to understand better what they are reading provided data about the effect of these features on students' perceived comprehension of the learning materials. Examining student feedback about their level of use of the specified digital textbook features and their preference for using digital textbooks provided data about how digital textbook features influenced students' choice of textbook format.

This survey contained Likert-style items. In the PQ section, the age variable was continuous and the gender variable was categorical, but for the purpose of correlational analysis, gender was converted to a continuous variable using dummy coding where females were coded as one and males were coded as zero, allowing the gender variable to be used in correlation testing. Asking the students for their ages and genders collected age and gender information.

The DQ section contained questions with answers on a three-point scale that addressed frequency of use of the features (from "have not used" to "moderate use" to "frequent use" of the feature) and measureable attitudes about the features (from "not useful" to "somewhat useful" to "very useful"). Higher numbers in these categories would indicate higher frequency of use and more favorable attitudes toward these

features. Likewise, lower numbers in these categories would indicate lower frequency of use and unfavorable attitudes toward these features. The Use of Features Score was calculated by adding the responses to these two questions together, for a possible score of two to six.

The CQ section's first three questions (Questions 9, 10, and 11) also contained answers on a three-point scale that addressed measureable student perceptions (from "no" to "somewhat" to "yes") about the effects of these features on student focus, organization, and comprehension of digital materials. Higher numbers in this category would indicate more favorable student perceptions of features on comprehension, while lower numbers would indicate less favorable perceptions. The Rate of Understanding Score was calculated by adding the responses on these three questions (with "no" rating zero, "somewhat" rating one and "yes" rating two), for a possible score of zero to six. The last questions (Questions 12 and 13) comprise the DP section. In this section, the Digital Textbook Preference Score was calculated from Question 12 (with "no" rating zero, "somewhat" rating one and "yes" rating two) and from Question 13 (with "strongly prefer printed" rated as one, "somewhat prefer printed" rated as two, "like both just as well" rated as three, "somewhat prefer digital" rated as four, and "strongly prefer digital" rated as five), for a possible score of one to seven. Higher numbers would indicate a preference toward digital textbooks while lower numbers would indicate a preference for printed textbooks.

Using demographic data from PQ and the scores from DQ and CQ allowed examination of how age and gender variables related to the Use of Features Score, Rate of Understanding Score, and Digital Textbook Preference Score. Additionally, scores

from the DQ, CQ, and DP allowed examination of how the Use of Features Score, Rate of Understanding Score, and Digital Textbook Preference Score related to each other.

Methodological Assumptions, Limitations, and Delimitations

The survey design method “provides a plan for a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population” (Creswell, 2008, Glossary). Quantitative research assumes the method has measureable variables and the method will seek “to understand the facts or causes of phenomena (disregarding) the subjective states of a situation or of individuals” and relies on “hypothetical-deductive procedures” (Velez, n.d., Assumptions: Quantitative Research, para. 1). Quantitative research also assumes that “if something is measured, validated, and generalizable, then that something is generalized to all populations that are similar to what was studied and reported” (Velez, n.d., Assumptions: Quantitative Research, para. 2). This research design used a Likert scale that specifically targeted measureable continuous variables. Another assumption was that the participants would answer the questions honestly and protecting the participant’s anonymity in this online survey questionnaire method promoted an atmosphere for honest responses.

Methodological limitation concerns for this study involved internal and external validity. A research study is considered valid “if it measures what it claims to measure” (McLeod, 2013, para. 1). “Internal validity is only relevant in studies that try to establish a causal relationship” (Trochim, 2006, para. 1). As this research design used a descriptive and correlational approach, the relationships between the variables were non-causal and internal validity was not relevant. External validity concerns the content and criteria of the study and whether “the results of a study can be generalized to other

settings (ecological validity), other people (population validity), and over time (historical validity)” (McLeod, 2013, para. 6). In this research design, one public university located in one state produced characteristics specific to these particular participants and the study results were specific to this population. These study results might vary at other universities or groups of universities, and also could vary with time (for example, conducting this study in 2025) and so this remains a limitation (external validity concern) for this particular study. As digital textbook technology is a relatively new phenomenon, it is reasonable to expect different study results as students who are born into this technology become commonplace and they expect this technology to be part of their learning experience. To address other external validity content concerns, the survey questionnaire for this research design could be assessed to make sure “it measures what it claims to measure”, and it relates to “underlying theoretical concepts” (McLeod, 2013, para. 1, and Assessing the validity of a test, Types of Validity Table). The pilot test provided support in assuring that the survey questions directly addressed the research questions.

Some methodological delimitation concerns of this study were that the data were gathered via an online survey, not conducting in-person interviews; the sample was a graduate population as opposed to an undergraduate population; and a quantitative method was used for analysis. Using an online survey allowed for specific targeting of the research questions for this study, and allowed more freedom for the participants to respond at their leisure and at the site of their choosing. In-person interviews could have compromised anonymity as the participant is face to face with the interviewer, but also could have allowed the participant to share more details and nuances in answers to survey

questions. While additional details and nuances are lacking in online surveys, more freedom of choice while responding to the online survey could alleviate stressors of time and location demands, and provide anonymity that could encourage more honest and open responses from participants. Many studies have been conducted using undergraduate populations, so the choice to use a graduate population helped to provide additional data on this topic about this under-studied segment of the population. Limiting the analysis of the data to the quantitative method allowed for defining systematic generalizations on the digital textbook feature perceptions and usage of the population studied, and allowed the data to be extrapolated further to other institutions across the country with similar traits.

Research Procedure

Once the questionnaire was developed, because it contains questions original to this specific study and researcher, a pilot test was conducted to identify any problem areas to be corrected before the actual research study was conducted. Fellow students and colleagues were engaged to take the pilot test. After the pilot test was taken, information was gathered from participants on whether the survey questions addressed the research questions, whether the survey questions were clear and focused on the research topic, and whether there were any recommended changes to the survey questions. Information on the length of time needed to take the survey also was gathered.

The finalized questionnaire was set up online using an online survey site and a link to the questionnaire was created. Student participants were informed of the study by email. This email contained information on the dissertation research project, researcher contact information, and survey information including anonymity protection for

participants. The email contained the informed consent form and provided survey availability dates and a link to the questionnaire with instructions that clicking on the link to the questionnaire constituted consent. The anonymity of the participants was maintained as the consent form and survey questionnaire did not ask for the participants' names. The informed consent also provided information on the approximate time needed to take the survey and informed the participants that they were free to stop taking the survey at any time if they wished. The professors of the graduate classes in which the student participants were enrolled were asked to share a brief announcement with their students about the email being sent to them regarding this dissertation research study and the opportunity to provide feedback on this research topic.

Data was analyzed to ascertain any correlations between these variables: amount of use of specific digital textbook features (search, highlighting, and single page display) as measured by the Use of Features Score, the age and gender of student participants, the students' rating of their comprehension of digital materials (Rating of Understanding Score), and student preference for using digital textbooks (Digital Textbook Preference Score). When data had been analyzed, findings were summarized, conclusions drawn, and suggestions for future research determined.

Data Processing and Analysis

This research study contained a categorical variable (gender) and multiple continuous variables (age, Use of Features Score, Rate of Understanding Score, and Digital Textbook Preference Score). For this correlational study, all variables needed to be continuous. The gender variable was converted to a continuous variable by dummy-coding using one for female and zero for male, which technically would measure the

femaleness when correlated with other scores, so that a positive correlation would mean women tended to have higher scores and a negative correlation would mean that men tended to have higher scores. This would allow all scores to go into a correlation matrix.

Each hypothesis was tested using correlational testing. This correlation testing tested the first research question by examining the relationship between the age of the student and the Use of Features Score. The correlation testing for the second research question examined the relationship between the dummy-coded gender of the student (femaleness) and the Use of Features Score. Correlation testing tested the third research question by examining the Use of Features Score and the Rate of Understanding Score. The correlation testing for the fourth research question examined the Use of Features Score and Digital Textbook Preference Score.

From the testing, a p-value of .05 or less meant that the probability was that the result of the testing was not due to chance and therefore was significant; a p-value well above .05 meant there was no a correlation between the variables and it was not significant. SPSS software was used to conduct bivariate Pearson Correlation testing. This testing measured “correlations among pairs of variables” and “correlations within and between sets of variables”, revealing “*associations* among continuous variables” (Kent State University, 2014, Common Uses, para. 1-2).

Conclusion

This quantitative research study gathered and analyzed information about student perceptions and use of digital textbook features (specifically the search and highlighting features), and how these features affected students’ perceived comprehension of learning material presented in a digital textbook format. This study examined students’ preference

for digital textbooks over printed textbooks. This study used online questionnaire surveys to gather information and then conducted non-causal descriptive and correlation testing using the continuous variables of age, dummy-coded gender (with zero for male and one for female), use of and preference for digital textbook features, students' rating of their ability to understand better what they are reading, and students' preference for using digital textbooks along with their perceived usefulness of the single-page display feature. The correlation testing looked for significant positive and negative correlations between the variables, determined a correlation coefficient, which measured the size of the relationship between the variables, determined a positive or negative direction of the coefficient, and determined a p-value, which indicated whether the results were significant or due to chance.

The research questions addressed were: Is there a relationship between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student? Is there a relationship between the level of use of the specified digital textbook features (Use of Features Score) and the dummy-coded gender (or femaleness) of the student? Is there a correlation between level of use of the specified digital textbook features (Use of Features Score) and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)? Is there a correlation between the student's use of the specified digital textbook features (Use of Features Score) and their preference for using digital textbooks (Digital Textbook Preference Score)? The data from this study could provide valuable insight into the possible benefits of further innovation and expansion of digital textbook feature technology in the educational arena.

CHAPTER FOUR: RESULTS

Statement of the Purpose

The purpose of this study was to gather information about student perceptions concerning the use of digital technology features in a post-secondary educational environment. The digital textbook features examined in this study were the search feature, the highlighting feature, and the single-page display feature. This quantitative study focused on non-causal, descriptive, and correlational research to identify student perceptions concerning these digital textbook features, and on identifying how these perceptions toward digital textbook features related to the students' perceived comprehension of their learning materials.

Descriptive research examined each variable being studied and correlational research examined non-manipulated existing variables, such as student perceptions of specific digital textbook features and student comprehension of materials delivered using these features. Correlational research is non-causal since it does not predict a cause and effect of these variables yet examines any correlation between the variables being studied (Lomax & Li, 2013). The data from this study could provide valuable insight into the possible benefits of further innovation and expansion of digital textbook feature technology in the educational arena.

Research Questions

RQ 1: Is there a correlation between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student?

H₀ 1: There is no correlation between the Use of Features Score and the age of the student.

H_A 1: There is a positive correlation between the Use of Features Score and the age of the student.

RQ 2: Is there a correlation between the Use of Features Score and the dummy-coded gender of the student (with female coded as one and male coded as zero)?

H₀ 2: There is no correlation between the Use of Features Score and the dummy-coded gender of the student.

H_A 2: There is a positive correlation between the Use of Features Score and the dummy-coded gender of the student.

RQ 3: Is there a correlation between the Use of Features Score and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)?

H₀ 3: There is no correlation between the Use of Features Score and the Rate of Understanding Score.

H_A 3: There is a positive correlation between the Use of Features Score and the Rate of Understanding Score.

RQ 4: Is there a correlation between the Use of Features Score and students' preference for using digital textbooks (Digital Textbook Preference Score)?

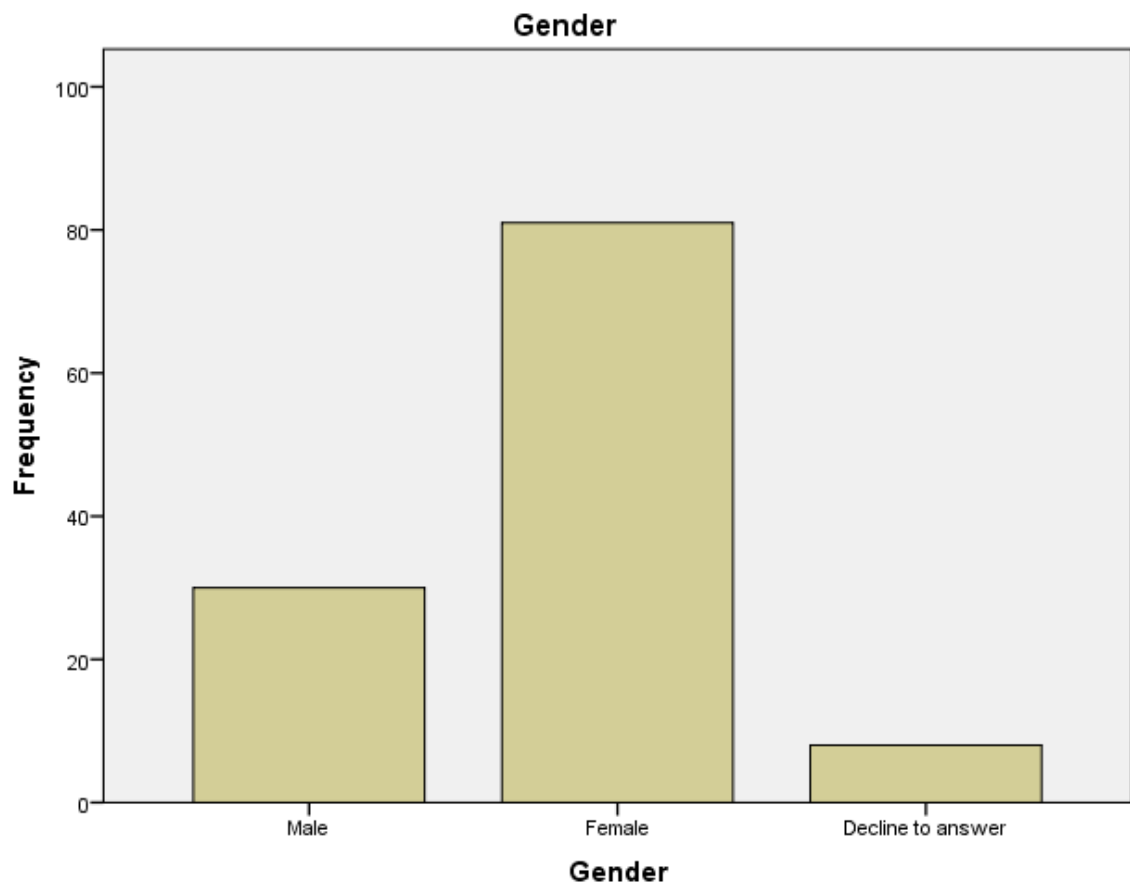
H₀ 4: There is no correlation between the Use of Features Score and the Digital Textbook Preference Score.

H_A 4: There is a positive correlation between the Use of Features Score and the Digital Textbook Preference Score.

Description of the Sample

One hundred and twenty-two graduate students from a non-profit public university in Pennsylvania participated in the survey. Three students responded on the survey that they did not use digital textbooks, while the remaining students used both printed and digital textbooks. The three students that did not have digital textbook experience were not considered in the analysis of this data and the remaining 119 students' responses were analyzed in this research. The remaining participant population was comprised of 81 females, 30 males and 8 students who declined to disclose their gender.

Figure 5: Age Frequency

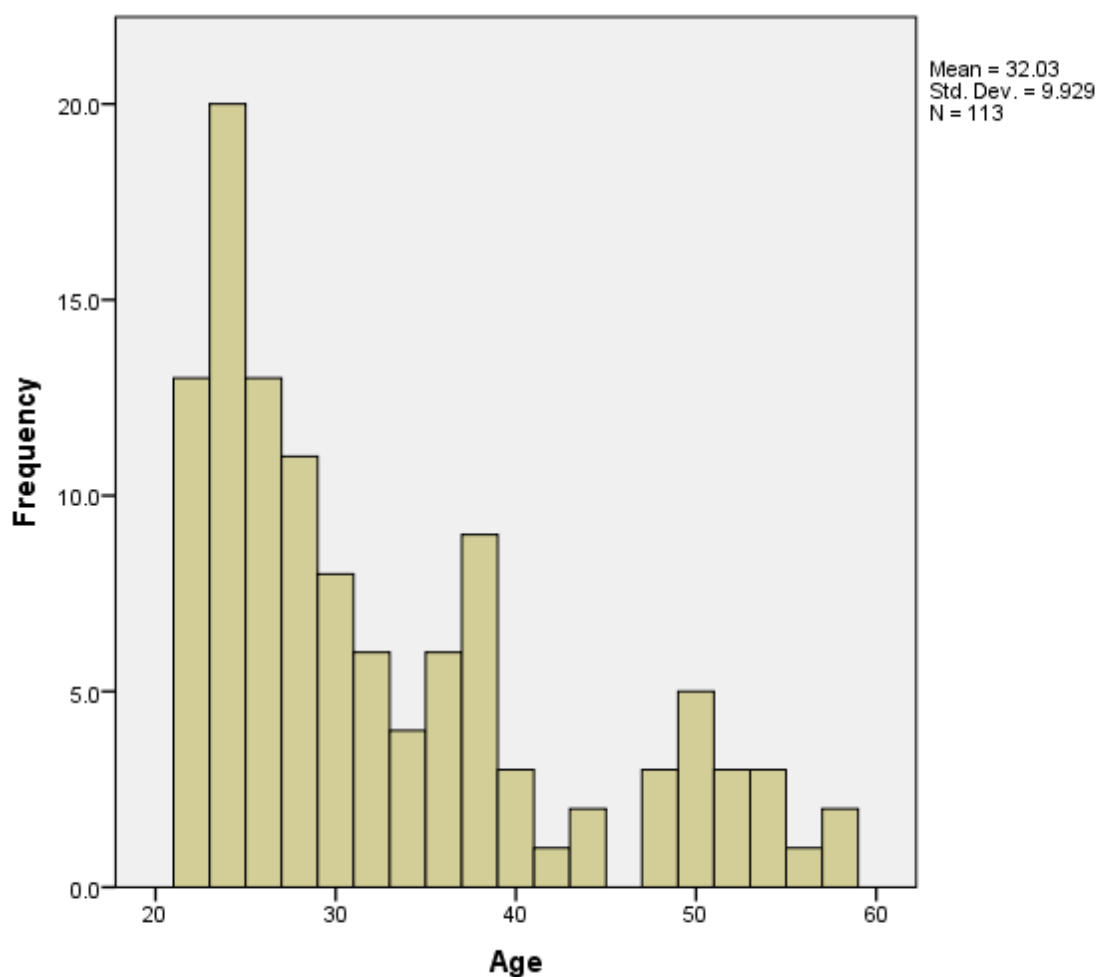


The distribution of the student participant ages is shown in the graphics below.

The vast majority of students are in the 20 – 30 age range, with the majority of those students in their mid 20s. The fewest amount of students are in the 40 – 50 age range.

Six of the students declined to disclose their ages. The mean was 32.03 with a standard deviation of 9.929.

Figure 6: Gender Frequency



Research Design

The research design for this quantitative study focused on non-causal, descriptive, and correlational approaches using information gathered from an online survey

questionnaire. Both descriptive and correlational approaches are non-causal as neither approach predicts a cause or effect between the elements being studied. “Descriptive research is used to answer descriptive research questions: *What is happening? How is something happening? Why is something happening?*” (ECS & McREL, 2004, Descriptive Research Questions and Designs, para. 1). The descriptive approach ascertained if and how often students used these available digital textbook features (search and highlighting). This approach also took into account the ages and genders of students who used these digital textbook features as well as ascertaining which students used traditional printed textbooks and which students used digital textbooks when both versions were available.

“Correlational research design is used to describe the statistical association (or relationship) between two or more variables” (ECS & McREL, 2004, Descriptive Research Questions and Designs, para. 6). Correlational research was used to discover any association or relationship between the student use of specified digital textbook features and their perceived comprehension of the materials presented digitally. This research also examined any relationship between the availability of digital textbook features and the use of these features by students. Correlational research was used to discover any relationship between the age and gender of the students and their use of the digital textbook features, as well as to find any relationship between the availability of digital textbook features and student preference for using digital textbooks.

Instruments

The data collected were the age and gender of the student, student use of print textbooks, digital textbooks or both formats, the Use of Features Scale, which is a scale

measuring student use of the search and highlighting feature, the Rate of Understanding Scale, which is a scale measuring student perceptions of the usefulness of these features, and Digital Textbook Preference Score, which is a scale measuring student preference for and choice of digital over printed textbooks and their perceived usefulness of the single-page display feature. Gender data were dummy-coded (with zero for male and one for female) to allow for correlation testing using continuous variables. Positive correlations of gender with other variables indicate that females would have higher scoring, while negative correlations of gender with other variables indicate that males would have higher scoring.

The scale items to measure each feature included these responses: have not used this feature, moderate use of this feature, and frequent use of this feature. The feature usefulness scale items included these responses: not useful, somewhat useful, and very useful. The feature use and usefulness responses data were coded numerically for continuous variable analysis. Feature use was coded: one = have not used this feature, two = moderate use of this feature, and three = frequent use of this feature. Feature usefulness was coded: one = not useful, two = somewhat useful and three = very useful. The Use of Feature Score was calculated by adding the student responses to their search and highlight features usage, both frequency and usefulness, for a possible score of two to six.

Additional data were collected on student perceptions of their focus and ability to pay attention to materials presented in a digital textbook, perceptions of their ability to organize information using the search and highlight features, and perceptions of their ability to understand and better comprehend information presented digitally, which

yielded the Rate of Understanding Score. All information from this data was coded numerically for continuous variable analysis: one = no, two = somewhat and three = yes. The Rate of Understanding Score was calculated by adding the student responses to their perceptions of their focus and ability to pay attention to materials presented in a digital textbook, perceptions of their ability to organize information using the search and highlight features, and perceptions of their ability to understand and better comprehend information presented digitally, for a possible score of three to nine.

Lastly, data were collected on the students' preference for and choice of digital over printed textbooks and the perceived usefulness of the single-page display feature. This yielded the Digital Textbook Preference Score. The responses on students' rate of usefulness of the single page display were coded numerically for continuous variable analysis: one = not useful, two = somewhat useful and three = very useful. The choice of digital textbooks over printed textbooks was coded: one = no, two = somewhat and three = yes. The overall preference for digital textbooks over printed textbooks was coded: one = strongly prefer printed, two = somewhat prefer printed, three = like both just as well, four = somewhat prefer digital and five = strongly prefer digital. The Digital Textbook Preference Score was calculated by adding the student responses to their preference for and choice of digital over printed textbooks and the perceived usefulness of the single-page display feature, for a possible score of three to 11.

SPSS software was used to test for significant positive and negative correlations between student age, gender, Use of Features Score, Rate of Understanding Score, and Digital Textbook Preference Score variables. Frequency charts and graphs were used in

descriptive statistics and analysis procedures, and the bivariate Pearson Correlation coefficient was used to test for and measure any associations between these variables.

Use of Feature Analysis Results

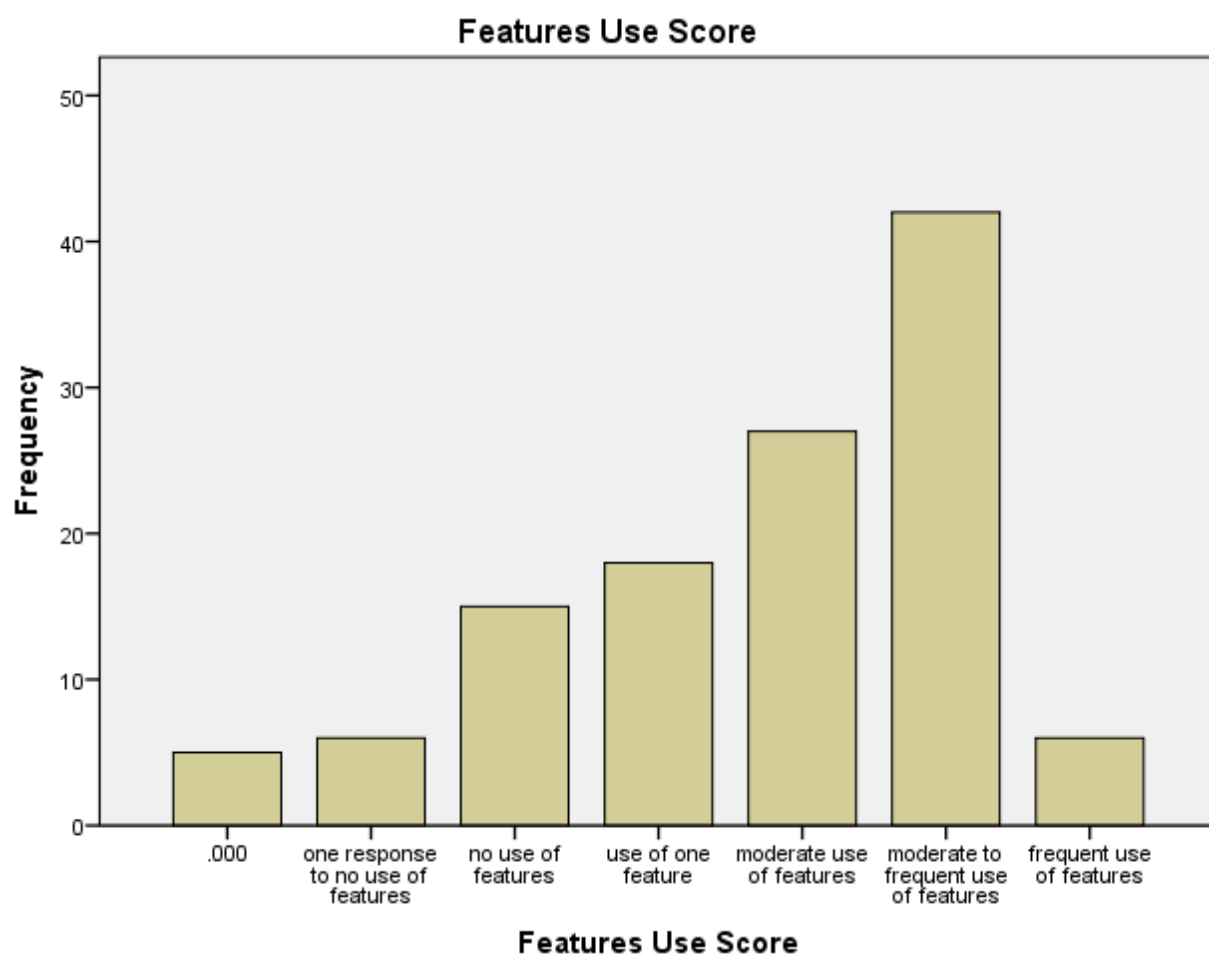
Search feature *use* showed the following: the plurality of students (40%) did use the search feature frequently, the amount of students who did not use this feature was roughly equivalent (25%) to the number of students who used this feature moderately (28%), and there were a small amount of students (7%) who declined to answer the question on this topic. Search feature *usefulness* showed the following: the largest group of students (45%) found the search feature very useful, 30% of students found this feature somewhat useful while 10% found the feature not useful, and the number of students (15%) who declined to answer the question on this topic was slightly higher than the students who found this feature not useful.

Highlight feature *use* showed the following: the plurality of students (35%) used the highlight feature moderately, followed by the number of students who did not use this feature (33%) and the students who used this feature frequently (23%). There was a small amount of students (9%) who declined to answer the question on this topic. Highlight feature *usefulness* showed the following: the plurality of students found the highlight feature very useful (30%) and somewhat useful (also 30%), while 25% of students found this feature not useful. There was a minority of students (15%) who selected the option for *declining to answer the question* on this topic.

The Use of Feature Score was determined by adding the student responses to their search and highlight features usage, for a possible score of two to six as specified above in Instruments. The moderate to frequent Use of Features Score was the highest at 35%,

followed by the moderate use score at 23%. The use of one feature (15%) was close to the no use of features score (13%), while the frequent use score was 5%. The one response to no use of features was 5% and the declined to answer across both areas score was 4%.

Figure 7: Features Use Score



Analysis of Rate of Understanding Results

The students' perceived level of attention and focus due to the digital textbook format showed that about two-thirds of students (65%) did not feel that this format enhanced their attention and focus on the materials presented digitally, while 15% felt

that the digital format *somewhat* supported their attention and focus, and another 15% also felt that the digital format *definitely* enhanced their attention and focus. There were a small number of students (5%) who declined to answer this question.

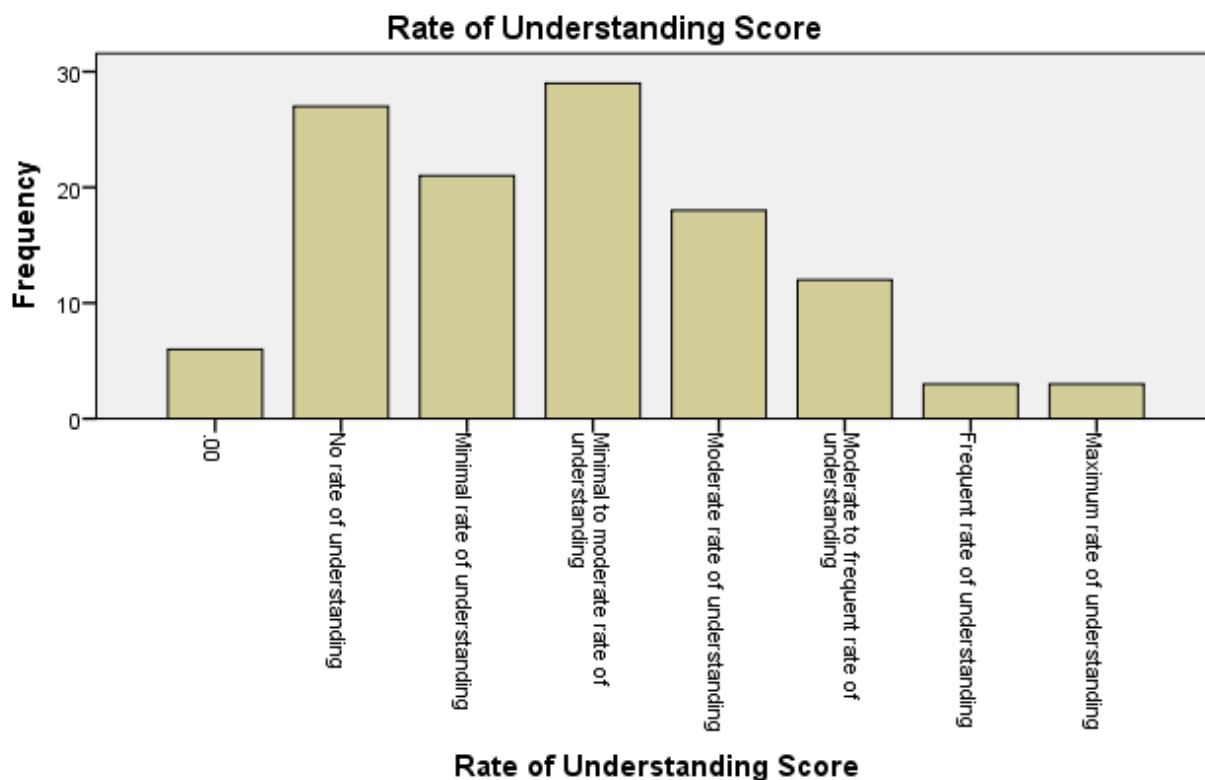
The students' perceived level of their ability to organize information due to the digital textbook features and single page display showed that all three responses (no, somewhat, and yes) were similar. The no responses were 30%, the somewhat responses were 33%, and the yes responses were 32%, and 5% declined to answer the question on this topic.

The students' perceived level of understanding and comprehension due to the digital textbook format showed that two-thirds of students (65%) did not feel that this format enhanced their understanding and comprehension of the materials presented digitally, while 23% felt that the digital format somewhat supported their understanding and comprehension, and 7% also felt that the digital format definitely enhanced their understanding and comprehension. There were a small number of students (5%) who declined to answer this question.

The Rate of Understanding Score was determined by adding the student responses to their perceived level of attention and focus using a digital textbook, their ability to organize information using digital textbook features, and their ability to understand and better comprehend information presented digitally, for a possible score of three to nine as specified above in Instruments. The minimal to moderate Rate of Understanding Score was the highest at 25%, followed by the no rate of understanding at 23%. The minimal rate of understanding (18%) was close to the moderate rate of understanding (15%), followed by the moderate to frequent rate of understanding (10%) while the frequent and

maximum rate of understanding scores were both 2%. The *declined-to-answer* across all areas score was 5%.

Figure 8: Rate of Understanding Score



Analysis of Digital Textbook Preference Results

The students' rate of usefulness of the single page display showed that 35% found this feature very useful, followed by 33% who found this feature to be somewhat useful and 20% who found this feature to be not useful. There were a smaller number of students (12%) who declined to answer this question.

The students' decision to choose digital over printed textbooks due to the availability of search and highlight features showed that the majority (51%) would not be influenced by these features to choose digital over print, while 26% would be somewhat influenced by these features to choose digital and 20% would definitely be influenced by

these features to choose digital. A small number of students (3%) declined to answer this question.

The students' overall preference for digital over printed textbooks showed that the plurality (45%) strongly preferred printed textbooks, followed by 33% who somewhat preferred printed textbooks and 8% of students liked both formats (digital and print) just as well. Additionally, 8% of students strongly preferred digital, 5% somewhat prefer digital and a small amount of students (1%) declined to answer this question.

Adding the students' preference for and choice of digital over printed textbooks and the perceived usefulness of the single-page display feature determined the Digital Textbook Preference Score for a possible score of three to 11 as specified above in Instruments. The digital textbook preference results showed the following: minimal preference was 20%, 19% had no preference, 15% had moderate preference, 8% had moderate to frequent preference, 5% had frequent preference along with 5% who had maximum preference and 5% who had minimal to moderate preference, and 3% who had frequent to maximum preference. The *declined-to-answer* across all areas score was 2% and 18% responded to two or three of the questions.

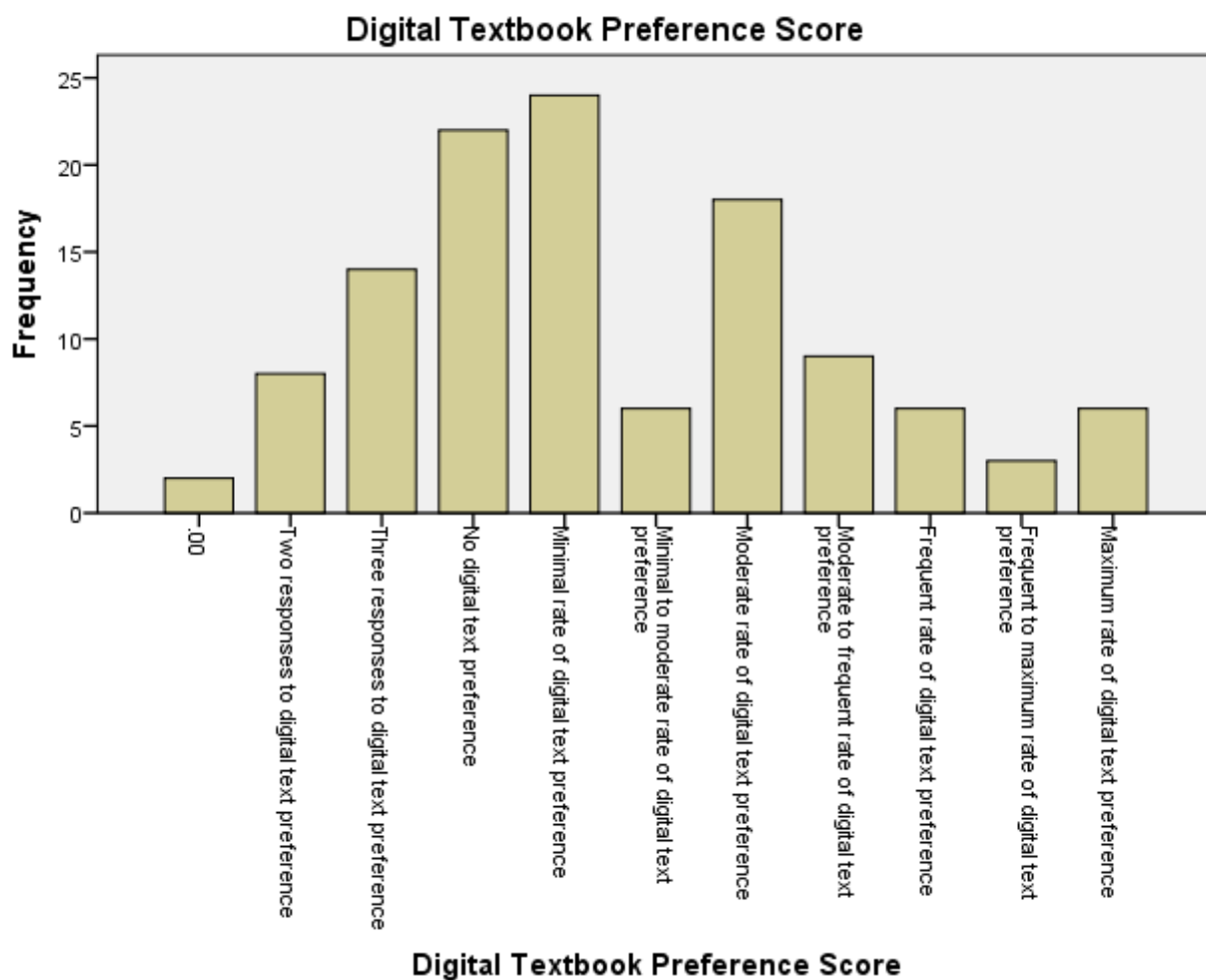
Figure 9: Digital Textbook Preference Score

Table 2

Correlations for Use of Features Score

Measure	Age	Gender	Understanding	Digital Preference
Use of Features	.02	.12	.49*	.62*

* $p < .001$

Note: Gender = female coded as 1 and male coded as 0

Research Question One: Age and Use of Features

The first research question is: Is there a correlation between the Use of Features Score and the age of the student? The Pearson's Correlation coefficient is $r = 0.02$ and $p = 0.806$, indicating that there is no significant relationship between age and the Use of Features Score. The null hypothesis is retained; there is no correlation.

Research Question Two: Gender and Use of Features

The second research question is: Is there a correlation between the Use of Features Score and the dummy-coded gender (with female coded as one and male coded as zero) of the student? The Pearson's Correlation coefficient is $r = 0.12$ and $p = 0.209$, indicating that there is no significant relationship between gender and the Use of Features Score. The null hypothesis is retained; there is no correlation.

Research Question Three: Use of Features and Rate of Understanding

The third research question is: Is there a correlation between the Use of Features Score and the Rate of Understanding Score? The Pearson's Correlation coefficient is $r = 0.49$ and $p < 0.001$, indicating that there is a large significant positive relationship between the Use of Features Score and the Rate of Understanding Score. The hypothesis is retained.

Research Question Four: Use of Features and Digital Textbook Preference

The fourth research question is: Is there a correlation between the Use of Features Score and the Digital Textbook Preference Score? The Pearson's Correlation coefficient is $r = 0.62$ and $p < 0.001$, indicating that there is a very large and significant relationship between the Use of Features Score and the Digital Textbook Preference Score. The hypothesis is retained.

Summary

The findings for the first and second research questions concerning age and the dummy-coded gender of the students in relationship to the Use of Features Score (level of use and perceptions of usefulness of the search and highlight digital textbook features) showed that there was no correlation between these features in either instance, and the null hypotheses were upheld.

The finding for the third research question concerning the Use of Features Score and the Rate of Understanding Score (students' perceived level of comprehension and organization of information using the search and highlight features and the single page display in the digital textbook format) showed that there was a large significant correlation between these two variables and the hypothesis was upheld.

The finding for the fourth research question concerning the Use of Features Score and the Digital Textbook Preference Score (and the students' rate of usefulness of the single page display along with their preference and choice of digital over printed textbooks) showed that there was a very large and significant correlation between these two variables and the hypothesis was upheld.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Statement of the Purpose

The purpose of this study was to gather information about student perceptions concerning the use of digital technology features in a post-secondary educational environment. The digital textbook features examined in this study were the search focus, the highlighting feature and the single-page display feature. This quantitative study focused on non-causal, descriptive, and correlational research to identify student perceptions concerning these digital textbook features, and also to identify how these perceptions toward digital textbook features related to the students' perceived comprehension of their learning materials.

Descriptive research examined each variable being studied and correlational research examined non-manipulated existing variables, such as student perceptions of specific digital textbook features and student comprehension of materials delivered using these features. Correlational research is non-causal since it does not predict a cause and effect of these variables yet examines any correlation between the variables being studied (Lomax & Li, 2013). The data from this study could provide valuable insight into the possible benefits of further innovation and expansion of digital textbook feature technology in the educational arena.

Research Questions

RQ 1: Is there a correlation between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student?

H₀ 1: There is no correlation between the Use of Features Score and the age of the student.

H_A 1: There is a positive correlation between the Use of Features Score and the age of the student.

RQ 2: Is there a correlation between the Use of Features Score and the dummy-coded (with female coded as one and male coded as zero) gender of the student?

H₀ 2: There is no correlation between the Use of Features Score and the dummy-coded gender of the student.

H_A 2: There is a positive correlation between the Use of Features Score and the dummy-coded gender of the student.

RQ 3: Is there a correlation between the Use of Features Score and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)?

H₀ 3: There is no correlation between the Use of Features Score and the Rate of Understanding Score.

H_A 3: There is a positive correlation between the Use of Features Score and the Rate of Understanding Score.

RQ 4: Is there a correlation between the Use of Features Score and students' preference for using digital textbooks (Digital Textbook Preference Score)?

H₀ 4: There is no correlation between the Use of Features Score and the Digital Textbook Preference Score.

H_A 4: There is a positive correlation between the Use of Features Score and the Digital Textbook Preference Score.

Chapter One Summary

Digital textbook technology is rapidly expanding to become a permanent addition to the educational landscape and it could become a very valuable asset to support and enrich the student learning experience. As digital textbooks are becoming more available in educational systems and especially in hybrid and online learning environments, it is important to examine the effectiveness and benefits of this technology for student learning. Student acceptance of this technology might be crucial to supporting student comprehension of materials presented in a digital textbook format.

The purpose of this research study was to explore student responses toward specific features of digital textbooks, and to examine student perceptions of their comprehension of the materials they are reading while using features of digital textbook technology. Examining the broader perspective on how digital textbook technology is evolving and how it is integrated into higher education institutions, along with focusing on student responses to specific digital textbook features and information comprehension, directed the goals of this research study.

Chapter Two Summary

Technology is impacting the educational landscape as deeply as it is impacting the modern learner (Beetham & Sharpe, 2013). As successful student engagement and learning is a primary goal of many educational institutions, it is worth examining the relationship between digital textbook technology and the modern student. Digital textbook technology addresses the need to modernize traditional printed textbooks to work with modern technology and engage modern learners who embrace this technology (Anderson, Boyles, & Rainie, 2012). This technology harmonizes well with modern

classroom technology and fulfills the need to provide learning information that can be shared in a digital format with modern learners that are “wired, networked, and computer savvy” (Blake, 2013, p. xi).

Digital textbook technology offers more learning options than traditional printed textbooks and might help students organize learned information in a way that better adapts to their modern thought processes. Using digital technology, students no longer have to memorize all information to build knowledge of the topics they are studying. They only need to know where to access the information they need for building knowledge. Conversely, the idea of having information available instantly using search features in digital textbooks might discourage deep learning habits and replace them with shallow learning habits.

Examining student knowledge and use of digital textbooks could provide information about how and why digital textbooks and their features are used or not used. Examining statistics, such as the age or gender of users who prefer digital textbooks and features could provide information toward any noticeable trends in using this digital technology over printed textbooks. Student expectations for their education have changed with digital technology and it is critical for institutions and publishers to pay attention to the effectiveness of digital textbook technology on student learning.

Chapter Three Summary

This quantitative research study gathered and analyzed information about student perceptions and use of digital textbook features (specifically the search and highlighting features), and how these features affected students’ perceived comprehension of learning material presented in a digital textbook format. This study examined students’ preference

for digital textbooks over printed textbooks. This study used online questionnaire surveys to gather information and then conducted non-causal descriptive and correlation testing using the continuous variables of age, dummy-coded gender (with zero for male and one for female), use of and preference for digital textbook features, students' rating of their ability to understand better what they are reading, and students' preference for using digital textbooks along with their perceived usefulness of the single-page display feature. The correlation testing looked for significant positive and negative correlations between the variables, determined a correlation coefficient, which measured the size of the relationship between the variables, determined a positive or negative direction of the coefficient, and determined a p-value, which indicated whether the results were significant or due to chance.

The research questions addressed were: Is there a relationship between the level of use of the specified digital textbook features (Use of Features Score) and the age of the student? Is there a relationship between the level of use of the specified digital textbook features (Use of Features Score) and the dummy-coded gender (or femaleness) of the student? Is there a correlation between level of use of the specified digital textbook features (Use of Features Score) and the students' rating of their ability to understand better what they are reading (Rate of Understanding Score)? Is there a correlation between the student's use of the specified digital textbook features (Use of Features Score) and their preference for using digital textbooks (Digital Textbook Preference Score)? The data from this study could provide valuable insight into the possible benefits of further innovation and expansion of digital textbook feature technology in the educational arena.

Chapter Four Summary

The findings of the first and second research questions concerning age and the dummy-coded gender (with female coded as one and male coded as zero) of the students in relationship to the Use of Features Score (level of use and perceptions of usefulness of the search and highlight digital textbook features) showed that there was no correlation between these features in either instance, and the null hypotheses were upheld.

The findings of the third research question concerning the Use of Features Score and the Rate of Understanding Score (students' perceived level of comprehension and organization of information using the search and highlight features and the single page display in the digital textbook format) showed that there was a significant correlation between these two variables and the hypothesis was upheld. The findings of the fourth research question concerning the Use of Features Score and the Digital Textbook Preference Score (and the students' rate of usefulness of the single page display along with their preference and choice of digital over printed textbooks) showed that there was a significant correlation between these two variables and the hypothesis was upheld.

Discussion of the Findings

As Denoyelles, Raible, & Seilhamer (2015) observe, "time might also be an influential factor in acceptance of e-textbooks: Students grow more receptive to e-textbooks and begin using their features when they use them over time" (Denoyelles, Raible, & Seilhamer, 2015, Key Issues, para. 3). This study examined student acceptance of digital textbooks and features in a 2015 setting.

This study showed that age and gender of students were not necessarily a factor in digital textbook search and highlight feature use. While digital textbook features were

shown to enhance some students' perceived level of attention and focus to the information presented digitally (15% somewhat and 15% definitely), a vast majority of students (65%) did not feel that these features added to their attention and focus. Likewise, a majority of students (65%) did not feel that the digital textbook format enhanced their understanding and comprehension of the materials presented digitally, while some students (23% somewhat and 7% definitely) felt that the digital format did enhance their understanding and comprehension.

The single-page display feature was found to be very useful by 35% of students, while 33% found this feature to be somewhat useful and 20% found this feature to be not useful. The single-page feature is automatic in most digital textbooks as the screen contains a single reading area at a time. The search and highlight features are not automatic but must be engaged by the student. So the higher positive findings between the single-page feature and the search and highlight features could be because the students are automatically confronted with the single-page feature as they open their digital textbook. They have no choice but to use this feature, as it is automatic.

The students' use of the search and highlight features (Use of Features Score) does have a significant relationship with students' perceived level of comprehension and organization of information using the search and highlight features and the single page display in the digital textbook format (Rate of Understanding Score).

The availability of digital textbook features necessarily does not influence students' choice of digital over printed textbooks (51% not influenced, 26% somewhat influenced, and 20% definitely influenced). The overall preference for choosing digital versus printed textbooks showed that 45% of students strongly prefer printed, 33%

somewhat prefer printed over digital, 8% like both formats, 5% somewhat prefer digital over printed, and 8% strongly prefer digital over printed.

The students' use of the search and highlight features (Use of Features Score) does have a significant relationship with students' rate of usefulness of the single page display along with their preference and choice of digital over printed textbooks (Digital Textbook Preference Score).

This research study focused on graduate students, but the information gathered could be useful for all college students as digital textbooks are becoming more common. This study showed that while students still prefer printed over digital textbooks at this point in time, digital textbook features could be important in helping students, faculty, and institutions to accept and adopt digital textbooks in the future. Digital textbooks have the ability to incorporate custom features and customized information for specific studies, while maintaining the most current information in easy updates and, in most cases, could be more affordable than their printed counterparts.

Population Impact

In 2006, the National Instructional Materials Accessibility Standard, known as NIMAS, stipulated that all textbooks in the United States be accessible in a digital format file that could readily be converted to various digital formats to address learning needs of the students (Office of Educational Technology, n.d). These formats include braille text, audio text, and large format text. A significant amount of the participants (119 out of 122 students) in this study did use both digital and printed textbooks, showing that this institution is making digital textbooks available to its graduate students and a large portion of students are using this format of textbook. Additionally, with digital textbooks

and features readily offered to students, this study showed that students do not use the features available in the digital textbooks as a rule, which can lessen the impact of studying using a digital textbook and keep the preference for printed textbooks higher than the digital textbook preference.

This study goes beyond previous literature in studying a graduate population at one institution in the northeast area of the United States. Prior studies, such as the Denoyelles et al. (2015) study included both undergraduate and graduate students, while other studies included only undergraduate students. This study focused on two specific digital textbook features (search and highlight) as well as examining how these features and their use impacted student preference for digital textbooks over printed textbooks, and how these features impacted student comprehension and focus on the information being studied.

Consistencies

This study shows that the major portion of students used the search and highlights features (73%) and found these features useful (58%). These findings align with the findings from the 2015 study by Denoyelles et al. (2015), which found “the search (feature) came up several times as a way to read and study more efficiently” and the highlighting feature was instrumental in studying the information delivered digitally (Denoyelles et al., 2015, Adoption Factors, para. 5). This study found that there was a significant relationship between the use of the search and highlight features and the students’ perceived level of comprehension and organization of information using these features. This is consistent with Philip & Moon (2013) who found that digital textbook features, such as the search feature, added to the appeal of digital textbook technology to

students, enhancing the time efficiency searching for material in the textbook (Philip & Moon, 2013). Denoyelles et al. (2015) concur with these results, as students described a benefit of the search feature to greatly enhance “the ability to search for information, rather than wasting time looking for it” (Denoyelles et al., 2015, Adoption Factors, para. 5). As students use these features, they could be more engaged in their learning experience and develop the skills needed to understand better and organize the information they are studying. Students “are (becoming) more sophisticated and more tech-oriented” with each passing year, and engaging these tech savvy students through the use of digital textbooks and features becomes essential to keep students fully involved with their learning experiences (Anderson et al., 2012, p. 16).

This study found that there was a significant relationship between the use of the search and highlight features and the students’ preference for and choice of digital over printed textbooks. Studying has evolved around technology and many students are very comfortable with a digitally delivered information environment. Students “often will purchase the e-book version of a resource suggested by the teacher” rather than purchasing the traditional printed version (Anderson et al., 2012, p. 30). Thomas (2007) discusses the ability to highlight information as a determining factor in student selection and satisfaction of the digital device (Thomas, 2007).

Inconsistencies

In this study, the null hypotheses from the first two research questions were upheld because there was no correlation between age and the Use of Features Score (level of use and perceptions of usefulness of the search and highlight digital textbook features), and no correlation between the dummy-coded gender (with female coded as one and male

coded as zero) and the Use of Features Score. As there are no correlations between these variables, in this sample gender and age were not factors in either the level of use or perceptions of usefulness of the search and highlight digital textbook features.

In a recent study by Denoyelles et al. (2015), it was found that “older male graduate students specifically favored e-textbooks more than other groups” (Denoyelles et al., 2015, Key Issues, para. 3). This is inconsistent with this study. The differing findings could be from a lower ratio of older male participants responding in this sample, so results did not concur with the results from Denoyelles et al. (2015). This study could be repeated with other graduate student populations to see if the Denoyelles et al. (2015) findings will hold up or to see if the findings will concur with this study.

Limitations of the Study

One of the limitations of the information collected in this study was the number of students who declined to answer the survey questions. The majority of students did answer all of the questions, but there were a small number of students (ranging from 1% to 15%) who declined to answer questions throughout the survey. *Responses* and *decline to respond* responses varied from student to student with no apparent pattern or trend regarding age or gender or any other factor, so it could be speculated that there is no factor influencing the *decline to respond* responses. This limitation could affect the accuracy of the analysis that was reached if the missing answers had been provided.

Another limitation is some of the students might not have had experience with or access to the search and highlight features in their digital textbooks. In the Use of Features analysis, 5% of students did not use this feature and 25% of students did not find this feature useful. Some (or all) of the students who did not use this feature could have

been part of the 25% of students who responded that they did not find this feature useful. This could skew the feature usefulness findings as this question only examined feature usefulness and did not examine students who did not find these features useful because they did not use these features.

Another limitation is some students might not have full access to the search and highlight features on their digital readers and this could skew the feature use and usefulness findings. According to Denoyelles et al. (2015), “previous research has identified issues with usability, as well as unavailability on certain devices, which could explain why students do not take full advantage of e-text features” (Denoyelles et al., 2015, Key Issues, para. 3).

Implications for Practice

Laws, such as NIMAS, are now commonplace. As institutions continue to incorporate digital textbook technology into their systems, they are strengthening their resolve to make textbooks accessible to everyone (Office of Educational Technology, n.d., *Serving the Underserved*, para. 7). Compliance with this law also strengthens institutions’ credibility for funding and accreditation. Digital textbook technology features also address disabilities and multiple learning styles, and provide access to all students with a more affordable product (Rosenwald, 2015).

Use of digital textbook features could be meaningful in engaging students and their perceived level of comprehension and organization of information using the search and highlight features. Using digital textbook features also could influence students’ perceptions of the usefulness of the single-page display, along with their preference and choice of digital over printed textbooks. Factors to consider when promoting digital

textbook availability include lower costs than printed textbooks, availability of digital textbooks across multiple digital devices, and ease of accessing and using digital textbook features, such as the highlight and search features.

Digital textbook designers, publishers, institutions, and other entities involved with developing this product could stay on the cutting edge of this technology by continually assessing how students view and use this product, and could update the product accordingly. Students are very technology aware and digital textbooks and features need to engage students to be effective (Falc, 2013). As institutions incorporate digital textbook technology into their programs and classes, it is also critical to design and provide faculty development training on this technology for faculty and staff to provide better modeling and support of this technology to their students (Denoyelles et al., 2015). This technology training could keep institutions relevant in the higher education sector and more relevant to students in choosing to attend the institution.

Institutions could offer printed textbooks, or the ability for the students to print out sections of the digital textbooks as they choose (with print on demand). Many students still prefer to have physical pages to flip through. Offering digital textbook features as they become available with the digital textbooks and offering training or tutorials on how to use these features within the digital textbook could provide support to both students and faculty (for instance, creating a *How to use Features* section at the start of each textbook). For both publishers and institutions that create their own digital textbooks, offering a way to gather feedback regularly from both students and faculty on the digital textbooks in use could provide valuable feedback for future designs.

Digital textbook technology could be successful in providing easy and immediate access for students to their textbooks on the first day of class (Abutaleb, 2012). Digital textbooks also are seen as more eco-friendly and “digital learning tools (have) become a "must-have" for students” (Armitage, 2015, para. 1 & 6). Even though studies show that students still have a strong preference for printed textbooks, they also prefer to have choices of both digital and printed textbooks available for their studies. Institutions would be wise to provide these choices to their students.

Recommendations for Further Research

Recommendations for further research include varying the demographics of the participants and institutions for more study. Research could be conducted with undergraduate and/or graduate students in both private and public profit and non-profit institutions. Research could be conducted outside of the United States and also, it could be narrowed to students with learning challenges to see whether or not this technology is beneficial.

Research could be conducted in K-12 environments, both public and private, as this technology is becoming more common. As new generations of students are born into technology, it becomes important to examine their attitudes about digital textbook technology. The future might hold only digital textbooks and no printed textbooks at some point, so analysis of how this technology could strengthen learning with the modern learner becomes essential to strengthen the educational environment.

Conclusion

As digital textbook technology is rapidly becoming a mainstay in higher education, this study provided a window into the current perceptions of graduate students' acceptance and adoption of digital textbooks and features. Using Pearson's Correlation testing, this study found that the age or gender of students did not affect their use of the search or highlight features as the findings of the first and second research questions concerning age and the dummy-coded gender (with female coded as one and male coded as zero) of the students in relationship to the Use of Features Score (level of use and perceptions of usefulness of the search and highlight digital textbook features) showed that there was no correlation between these features in either instance, and the null hypotheses were upheld. The Pearson's Correlation coefficient for age is $r = 0.02$ and $p = 0.806$, while the Pearson's Correlation coefficient for gender is $r = 0.12$ and $p = 0.209$.

Correlation testing did prove that students' use of the search and highlight features (Use of Features Score) does have a large and positive significant relationship with students' perceived level of comprehension and organization of information using the search and highlight features and the single page display in the digital textbook format (Rate of Understanding Score). The Pearson's Correlation coefficient for the Rate of Understanding is $r = 0.49$ and $p = < 0.001$, indicating that there is a significant relationship between the Use of Features Score and the Rate of Understanding Score. The hypothesis is retained.

Correlation testing also proved that the students' use of the search and highlight features (Use of Features Score) does have a very large and significant relationship with students' rate of usefulness of the single page display along with their preference and

choice of digital over printed textbooks (Digital Textbook Preference Score). The Pearson's Correlation coefficient for the Digital Textbook Preference is coefficient is $r = 0.62$ and $p = < 0.001$, indicating that there is a significant relationship between the Use of Features Score and the Digital Textbook Preference Score. The hypothesis is retained.

Table 3

Correlations for Use of Features Score

Measure	Age	Gender	Understanding	Digital Preference
Use of Features	.02	.12	.49*	.62*

* $p < .001$

Note: Gender = female coded as 1 and male coded as 0

The findings from this study might contribute information toward the advantages and disadvantages of this developing technology by showing that while there is no apparent relationship between student age or gender and student use of the search or highlight features, there is a relationship between students' use of the search and highlight features (Use of Features Score) and students' perceived level of comprehension and organization of information using the search and highlight features and the single page display in the digital textbook format (Rate of Understanding Score). Likewise, there is a relationship between students' use of the search and highlight features (Use of Features Score) and students' rate of usefulness of the single page display along with their preference and choice of digital over printed textbooks (Digital Textbook Preference Score). Encouraging students to use digital textbook features could increase students' Rate of Understanding and Digital Textbook Preference. This could be accomplished by designing easy to access and user friendly digital textbook features

(such as the search and highlight features) and providing specific training in digital textbooks on how to access and use these features. Publishers and institutions also could design and provide faculty development training on the benefits to students on accessing and using digital textbook features and providing information on how these features might shape student learning experiences using this technology.

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APPENDICES

APPENDIX A

Survey Questionnaire

APPENDIX A

Survey Questionnaire

Preliminary demographic questions

1. What is your age?

Age _____

Decline to answer _____

2. What is your gender?

A. Male

B. Female

C. Decline to answer

3. Please describe your use of traditional printed textbooks and digital textbooks.

A. Printed textbooks only

B. Digital textbooks only

C. Both print and digital textbooks

Digital textbook feature questions

4. Please share your use of the **search feature** each time you use a digital textbook.

A. Have not used this feature

B. Moderate use of this feature during reading

C. Frequent use of this feature during reading

5. Please rate the usefulness of the **search feature** during the time you are reading your digital textbook.

A. Not useful

B. Somewhat useful

- C. Very useful
6. Please share your use of the **highlighting feature** each time you use a digital textbook.
- A. Have not used this feature
 - B. Moderate use of this feature during reading
 - C. Frequent use of this feature during reading
7. Please rate the usefulness of the **highlighting feature** during the time you are reading your digital textbook.
- A. Not useful
 - B. Somewhat useful
 - C. Very useful
8. Please rate the usefulness of the **single page display** as you are reading your digital textbook.
- A. Not useful
 - B. Somewhat useful
 - C. Very useful

Comprehension questions

9. In your opinion, does the digital textbook format (over the printed textbook format) allow you to pay more attention to what you are reading and have better focus on the material being presented?
- A. No
 - B. Somewhat
 - C. Yes

10. Do you feel digital textbook features (search, highlighting and single page display) enhance your ability to organize the information you are reading?
- A. No
 - B. Somewhat
 - C. Yes
11. Do you feel digital textbook features enhance your ability to better understand and comprehend what you are reading?
- A. No
 - B. Somewhat
 - C. Yes

Digital textbook preference questions

12. Would the availability of digital textbook features influence your decision to choose digital textbooks over printed textbooks?
- A. No
 - B. Somewhat
 - C. Yes
13. Please describe your overall preference of printed or digital textbooks for educational purposes.
- A. Strongly prefer printed
 - B. Somewhat prefer printed
 - C. Like both just as well
 - D. Somewhat prefer digital
 - E. Strongly prefer digital

APPENDIX B

Letter of Informed Consent

APPENDIX B

Letter of Informed Consent

This research is being conducted by Lori Trujillo-Cole who is a student in the Education College at Argosy University Online working on a dissertation. This study is a requirement to fulfill the researcher's degree and will not be used for decision-making by any organization.

The title of this study is STUDENT PERCEPTIONS OF DIGITAL TEXTBOOK FEATURES AND THEIR EFFECTS ON COMPREHENSION OF MATERIAL PRESENTED IN A DIGITAL TEXTBOOK FORMAT.

- The purpose of this study is to examine graduate student attitudes and responses towards the use of digital textbook feature technology in a public post-secondary educational environment.
- I was asked to be in this study because I am a graduate student in a public post-secondary educational environment that is utilizing either digital textbooks or traditional textbooks.
- All graduate students have been asked to participate in this study.
- If I agree to be in this study, I will be asked to visit an online survey and answer questions regarding your use of and attitude towards digital textbooks.
- This study will take 10 – 15 minutes.
- The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in daily life.
- The benefits of participation are not immediate, but the participants and/or future generations of students may benefit from this study as it may ultimately contribute valuable insight towards further innovation and expansion of digital textbook feature technology design in the future.
- I will receive no compensation, monetary or otherwise, for participating in this study.
- The information I provide will be treated confidentially, which means that nobody except Lori Trujillo-Cole will be able to tell who I am.

- The records of this study will be kept private. No identifiers linking me to the study will be included in any sort of report that might be published.
- The records will be stored securely and only Lori Trujillo-Cole will have access to the records.
- I have the right to get a summary of the results of this study if I would like to have them. I can get the summary by contacting Lori Trujillo-Cole at lori@loricoledesigns.net.
- I understand that my participation is strictly voluntary. If I do not participate, it will not harm my relationship with Slippery Rock University. If I decide to participate, I can refuse to answer any of the questions that may make me uncomfortable. I can withdraw at any time without my relations with the university, job, benefits, etc., being affected.
- I can contact Lori Trujillo-Cole and Dr. Nancy Hoover with any questions about this study.

I understand that this study has been reviewed and certified by the Institutional Review Board, Argosy University Online. For problems or questions regarding participants' rights, I can contact the Institutional Review Board Chair, Dr. Nancy Hoover at nhoover@argosy.edu.

I have read and understand the explanation provided to me and I have had all my questions answered to my satisfaction. By continuing with the study, I am giving my voluntary consent to participate.

APPENDIX C

Participant Consent

APPENDIX C

Participant Consent

I understand that this research study has been reviewed and Certified by the Institutional Review Board, Argosy University – (*Online Division/Phoenix*). For research-related problems or questions regarding participants' rights, I can contact Argosy's Institutional Board at IRB@argosy.edu.

I have read and understand the information explaining the purpose of this research and my rights and responsibilities as a participant. By accessing the survey link below, I understand that I give my consent to participate in this research study, according to the terms and conditions outlined above.

Please copy and paste the link below into your browser address field, to be taken to the online questionnaire survey.

Survey link- TBD

The survey is accessible from DATE to DATE (TBD).