ELECTRONIC VERSUS TRADITIONAL PRINT TEXTBOOKS: AN EVALUATION OF STUDENT ACHIEVEMENT AND INSTRUCTOR LEVELS OF USE OF THE INNOVATION IN A COMMUNITY COLLEGE

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ABSTRACT

E-textbooks are becoming more prevalent in today's digital and mobile environment, and many school systems are conducting trials to evaluate e-textbook effectiveness (Miller, Nutting, & Baker-Eveleth, 2013). Utilizing Hall, Loucks, Rutherford, and Newlove's (1975) Levels of Use (LoU) for analyzing innovation adoption as the framework, this study sought to determine instructors' LoU of e-textbook features, whether there was a difference in instructor LoU across programs of study, and what factors were related to LoU at an institution conducting an e-textbook trial. Furthermore, this study evaluated the effectiveness of e-textbooks compared to paper textbooks on student achievement and sought to determine any differences based on student demographics.

This study revealed e-textbook features were used at a low to non-existent level by instructors. Instructors either had no knowledge of or involvement with the features or had acquired some information about the features and were considering whether they would be useful for their classes. The average LoU by instructor showed no difference by program of study. The relationship between LoU and the variables of instructor age, gender, rank, years of college-level teaching, and number of e-textbook professional development experiences was studied. The number of e-textbook professional development experiences was found to be a significant predictor of LoU. Course comparisons revealed no significant difference in grade average between text formats. Analysis of the student grade data further revealed interactions between text format, age, and gender.

Findings suggest the institution could benefit from professional development interventions aimed at increasing the LoU of e-textbook features among instructors. The college could also explore alternative e-textbooks that offer more interactivity and multimedia functions. The e-textbook trial demonstrated that students could be equally successful with electronic or paper formats. While the trial period did not have a negative impact on student learning, the low LoU of e-textbook features indicates there is a potential to have a positive impact as the features and functions of e-textbooks and mobile learning are leveraged for student success.

DEDICATION

This dissertation is dedicated to my husband, Jason. Words of encouragement were important during this process, but he went beyond verbal support. He actually demonstrated his support of my goal by graciously making financial sacrifices with me on this journey. This dissertation is also dedicated to my parents, Robert and Lee Carmack. They have loved, sacrificed, provided, supported, and more. They have unfailingly fulfilled the role of a parent to me every day of my life.

LIST OF ABBREVIATIONS AND SYMBOLS

ANOVA	Analysis of variance
CBAM	Concerns-Based Adoption Model
d	Cohen's *d* effect size
df	Degrees of freedom
e-textbook	Electronic textbook
F	Fisher's *F* ratio
IC	Innovation Configurations
LoU	Levels of Use
M	Mean
mLearning	Mobile learning
MS	Mean Square
n	Sample size
p	Estimated probability of rejecting the null hypothesis when that hypothesis is true
r	Pearson product-moment correlation
R	Coefficient of determination
SD	Standard Deviation
SE	Standard Error
SS	Sum of Squares
SoC	Stages of Concern

t	Computed value of t-test
z	z-score for a normal approximation of the data

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I:

INTRODUCTION

Introduction

Textbooks have a long association with classrooms in the United States (Wakefield, 2006). Although statistics vary with grade and subject, textbook usage rate was estimated to constitute 70-95% of classroom activity in the 1980s and early 1990s (Chambliss & Calfee, 1998; Woodward & Elliott, 1990). Whether the text plays a primary role in class discourse or a supplementary role as a guide or reference, the textbook is considered an essential learning tool in physical and virtual classrooms across the nation (Rockinson-Szapkiw, Courduff, Carter, & Bennett, 2013).

While the purpose of the textbook remains unchanged, its delivery method has changed to support the digital and mobile environment of the twenty-first century. According to Smith and Caruso (2010), 80% of college and university students own laptops. In addition, college students are using tablets, smart phones, and e-book readers and now expect access to academic resources on these devices. As an example of this movement, the EDUCAUSE Center for Applied Research reports that smart phone use for academic purposes nearly doubled from 2011 to 2012 (Chen & Denoyelles, 2013). With this growth in mobile device ownership, the market is now seeing an increase in the number of electronic textbook (e-textbook) providers and e-textbook availability (Miller, Nutting, & Baker-Eveleth, 2013). E-textbooks are advancing from mere portable document format (PDF) versions of hard-copy books to interactive multimedia tools (Porter, 2010).

With the development of e-reader capabilities and the innovations in digital publishing, many school systems from K-12 to higher education are pursuing a transition from traditional paper textbooks to e-textbooks (Johnson, 2013). The Huntsville City School system in Huntsville, Alabama, made a complete conversion to digital textbooks on mobile devices through their Digital 1:1 Initiative in 2012 (Huntsville City Schools, 2014). Many universities, such as the University of Phoenix, Northwest Missouri State University, and the University of Idaho, are conducting trials to evaluate e-textbook effectiveness (Miller et al., 2013).

Statement of the Problem

E-textbooks can solve many problems in today's education systems. For example, students are trying to manage the rising costs of tuition, books, and fees. Outstanding student loan debt surpassed credit card loan debt in 2010 and is now over $1 trillion and rising (Kantrowitz, 2014). An e-textbook initiative is designed to ultimately deliver a cost-savings to students through a flat-rate for all books. Another problem that can occur is the lack of student access to the required text when the semester begins. An e-textbook platform gives students access to books on the first day of class, which theoretically should increase their success rate by engaging them in the course earlier (Upadyaya & Salmela-Aro, 2013). Even when students have their required texts, they may not read assigned material or comprehend the content (Johnson, 2013). An advantage of the e-textbook is the availability of hyperlinks to definitions, instructor's notes, or assessments that can assist with reading comprehension. E-textbooks also offer the possibility of mobile learning since the books and their associated learning resources are accessible anytime, anywhere on today's ubiquitous mobile devices (Georgiev, Georgieva, & Smrikarov, 2004). Finally, as the cost of printed textbooks increases, students find other, sometimes illegal, ways of coping. These methods infringe on copyright laws and put the

viability of publishing industries at risk. Students may cope by failing to purchase a book at all, making the job of the student and the professor more difficult (Storch, 2009).

E-textbooks can offer solutions to these problems; thus, institutions from K-12 to higher education are incorporating e-textbooks into the curriculum. Some institutions such as Northwest Missouri State University made an anxious transition to an electronic format and are now moving more cautiously by conducting experiments first (Young, 2009). Research is needed to know what kind of impact the digital format has on student learning outcomes, so that well-informed strategic decisions can be made regarding e-textbook initiatives.

Theoretical Framework

The transition to an e-textbook initiative can be viewed as the adoption of a technological innovation. Thus, the framework for this study was Hall, Loucks, Rutherford, and Newlove's (1975) Levels of Use (LoU) for analyzing innovation adoption. LoU, along with Stages of Concern and Innovation Configurations, is a dimension of the overarching Concerns-Based Adoption Model (CBAM) proposed by Hall, Wallace, and Dossett (1973). CBAM contends that teachers are the key adopters of interest in the evaluation of an educational change innovation (Ellsworth, 2000). Subsequently, LoU can be used as a tool for mapping "the adopter's behavioral progress in putting the innovation into practice" (Ellsworth, 2000, p. 149). The LoU index consists of eight potential states for the use of an innovation: Level 0 (Non-Use), Level I (Orientation), Level II (Preparation), Level III (Mechanical Use), Level IVA (Routine), Level IVB (Refinement), Level V (Integration), and Level VI (Renewal). This rigorous method of describing the experience of adopters assists with the development of intervention and improvement strategies for innovation adoption (Ellsworth, 2000).

Purpose of the Study

The purpose of this study was to identify and analyze instructors' LoU of e-textbook features and innovations at a community college in the North Alabama area and determine if there were differences in instructor LoU profiles across programs of study. This study also evaluated the effectiveness of e-textbooks compared to paper textbooks on student achievement during a pilot period of e-textbook implementation. Moreover, the influence of text format on student achievement by age and gender was examined.

Research Questions

The research questions for this study included the following:

1. What are the instructors' LoU with e-textbook features;
2. Is there a difference in instructors' e-textbook LoU profile ranking across programs of study;
3. What demographic characteristics of instructors (age, gender, rank, years of college-level teaching, and number of e-textbook professional development experiences) are related to LoU of e-textbook features;
4. Is there a difference in student achievement level, as measured by the final course average, for students using e-textbooks compared to paper textbooks; and
5. What relationship do age and gender have on a student's achievement level, as measured by the final course average, considering textbook format?

Methods

Participants of this study were students and instructors in a large-sized, two-year, public institution in the Alabama Community College System. Data to answer the first three research questions were collected from a survey using the LoU protocol and administered electronically

to the college instructors. Data to answer the last two research questions were collected from the college's Student Information System (Banner®) with student identifiers removed. Descriptive and inferential statistics were used to answer the research questions.

Significance of the Study

This study determined whether text format (electronic or paper) impacted student achievement level as measured by the course grade at the end of the semester. This information could benefit administration and faculty at the community college as they strive for a successful e-textbook initiative. Furthermore, it provides useful information to other institutions investigating a digital transition. As digital textbooks change with technology, continued research is necessary to determine changes in efficacy. As e-textbooks become more widely accepted and used, it is important to understand how student learning can be improved through technology innovations offered in e-textbooks. Thus, this study also determined instructors' LoU rankings with various e-textbook features. Conclusions from the data can assist in identifying instructor and/or student development programs with the highest potential impact on student learning.

Assumptions of the Study

This study made the following assumptions. It was assumed that prior to the e-textbook initiative, when instructors utilized print textbooks in the classroom, students purchased and utilized the print text. Likewise, it was assumed that in an e-textbook course, where the cost of the text was incorporated into the students' tuition, students utilized the electronic text.

It was also assumed that instructors did not self-inflate their levels of use of e-textbook features in order to give a perceived desired response. LoU is designed to measure and quantify

behaviors and is not intended to be a performance evaluation or final examination of faculty or faculty development programs.

Limitations of the Study

The following limitations applied to this study. Many research designs can and have been used to compare student results between textbook print mediums. In this research, student final grades with each format were compared over different semesters; thus, measures were taken to control for variability between semesters.

Also, this study evaluated student performance with e-textbooks during a pilot period at the institution, which was already in progress. Therefore, a student's final course average was the best available quantitative measure and served as the measure of learning. Previous studies have used final grade as the dependent variable as well. While student performance is understood to be a multivariable phenomenon, research by Rockinson-Szapkiw et al. (2013) states, "Throughout the literature, learning is often used as a measure to determine the efficacy of educational strategies and tools, and grades are most commonly used to measure learning" (p. 261).

In addition, in the first semester that e-textbooks were offered at the institution (Fall 2013), students were notified after enrollment that an e-textbook was assigned for the course. In subsequent semesters, e-textbook courses were designated in the enrollment process. Thus, students self-selected into either e-textbook or traditional print book sections.

Another limitation was that the study was limited in scope to the cross-sectional design of responses from voluntary participants at one community college in the Alabama Community College System. Thus, results may not be generalizable to the entire population of higher education institutions.

Another limitation of the study included a relatively low response rate from the LoU survey design, thus impacting the ability to achieve adequate sample size for inferential statistical analysis.

Finally, a non-experimental research design was employed to determine if there was a difference in course performance between e-textbook and paper textbook sections. Measures were taken to control for extraneous variables; however, the non-experimental design is still more limited than an experimental design in its ability to isolate the effect of the treatment.

Delimitations of the Study

This study is bound by the following delimitations. First, while there are psychomotor and affective measures of learning, this study employed the more cognitive measure of final course grades as the means to compare student learning with e-textbooks and print textbooks. Second, this study was bound by e-textbooks. Although many publishers now offer supplemental digital learning resources with e-textbooks (e.g., McGraw-Hill's Connect or Pearson's MyLab), the use of these was not considered within the study.

Definition of Key Terms

Concerns-Based Adoption Model (CBAM) – An applied research framework for exploring the affective and behavioral changes of key adopters during the adoption of educational innovations (Hall et al., 1975).

E-textbook – A digital book used for formal study and accessed via an electronic device (Rockinson-Szapkiw et al., 2013).

Levels of Use (LoU) – A dimension of the CBAM that measures users' behaviors and actions during implementation of an innovation. This construct consists of eight levels ranging from unawareness to effective integration (Hall et al., 1975).

Mobile Learning - Leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviors, or skills through education, training, or performance support while the mobility of the learner may be independent of time, location, and space (Mobile Learning Handbook, n.d., "Basics," para. 11).

Summary

E-textbooks are becoming more prevalent in today's digital and mobile environment. Many school systems from K-12 to higher education are conducting trials to evaluate e-textbook effectiveness (Miller et al., 2013). While e-textbooks have potential advantages over traditional print textbooks in the areas of cost, student engagement, reading comprehension, and mobile learning, research is needed to understand the impact on student learning. Furthermore, this research can assist administration and faculty with making strategic decisions regarding e-textbook initiatives.

Utilizing Hall et al.'s (1975) LoU for analyzing innovation adoption as the framework, this study sought to identify and analyze instructors' LoU rankings for e-textbook features. This study also evaluated the effectiveness of e-textbooks compared to paper textbooks on student achievement and sought to determine any differences based on student demographics.

The remainder of the study is organized as follows. Chapter II presents a review of related literature in the areas of e-textbook efficacy studies and the LoU framework. Chapter III outlines in detail the research methodology employed in the study. Chapter IV presents the findings and results and Chapter V presents the conclusions and recommendations.

CHAPTER II:

REVIEW OF THE LITERATURE

Introduction

Learning content in the K-12 and higher education segments in the United States is a $12 billion industry (Reynolds, 2012). Digital textbooks have experienced exponential growth over the last several years and Reynolds (2011) projects that digital textbooks will comprise 44% of the total textbook market by 2017. Numerous studies have been published evaluating student performance with e-textbooks compared to paper. This literature review will discuss findings from efficacy studies of e-textbooks in higher education, e-textbooks in the mobile learning environment, student preferences, and faculty perceptions of electronic versus paper textbooks. Moreover, research on the LoU framework for analyzing innovation adoption will be discussed, to establish how instructors' LoU may impact student learning with e-textbooks.

Efficacy Studies of E-Textbooks

An often-cited study of e-textbooks is that of Shepperd, Grace, and Koch (2008). Shepperd et al. (2008) examined whether there was a difference in course grades for 392 undergraduate students who elected to use an electronic versus paper text in an introductory psychology course. The authors also examined whether there was any difference in the amount of time spent reading with each format. In their method, students who elected electronic versions of the text were given a compact disc (CD) with the text. They found no difference in course grade or time spent reading. They also found students evaluated the electronic text

unfavorably. Students did not find the electronic text to be convenient, would not be willing to use it in the future, and would not recommend it to a friend.

Daniel and Woody (2012) conducted a similar study in which they examined whether there was a difference in quiz scores for 298 undergraduate students using electronic and paper texts for one chapter of an introductory psychology textbook. This study found a statistically significant difference in reading time as a function of text format in both the lab setting and home environment. Students assigned to read the material in the lab spent 7% longer reading the electronic media compared to print media. Students assigned to read the material at home spent 22% longer reading the electronic format versus print format, based on self-reported reading times. Regardless of reading time or location, however, there was no difference in quiz scores. Furthermore, student response to a Likert scale survey revealed no difference in motivation, enjoyment, or perceived comprehension of the text based on format.

Rockinson-Szapkiw et al. (2013) recognized that the ubiquity of mobile devices in academic milieu may be the key to wider acceptance of e-textbooks. In their research, final course grades of 538 undergraduate and graduate students in fifty-nine education courses were compared between those using e-textbooks and paper textbooks. They also examined perceived learning on a scale that captured not only cognitive learning, but affective and psychomotor learning as well. In their study, 90% of students reported accessing their e-textbook on a mobile device. Results indicated no significant difference in course grade and cognitive learning between the two text formats. However, perceived psychomotor and affective learning were significantly higher for students using e-textbooks.

Johnson (2013) published a comparison study of reading comprehension scores for students using e-textbooks and traditional print textbooks for one chapter of a business text

regarding organizational culture and organizational change. Although he found no difference in scores between the two formats, the survey revealed a dichotomous, highly positive valence on format. Students who preferred the printed text did so strongly. Students who preferred the electronic text expressed the same positive strength of feeling.

Reading comprehension between digital and paper texts was also tested by Taylor (2011). In this study, 72 introductory psychology students were assigned either a digital or paper copy of an economics book. Participants were then given a 20-item standardized quiz. Results indicated no comprehension differences between the two text formats. Furthermore, the study sought to answer whether there was any difference in retention of the material over time. Participants took the same quiz one week later and no interaction between test time and text medium was found. Student performance was poorer after the delayed test regardless of format. Additionally, participants were assigned to a "clean" condition, in which they were not to make any marks in their text or take any notes, and an "annotated" condition, in which they were encouraged to engage with the text through underlining, highlighting, and taking notes. Interestingly, there was no difference in reading comprehension between the two levels of engagement. Taylor (2011) concluded that text format was not as important as getting the students to actually read.

This conclusion finds precedence in other research as well. When Ditmyer et al. (2012) surveyed 703 students in dental school, they found that although the majority of students were spending 16 hours or more per week studying, they spent only one to five hours per week using their textbook, regardless of format. Researchers found the students were using e-textbooks "in a more nonlinear way and reading segments rather than cover to cover" (Ditmyer et al., 2012, p. 736). In Walton's (2007) study of e-textbooks at a small liberal arts college, he stated "it is rare to find a student who has read an e-book cover-to-cover" (p. 95).

Mobile Learning

While some studies find there is no relationship between student outcome and text format use and caution against a digital conversion (Shepperd et al., 2008), other researchers state that e-textbooks are primed to play a vital role in mobile learning (mLearning) (Rockinson-Szapkiw et al., 2013). The literature review indicates a slow evolution in e-textbook research results. What began as e-textbooks on relatively static formats with unfavorable perceptions (Shepperd et al., 2008) has evolved to affective and psychomotor learning with mobile devices (Rockinson-Szapkiw et al., 2013), to strong, favorable opinions of e-textbooks for those that use them (Johnson, 2013). Continued research may reveal a tipping point in the future, where a difference in measurable learning outcomes will be found as students and instructors engage in effective mLearning.

The Evolving Definition of mLearning

The integration of mobile technologies with learning environments has created an evolving definition of mLearning. Early definitions of mLearning focused on the device itself. Quinn (2000) defined mLearning as "eLearning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone" (para. 1). Later definitions broadened to include the learner, such as Woodill's (2010) description of mobile learning as "where a learner can be physically mobile while at the same time remaining connected to non-proximate sources of information, instruction, and data communications technology" (as cited in Mobile Learning Handbook, n.d., "Basics," para. 9). Mobile platforms also allow for various mLearning activities such as behaviorist-type activity, constructivist activity, situated activity, collaborative learning, informal and lifelong learning, and support or coordination of learning and resources (Traxler, 2009). The definition of mLearning from the Advanced Distributed Learning Initiative captures

the comprehensive and flexible nature of mLearning. It is "leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviors, or skills through education, training, or performance support while the mobility of the learner may be independent of time, location, and space" (Mobile Learning Handbook, n.d., "Basics," para. 11).

Effective Mobile Learning

A review of literature by El-Hussein and Cronje (2010) identified the theme of a tripartite concept of mobile learning including the mobility of the technology, the mobility of the learner, and the mobility of learning. Furthermore, Koole (2009) explored a similar framework with the Framework for the Rational Analysis of Mobile Education (FRAME) model that takes into account mobile technologies, human learning capacities, and social interaction.

Koole (2009) concluded that effective mobile learning occurs at the overlap of the device, learner, and social aspects. In an effort to expand learning beyond just social learning, social aspects can be replaced with learning aspects to yield a modified version of Koole's Venn diagram of the mobile learning process as shown in Figure 1.

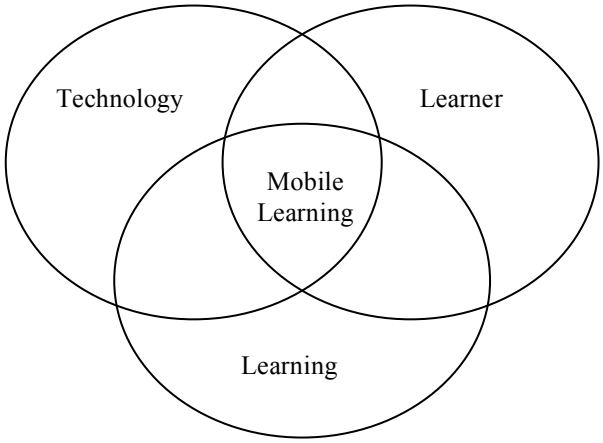

Figure 1. A variation of Koole's FRAME model. This variation is from M. L. Koole's (2009) *A model for framing mobile learning.*

Mobility of the technology. Mobility of the technology refers to "the physical, technical, and functional characteristics of a mobile device" (Koole, 2009, p. 28). The introduction and proliferation of handheld portable devices and wireless technology has radically changed how people conduct business and how they interact socially (El-Hussein & Cronje, 2010). For the past decade, researchers and educators have been exploring the pedagogical role these devices play in learning. A report from the International Telecommunication Union (2014) reveals there are 6.8 billion mobile-cellular subscriptions in the world. This market penetration rate of 96% means that there are almost as many cell phone subscriptions as people in the world. Furthermore, mobile broadband subscriptions are experiencing an average annual growth rate of 40%, up from 268 million in 2007 to 2.1 billion in 2013. The market is now at a saturation point with mobile devices (ITU, 2014). Learners as young as preschool age are using multiple mobile devices. Forty-three percent of pre-K-12 children and 60% of high school students are using a smartphone (Grunwald Associates LLC, 2013). College students are using laptops, tablets, smart phones, e-book readers, and more and expect access to academic resources on these devices (Smith & Caruso, 2010).

Mobile devices are the medium for connecting learners and instructional content and now offer the technical capabilities and functionality needed in learning design. For example, voice recognition allows the ability to navigate through learning content by voice without having to look at the device. Voice-based personal assistants and intelligent tutoring systems could ultimately accompany learning modules. E-textbooks are capable of text-to-speech (TTS) with programs such as Pageburst™ by Elsevier (Pageburst™, 2013). Location awareness capability of mobile devices through a global positioning system (GPS) can be a powerful tool for social-learning based activities. Video chat technologies like FaceTime and Skype connect learners

with their instructors or with other learners to overcome delayed transmissions like email and video (Mobile Learning Handbook, n.d.). Textbooks are now integrated into the same devices as all of these learning technologies, further assimilating the textbook into learners' day-to-day lives.

Mobile devices do not come without concerns. These include battery life, connectivity, data and service charges, carriers, device ownership, digital equity considerations, media compatibility, screen size and visibility in ambient environments, and security (Mobile Learning Handbook, n.d.). However, technological solutions exist and are being explored to assist with delivery of e-textbooks on mobile devices (Lee, Messom, & Yau, 2013).

Mobility of the learner. A salient feature of mLearning is the freedom from location and time (availability) constraints. Learning extends beyond the walls of the classroom and beyond the static location of a personal computer to occur "at any place and at any time" (El-Hussein & Cronje, 2010, p. 18). Alexander (2004) described the untethered mobile learner as nomadic. Nomadic learners can read, complete assignments, engage in group projects, interact with their Learning Management Systems, and explore deeper interests from the proximity of their couch to the quad to the break room at work (Alexander, 2004).

In traditional teaching environments, instructors have the responsibility of incorporating examples from the outside world to create relevance for students. But in the mLearning environment, students can create their own relevance to build a learner-centric pedagogy as opposed to teacher-centric. With cameras and video, for instance, students can create, capture, and share their own content so that discussions revolve around examples defined by the students themselves in their real-world environment (Mobile Learning Handbook, n.d.).

Mobility of learning. Stead (2006) explored mLearning from two complementary approaches: safe learning and disruptive learning (as cited in Koszalka & Ntloedibe-Kuswani, 2010). In safe learning, mobile technologies "provide access to learning resources in common learning contexts" such as the classroom (Koszalka & Ntloedibe-Kuswani, 2010, p. 142). Safe learning is explicit (Koszalka & Ntloedibe-Kuswani, 2010). For example, a learning objective is presented and students use mobile devices to explore, find, and learn information about that objective. Mobile learning also has the power to create disruptive learning where the traditional learning environment is disrupted to allow learners to engage in implicit, informal, or incidental learning in their everyday contexts (Koszalka & Ntloedibe-Kuswani, 2010).

Mobile devices can be taken to an authentic, context-aware environment such as a museum (Traxler, 2009) or the work place for situated learning. The information sharing and communication capabilities of mobile devices create unique opportunities for collaborative learning. Online communities are learning environments that connect people with similar interests and are not constrained by physical presence (Bingham & Conner, 2010).

Seymour Papert, MIT professor and artificial intelligence pioneer, captured the sentiment of many instructors when he said, "You can't teach people everything they need to know. The best you can do is position them where they can find what they need to know when they need to know it" (Mobile Learning Handbook, n.d., "Think Differently," para. 3). Perhaps this is one of mobile learning's greatest potentials – performance support. While media-rich, interactive learning content piques the interest of instructional designers, all a user may require at the moment of learning need is a checklist or reminder (Mobile Learning Handbook, n.d.). Indeed, research demonstrates how students are using e-textbooks as performance support or as reference sources. Walton's (2007) research found that, "Students were using e-book collections as a tool

to conduct research rather than for reading. Students search through a collection of e-books, scan 'relevant' sentences, select a section of text, cut a desired portion, and paste the retrieved content into another application" (p. 93). Electronic medical books are often used for searching and locating key pieces of information, rather than for reading cover-to-cover, and were found to be highly used among medical students at Texas A&M University (Ugaz & Resnick, 2008).

Student Preferences

While the majority of studies indicate no difference in student performance between e-textbooks and paper textbooks (Daniel & Woody, 2012; Johnson, 2013; Shepperd et al., 2008; Taylor, 2011), and while the use of mobile devices is highly prevalent among today's students (Chen & Denoyelles, 2013; Rockinson-Szapkiw et al., 2013), the acceptance of e-textbooks is in an early stage of migration. In a study by Woody, Baker, and Daniel (2010), undergraduate students in a general psychology course were surveyed regarding their satisfaction with e-books, their usage of e-book features, and their comfort level with computers. Results indicated that the use of e-books was not affected by comfort level with computers or by gender. The study found that although e-books offered special features such as embedded links and web activities, e-book users were not more likely to engage in these activities. A similar result was found in Daniel and Woody's (2012) study of e-textbooks. There was no difference in the rate of completion for learning activities as a function of media type (Daniel & Woody, 2012). Woody et al. (2010) concluded that not only were paper textbooks preferred by students, there was an aversion to e-books.

Robinson's (2011) study of student practices may denote this aversion. In 2009, students in a principles of management course were given a choice of using a free e-textbook or purchasing a low-cost version of the same book. Even though high textbook costs are a concern

to students, one-third of the students in this study were willing to pay for a paper copy of the book rather than use a free version of the book electronically.

When Walton (2007) investigated students' use of e-books for conducting research, as a textbook, and for leisure reading, he found the majority of students prefer paper books to e-books at the small liberal arts institution. Students preferred using traditional books to e-books for conducting research at a ratio of 2.3 to 1. Students preferred a traditional textbook format to e-book format at a ratio of 3.6 to 1. Finally, students overwhelmingly preferred using paper books over e-books for leisure reading at a ratio of 30.3 to 1.

In contrast to Robinson's (2011) and Walton's (2007) findings, Weisberg (2011) found an increasing reception to and acceptance of e-textbooks. In this two-year longitudinal study, student attitudes and behavior toward e-textbooks were evaluated in undergraduate students in a management strategy course. Data were collected by student surveys, observations, and learning assessments. From 2009 to 2011, observable changes in student attitudes and behaviors were found. Initially, students were unfamiliar with the e-readers and e-textbook devices assigned to them and felt that these devices were not conducive to the classroom yet. The following year, several students reported enjoying using the e-textbooks and stated it was their preferred way of reading their text. In the final year of the study, an increase in the technology readiness and awareness of the students was seen. There had also been advancements in e-textbook features and capabilities such as note sharing and searching. Many of the students under study by then had purchased their own digital reading devices and were using them to read their texts. Weisberg (2011) found that "The number of students who reported that they would not use an eReader device for their textbook even if it were available, decreased by over 50% over the duration of the class to less than 10% of the students" (p. 193). Three major factors were

identified as the force behind the increase in and acceleration of student acceptance and use of e-textbooks. These were cost, the impact on learning, and whether e-textbooks were assigned or recommended by the instructor.

Other studies also support the impact of the instructor on e-textbook preferences among students. Stone and Baker-Everleth (2013) surveyed students in a mid-sized university in the western United States. The research concluded that ease-of-use of e-textbooks had "positive, meaningful affects on students' attitudes toward e-textbooks and behavioral intentions to purchase e-textbooks" (Stone & Baker-Everleth, 2013, p. 44). In addition, verbal persuasion/social norms had a positive influence on students' attitudes towards and intentions to use e-textbooks. In other words, encouragement to use e-textbooks by faculty, parents, and classmates could promote a positive attitude toward and acceptance of e-textbooks.

Student Differences and Text Format

Studies have found no significant difference in student outcomes between the electronic and print texts controlling for gender (Johnson, 2013; Woody et al., 2010) or age (Ditmyer et al., 2012; Johnson, 2013). However, research indicates student preferences for text format do differ by discipline. A study of 313 undergraduate students by Ciampa, Thrasher, Marston, and Revels (2013) concluded that non-business majors were more satisfied with e-textbooks and more likely to use them again in the future compared to business majors.

It appears e-textbooks have found a niche as reference books with many students; thus, disciplines in the medical field find e-textbooks particularly attractive. A study of first-year medical students at the University of Central Florida College of Medicine found that students reported a higher level of motivation using interactive e-textbooks over printed books (Gillum, Garner, Walton, & Dexter, 2014). Students favored the interactive e-textbook "because of its

ease of navigation and access, self-assessment features, and its interactivity and search capabilities" (Gillum et al., 2014, para. 5).

The Medical Sciences Library at Texas A&M University studied the use of core medical texts in electronic and print format (Ugaz & Resnick, 2008). For the fifty-one titles analyzed in their reference/core collection during 2005-2006, electronic editions were used substantially more than printed editions. This could be the result of mobile learners in mobile learning environments. In addition to serving traditional classroom students, the library served geographically dispersed medical students completing their third and fourth years of clinical residency. The 12,132 uses of electronic editions over the 278 uses of print editions ultimately led the library to designate the e-book version as the primary reference copy.

Faculty Perceptions

Studies on faculty perceptions of e-textbooks reveal the same pattern as that of students. Initially there is an aversion to e-textbooks followed by more acceptance over time. For example, a study by Walton (2007) found that only 8% of faculty indicated a preference for e-books over books for conducting research. This study also found that 0% of faculty preferred e-books as a textbook and 0% preferred e-books for leisure reading.

Bossallar and Kammer (2014) conducted narrative interviews with eight faculty members across various disciplines regarding their experiences with e-textbooks. Results indicated that the instructors were concerned about the affordability of learning content and thus, the cost of the e-textbook was a factor when determining what materials would be used. Many e-textbook programs offer students the option to purchase a paper version for a relatively low cost, and some participants expressed the importance of retaining that option. Regarding the loss of access to content after the course, participants expressed mixed opinions. Some instructors felt

continued access was important for future courses while others cited the availability of online information as reducing the need to retain access. There was concern regarding the technical support role instructors sometimes had to play; however, 24/7 customer support was generally available from the publishers. E-textbook platforms allow instructors to monitor student use of the text. For example, instructors can track a student's number of unique visits, number of pages viewed, number of pages printed, number of highlights made, and number of notes made. While some instructors expressed concerns about privacy, others saw value in the ability to track student activity to assess performance and provide assistance.

Some educators not only advocate the use of digital textbooks in their courses, they encourage writing and using open source content (Allen, 2014). Stewart (2009), a professor in the Oceanography Department at Texas A&M University, identified several benefits to online textbooks. One benefit is that electronic publication allows for quicker and easier revision. The publication process for traditional textbooks can take two to three years after writing is complete. By then, material is out of date, especially in scientific fields where discoveries might be made every few months. Another benefit is the growing availability of multimedia materials that can be inserted into online texts. Stewart (2009), an author of free, online oceanography textbooks, states "A short film clip of the tsunami coming ashore at Banda Aceh in Indonesia on December 26, 2004, is much more effective in showing the power of a tsunami than any words I might write" (p. 24).

Ciampa et al. (2013) found a significant, positive relationship between students' use of e-textbook features and their satisfaction with the e-textbook. Thus, instructors hold one of the keys to increasing student satisfaction with and utilization of e-textbooks – use of the features. Ciampa et al. (2013) advocated for educators and e-textbook publishers to "expose students to

the special features incorporated as part of an e-textbook" (p. 8) through demonstrations and use during class, which leads to this study's framework of levels of use of an innovation.

Levels of Use of an Innovation Framework

The preceding review of literature revealed that e-textbooks initially offered on CD or through other static mediums were not perceived favorably by students (Shepherd et al., 2008). However, the widespread ownership and use of mobile devices may drive the acceptance rate of e-textbooks higher (Rockinson-Szapkiw et al., 2013). Regardless of whether an electronic or paper text was used, the overwhelming majority of studies have found no significant difference in student learning. Indeed, it is promising that technology can be implemented without a negative impact to student learning. However, how can technology not only maintain the status quo, but also contribute to improvement in student learning? Understanding instructors' levels of use of e-textbook features and innovations may assist with the challenge of efficiently maximizing learning.

The Change Model

The transition to an e-textbook initiative can be viewed as a planned change for the adoption of a technological innovation. As illustrated in Figure 2, Ellsworth (2000) used this change context in Shannon and Weaver's (1963) general communication model to establish

> a *change agent* who wishes to communicate an *innovation* to an *intended adopter*. This is accomplished using a *change process* that establishes a channel through the *change environment* between the two communicants. However, this environment also contains *resistance* that can disrupt the change process or distort how the innovation appears to the intended adopter. (p. 26)

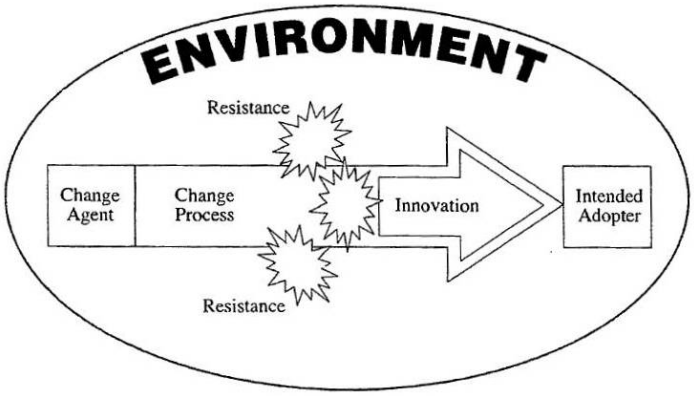

Figure 2. The change communication model. This figure is from J. B. Ellsworth's (2000) *Surviving change: A survey of educational change models*.

Intended Adopters

While any or all of these components of the change communication model may be explored, this study focused on intended adopters, specifically instructors. Teachers are a key stakeholder in educational change. As exemplified by Ellsworth (2000),

> Regardless of what governments, school boards, or administrators require – it is the teacher who is in the classroom day after day with the students. If the teacher resists implementation, implements without critical components, or merely maintains a façade of implementation, then educational change will not succeed. (p. 84)

An illustration of the significance of the teacher as a change adopter can be found in the 1940s and early 1950s. During this time, the high school physics curriculum in the United States predominantly used a progressive education approach to teach the everyday practicality of physics (Donahue, 1993). However, upon the launching of the Soviet Union Sputnik satellite, a reform movement began for a more rigorous, discipline-based curriculum. Highly trained physicists and members of prominent organizations such as the National Science Foundation and the Physical Science Study Committee rewrote textbooks and modified teaching strategies. While the debate between a progressive or discipline-centered approach ensued, Donahue (1993) explained that the manifestation of curriculum reform was largely a function of teacher elucidation. While physics textbooks may have been written by professional scientists

advocating a discipline-centered curriculum, it was the teacher that served as the link between the textbook material and how it would be used in the classroom. Valuing autonomy, teachers would often use a combination of progressive and discipline-centered approaches.

Lack of teacher engagement has been cited as one of the reasons why John Dewey's curricular ideas never came to fruition (Kleibard, 2004). Dewey's pedagogical theories used everyday activities, or social occupations, to teach traditional subjects. Dewey sought cohesiveness – cohesiveness in the transition from children's interests to their role in the world and cohesiveness in the subjects taught in schools. However, Dewey's pedagogy was met with misinterpretation and resistance. Whether it was from the teachers' lack of ability, interest, or authority, Dewey recognized the pedagogy could not be successful without the active involvement of the teacher (Kleibard, 2004).

CBAM

CBAM is a framework for exploring the affective and behavioral changes of these key adopters during the adoption of educational innovations (Ellsworth, 2000). The CBAM methodology was developed by researchers at the University of Texas at Austin in the early 1970s (Hall et al., 1973) and is a seminal work in the field of innovation adoption in educational institutions. One of the central constructs of this model is that the existence of an innovation does not guarantee its use. Successful adoption considers the multiple and complex activities, decisions, and evaluations that must occur during the integration of an innovation into an organization (Hall et al., 1973). Another key construct of the model is that adoption of the innovation does not occur at a single point in time, but rather is a process. As such, the variation in adoption by individual users can be described and profiled over time in order to identify strategies that will yield the most effective adoption (Hall et al., 1975).

Stages of Concern

CBAM is comprised of three core dimensions and their corresponding diagnostic tools. Stages of Concern (SoC) and Innovation Configurations (IC) are briefly described first, followed by a more in-depth analysis of LoU. SoC is a categorization of adopters' feelings and concerns as they progress through implementation of a change and is measured by a 35-item Stages of Concern Questionnaire (SoCQ) (George, Hall, & Stiegelbauer, 2006). Seven stages of concern are identified, which reveal a progression from adopters' focus on self, to the task, and then finally to the impact on students (Hall et al., 1973). Table 1 provides a description for each of the SoC.

Table 1

Stages of Concern About the Innovation

Focus	Stage	Description
Self	0 - Unconcerned	There is little concern about or involvement with the innovation.
	1 - Informational	There is general awareness of the innovation and interest in learning more details about it.
	2 - Personal	There is uncertainty about the demand of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation.
Task	3 – Management	There is focus on the processes and tasks of using the innovation and the best use of information and resources.
	4 - Consequence	There is focus on the innovation's impact on students in his or her immediate sphere of influence.
	5 - Collaboration	There is focus on coordinating and cooperating with others regarding use of the innovation.
Impact	6 - Refocusing	There is focus on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.

Note. From *Measuring implementation in schools: The Stages of Concern Questionnaire* (p. 8), by A.A. George, G.E. Hall, and S.M. Stiegelbauer (2006).

Innovation Configurations

The IC component of CBAM seeks to identify gaps between the change facilitator's intended use of the innovation and the adopter's actual use of the innovation (Hord, 1986). Innovation adopters may sometimes modify or adapt an innovation to fit their context, resulting in a deviation from the ideal implementation. This modification of the innovation does not necessarily reflect ill intentions or a lack of ability. Rather, there may have been a failure to adequately describe use of the innovation to adopters, or change facilitators themselves may not have had a clear and specific plan for use to share with adopters (Ellsworth, 2000). IC maps, or rubrics, are used as diagnostic tools to answer two key questions: "what does the innovation look like in practice?" and "has quality implementation occurred?" (Roy & Hord, 2004, pp. 56-57).

Levels of Use Component of CBAM

While SoC reflects users' feelings and affect about the innovation and IC describes what use of the innovation is supposed to look like, LoU reflects users' behavior and action (Ellsworth, 2000). This behavior falls within eight discrete levels ranging from unawareness of the innovation to effective use of the innovation, including a search for even better innovations. Table 2 depicts the LoU chart.

Table 2

LoU Chart

Level of Use	Description
0 (Non-Use)	User has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.
Decision Point A: Takes action to learn more detailed information about the innovation.	
I (Orientation)	User has acquired or is acquiring information about the innovation and/or has explored or is exploring its value orientation and its demands upon user and user system.
Decision Point B: Makes a decision to use the innovation by establishing a time to begin.	
II (Preparation)	User is preparing for first use of the innovation.
Decision Point C: Begins first use of the innovation.	
III (Mechanical Use)	User focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
Decision Point D-1: A routine pattern of use is established.	
IV (A Routine)	Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.
Decision Point D-2: Changes use of the innovation based on formal or informal evaluation in order to increase client outcomes.	
IVB (Refinement)	User varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short-term and long-term consequences for clients.
Decision Point E: Initiates changes in use of innovation based on input of and in coordination with what colleagues are doing.	
V (Integration)	User is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
Decision Point F: Begins exploring alternatives to or major modifications of the innovation presently in use.	
VI (Renewal)	User reevaluates the quality of use of the innovation, seeks major modifications or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

Note. Hall, G.E. Loucks, S.F. Rutherford, W.L. & Newlove, B.W. (1975). Levels of use of the innovation: A framework for analyzing innovation adoption. *Journal of Teacher Education, 26*(1), p. 54.

LoU goes beyond identifying adopters as merely users or non-users of the innovation. The LoU profile consists of five levels of use (LoU III – VI) and three levels of non-use (LoU 0 – II) (Julius, 2007). The LoU protocol also utilizes decision points to establish distinctions between each level. While LoU represents a growth continuum, CBAM developers do not assume every innovation user will progress in a step-wise sequence through LoU or SoC (Hall et al., 1975).

After extensive research, Hall et al. (1975) concluded that during the first cycle of LoU, most users are at LoU III, where use is disjointed and not highly effective. Their research stated that "after three cycles of use, 30-40 percent of an innovation's users are stable at LoU IVA" (Hall et al., 1975, p. 56). The LoU profile can assist in selecting development plans or intervention strategies to facilitate further growth in innovation use (Hall et al., 1975). Furthermore, Hall et al. (1975) suggested assessing LoU for each particular innovation if several innovations are part of one innovation bundle. As such, this study explored LoU values for single e-textbook features rather than considering the transition to e-textbooks as one innovation bundle. While CBAM is a conceptual framework that examines SoC, LoU, and IC, this study examined instructors' LoU only. CBAM studies have examined the CBAM dimensions independently or all together (Hord, Rutherford, Huling-Austin, & Hall, 1987). It is the objective examination of behaviors through LoU that will lend insight into impacts on student learning and strategies for effective implementation of an e-textbook initiative.

A review of literature indicates CBAM studies have been more prevalent in K-12 settings (Julius, 2007). Thus, this research contributes to the body of knowledge on the LoU construct within CBAM in higher education settings. With less research on higher education, there are even fewer studies on community colleges. Community colleges offer an inclusive vantage point

from which to evaluate student performance as they are "now the entry point for almost half of all people who begin higher education, those who have just graduated from high school as well as those over 24" (Weisbrod, Ballou, Asch, 2008, p. 11). Community colleges are diverse institutions and offer programs for those seeking job skills training, those pursuing an associate degree to transfer to a four-year institution, and those pursuing special interests (American Association of Community Colleges, 2014).

LoU Studies

There is a substantial body of research utilizing CBAM to guide the implementation of innovations and changes (Ellsworth, 2000). According to Anderson (1997), CBAM is "arguably the most robust and empirically grounded theoretical model for the implementation of educational innovations to come out of educational change research in the 1970s and 1980s" (p. 331). Furthermore, CBAM is "widely known and has been applied throughout North America, Western Europe, and Australia by both education researchers and practitioners" (p. 332). The CBAM LoU procedure has been used in a variety of contexts ranging from education, to service sectors, and to industry (Roberts, 2002).

Biery (1998) investigated the LoU of innovative language strategies resulting from a revised Language Arts curriculum among four elementary school teachers. Using the LoU focused interview approach, the researcher sought to determine teachers' LoU after thirty hours of professional development training and one academic year of implementation. Results showed that three participants were at Level IVA (Routine) and one participant was at Level III (Mechanical Use). These results align with Hall et al.'s (1975) findings that most users are operating at Levels III-IVA in the first one to three years of implementation. Biery (1998)

recommended allowing teachers adequate time for collaborative planning and reflection to influence movement from Level IVA to IVB.

LoU has been used to evaluate the science curriculum in elementary schools as well. Using a multiple case study approach, Bouchelle (2002) conducted a similar study to investigate eight teachers' LoU with a state-sponsored science kit. Similar to Biery's (1998) findings, the modal LoU was IVA, and time limitation was a common theme constraining the ability to more fully implement the initiative's pedagogy (Bouchelle, 2002). Although the sample size was small, Bouchelle (2002) did find a positive relationship between years of teaching and LoU. As years of teaching increased, so did the overall LoU.

In a study by Forsgren (1997), factors affecting secondary school teachers' LoU of the innovation were analyzed. In this study, the innovation was defined as the National Standards for United States History, and participants were selected from a stratified sample of school districts in Iowa and Oregon. In contrast to the focused interview approach, Forsgren (1997) utilized a self-administered survey to determine users' LoU. The survey was developed in accordance with LoU definitions and consisted of 24 items on a six-point Likert scale. The sample size in this study was much larger than the previously mentioned case studies (n = 151, 60% useable response rate). Results indicated the majority of teachers were at Level III or lower. Data showed that a respondent's ranking of personal knowledge of the standards was a strong predictor of higher LoU. Furthermore, teachers who subscribed to professional history education journals or were members of history education national organizations were more likely to have higher LoU. Other factors that correlated with higher LoU included teachers' opportunities to work collaboratively with other teachers to incorporate the standards into the

curriculum, and teachers' opportunities to be informed of the standards such as with in-services, workshops, or conferences.

The LoU index has been used in higher education settings as well. Orr and Mrazek (2010) used a modified LoU instrument to analyze self-reported levels of adoption of emerging and innovative educational technologies in a graduate-level education course. The study sought to use the LoU index to assess the participants' knowledge of, confidence with, and continued use of emergent technologies taught in the course. Twenty-six students from the summer session of an emerging technologies course at the University of Lethbridge were asked to report their LoU with 20 emerging technologies at three different points in time. Students responded to the same survey prior to arrival on campus for the class (pretest), at the conclusion of the class (posttest), and four months later (post-posttest).

The researchers skillfully framed descriptors that would capture the behavior and changes in professional knowledge for the technologies under study. Participants then selected from identical stem responses for each of the technologies. Figure 3 depicts the LoU descriptors adapted by Orr and Mrazek (2010). Orr and Mrazek (2010) noted that the descriptors "should not imply a hierarchical progression, but rather a nominal description of the state of the community's adoption of an innovation" (p. 4). The authors noted that respondents should feel comfortable with whatever level they are. The LoU index is a tool "to inform programs and processes, not to evaluate people" (Orr & Mrazek, 2010, p. 10).

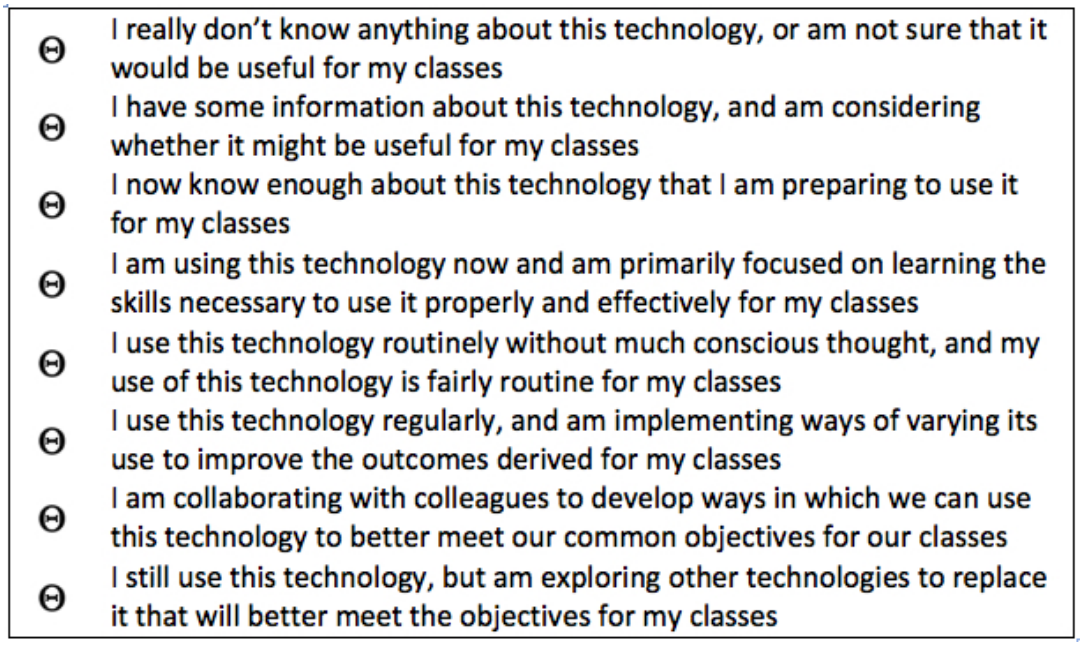

Figure 3. Level of adoption descriptors. This figure is from D. Orr's (2010) "Developing the level of adoption survey to inform collaborative discussion regarding educational innovation" in the *Canadian Journal of Learning and Technology / La Revue Canadienne De L'Apprentissage Et De La Technologie, 35*(2).

The data revealed an increase in the LoU index for the four specific technologies taught in the course (videoconferencing, learning management system, interactive whiteboard, and conferencing/bridging technologies), as well as an increase in the LoU for peripheral technologies and technologies used by the instructors. There was a statistically significant difference in the LoU for the four technologies from the posttest to the post-posttest, with higher values being reported post-posttest. Similar findings were reported for the other technologies as well. This study showed that the same survey can be administered during various stages of implementation of an innovation to provide longitudinal data about knowledge of and confidence with the innovation.

Over four decades of LoU research has identified not only numerical LoU values, but correlations with LoU as well (Forsgren, 1997; George, Hall, & Uchiyama, 2000). Relationships between LoU and teacher characteristics, school environments, and student outcomes have been

studied (Roberts, 2002). A study of the U.S. Department of Defense Dependents' Schools system evaluated teachers' LoU in implementing a constructivist approach to teaching mathematics. Fifty-nine teachers at the German site were assessed during the second semester of a two-year implementation plan and students' math scores were measured over a two-semester period. Results revealed a significant and positive relationship between LoU and student learning; the higher the teachers' LoU, the greater the students' improvement in scores over the school year (George et al., 2000).

The LoU tool has extended beyond the field of education and into other contexts such as service and industry sectors as well. For example, Bedell, Ward, Archer, and Stokes (1985) investigated "characteristics of mental health agencies that contributed to the adoption and use of treatment innovations following consultation" (p. 120) and training. Characteristics that affected adoption were measured using a Decision Determinant Questionnaire (DDQ) to calculate scores for the eight subsets of the questionnaire and an overall DDQ score. The treatment innovation was defined as the use of social skills training procedures (e.g., communication, problem-solving, daily living skills) with mental health patients. Three levels of professional staff were interviewed at each of 30 mental health agencies in the state of Florida, resulting in 213 LoU interviews. Researchers developed a modified version of Hall et al.'s (1975) LoU methodology to measure three levels of use: no use, full or partial use, and previous use. The category of "previous use" was implemented due to the fact that the LoU interview was being conducted three years after the social skills training. Results indicated that the overall DDQ scores were different between agencies among the three levels of use. Thus, researchers were able to empirically evaluate innovation adoption to make recommendations for improved staff training.

LoU Modifications and Adaptations

While the LoU interview protocol is very rigorous, it also requires a significant investment in time and is labor-intensive. Over the years, researchers have modified the LoU schema to improve efficiency and to use the construct in contexts other than education (Bedell et al., 1985; Forsgren, 1997; Orr & Mrazek, 2010; Roberts, 2002; Schaafsma, 1995). For example, using the definitions for LoU developed by Hall et al., (1975), Forsgren (1997) developed a 24-item questionnaire to mail to participants. The instrument consisted of three statements for each of the eight LoU states. Participants selected a response from a six-point Likert scale so that LoU of National Standards for U.S. History could be assessed.

Roberts (2002) designed and tested a web-based instrument for measuring LoU of technology and innovative teaching strategies. In this instrument, Roberts (2002) was able to maintain the branching format of the interview that determines whether one is a user or non-user or is focused on use or focused on improvement, due to the increased sophistication in Internet tools.

Another example of the progression from interviews to self-reporting scales can be found in the work of Orr and Mrazek (2010). These researchers framed LoU descriptors that would capture the behavior and changes in professional knowledge for the technologies under study.

While Bedell et al., (1985) used the traditional interview approach, the eight LoU states were reduced to three to analyze the use of treatment innovations in a mental health facility. Because a period of three years had elapsed since the implementation of these treatment procedures, a level of "previous use" was deemed necessary to accompany the condensed levels of "no use" and "full or partial use."

In addition to changes in the LoU assessment method and the number of levels over the years, the LoU instrument language has been modified as well. The LoU construct was applied in a large Australian telecommunication organization to evaluate a new telephone repair service (Schaafsma, 1995). These researchers modified the language of the LoU instrument "in order to be meaningful to the culture of the end-users" (Schaafsma, 1995, p. 411). To avoid feelings of threat by participants, telephone interviews were conducted rather than face-to-face interviews. Furthermore, the LoU chart was simplified and adapted to align with the Plan-Do-Check-Act cycle associated with the Total Quality Management principles the company practiced.

Summary

Digital textbooks have experienced exponential growth over the last several years (Reynolds, 2011); however, acceptance by student and faculty has been a slow migration (Robinson, 2011; Walton, 2007; Weisberg, 2011; Woody et al., 2010). While scholarly research studies vary in population and methodology, several common themes emerge. The overwhelming majority of textbook studies find no differences in student quiz scores, grades, or reading comprehension between electronic and paper textbooks (Daniel & Woody, 2012; Shepperd et al., 2008; Taylor, 2011). Many students still prefer traditional books over e-textbooks, even when traditional books come at a higher cost (Robinson, 2011). However, studies do indicate preference for text format differs by discipline, with those in the medical fields favoring e-textbooks (Ciampa, 2013; Gillum et al., 2014; Ugaz & Resnick, 2008). This may be due to e-textbooks finding a niche as portable reference books with students. Thus, the effectiveness of e-textbooks may come with a better understanding of mobile learning pedagogy.

E-textbooks can now be integrated with ubiquitous mobile devices that come with learning technologies such as text-to-speech, voice recognition, and video chat. Moreover, e-

textbooks on mobile devices allow learners to more easily extend learning beyond the classroom and into real-world contexts (Traxler, 2009). Continued research may reveal a tipping point in the future, where a difference in measurable learning outcomes will be found as students and instructors engage in effective mLearning.

Some faculty share the same concerns and exhibit the same hesitation to use e-textbooks as students (Walton, 2007), while others promote the benefits of electronic publication such as faster publication and availability of multimedia materials (Stewart, 2009). Ciampa (2013) found that as students utilized e-textbook features, their satisfaction with e-textbooks increased. Thus, as instructors incorporate e-textbook features into their teaching methods, student engagement with the e-textbook may increase, leading to higher performance. The LoU schema is designed to measure this level of utilization.

The LoU framework was developed in the 1970s by researchers at the University of Texas at Austin and has been used in various contexts for over four decades. The LoU chart outlines eight potential states of a user's behavior and action when implementing an innovation. These levels are: Level 0 (Non-Use), Level I (Orientation), Level II (Preparation), Level III (Mechanical Use), Level IVA (Routine), Level IVB (Refinement), Level V (Integration), and Level VI (Renewal) (Hall et al., 1975).

This study added to the body of knowledge regarding e-textbook efficacy. While other studies employed an experimental approach to the evaluation of e-textbooks and traditional textbooks, this study contributed to the body of knowledge by evaluating student grade data during the transition period from paper to e-textbooks at a community college. While many studies stop with the conclusion that there is no difference in student outcomes between text formats, this study addressed a gap in literature on how to improve student performance with e-

textbook technology. This was done by utilizing the LoU of an innovation framework to determine instructors' LoU of e-textbook features, whether there was a difference in LoU profiles across programs of study, what factors were related to higher LoU, and what improvements or programs could be implemented to increase LoU and student learning.

CHAPTER III:

METHODOLOGY

Introduction

Today's digital and mobile learning environment has contributed to the increased availability of and interest in e-textbooks, and many school systems are conducting trials to evaluate their effectiveness (Miller et al., 2013). As the technology of e-textbooks continues to evolve, research is needed to understand their influence on student learning. Furthermore, understanding the efficacy of e-textbooks and how instructors use e-textbooks can assist academic institutions with development plans and strategic direction.

Purpose of the Study

The purpose of this study was to explore instructor use of e-textbook features and innovations through the LoU model to determine instructors' current LoU and any differences in their profiles across the four divisions of a community college in the North Alabama area. Furthermore, this study sought to identify variables related to LoU of e-textbooks. This study also evaluated the effectiveness of e-textbooks compared to paper textbooks on student achievement during a pilot period of e-textbook implementation. Moreover, the influence of text format on student achievement by age and gender was also examined.

Research Questions

The research questions for this study included the following:

1. What are the instructors' LoU with e-textbook features;
2. Is there a difference in instructors' e-textbook LoU profile ranking across programs of study;
3. What demographic characteristics of instructors (age, gender, rank, years of college-level teaching, and number of e-textbook professional development experiences) are related to LoU of e-textbook features;
4. Is there a difference in student achievement level, as measured by the final course average, for students using e-textbooks compared to paper textbooks; and
5. What relationship do age and gender have on a student's achievement level, as measured by the final course average, considering textbook format?

Setting

Participants of this study were students and instructors in a large-sized, two-year, public institution in the Alabama Community College System. The institution offers Associates degrees for exclusively undergraduate two-year programs. Programs of study are offered in four divisions: the Division of Business/Computer Information Systems (CIS), Technology, and Workforce Development; the Division of Health; the Division of Humanities and Social Sciences; and the Division of Mathematics and Natural Sciences. The institution serves a four-county area in North Alabama. Fall 2012 enrollment was 11,323 students in credit programs. According to the school's 2011 Southern Association of Colleges and Schools (SACS) report, student demographics were described as 44% male and 56% female, with an average student age of 27. Ethnicity data indicated 72% of students were White, 19% were Black/African American,

and 9% were of various minority groups. Ninety-eight percent of students were Alabama residents. The school reported 45% of students were enrolled full time, 80% worked at least part-time, and 46% received financial aid. The school employs 148 full-time faculty and 339 part-time faculty. Over 80% of faculty have earned a master's degree or higher in their discipline.

Sample Selection

This institution was selected based on several criteria. First of all, an institution with an active e-textbook initiative was needed. The institution of study had historically used paper textbooks and was in the process of piloting e-textbooks for the 2013-2014 and 2014-2015 academic years. Second, an institution of higher education was sought. A review of literature indicates CBAM studies have been more prevalent in K-12 settings (Julius, 2007). Thus, this research contributed to the body of knowledge on the LoU construct within CBAM in higher education settings. Finally, the institution of study needed to offer a comprehensive range of programs for evaluation.

The sample of instructors to address LoU in the first three research questions was instructors who taught an e-textbook course during the 2013-2014 or 2014-2015 pilot period. The last two research questions addressed whether there was a difference in student performance between the e-textbook section and the traditional print section of a course. Sample selection criteria for course comparisons were as follows:

1. The same instructor taught both an e-textbook section of the course and a traditional print section of the course;
2. The same textbook was used in the e-textbook section of the course and the traditional print section of the course; and

3. The same class format (classroom, online, hybrid) was used for the e-textbook section and the traditional print section.
4. The instructor utilized the same assessment measures in the e-textbook section and the traditional print section, as determined by Section V (grading plan) of the syllabus.

These sample selection criteria were established to decrease variability in the comparison of final course grades between e-textbook and print textbook courses.

Data Collection

There were two forms of data collection for this study. To address the first three research questions, a survey was administered to instructors to identify the LoU index for various e-textbook features and innovations. This information lent insight into the extent of the adoption of e-textbook innovations by college instructors. All instructors who utilized an e-textbook during the pilot period were identified by the institution's Distance Learning Coordinator. These individuals were then notified electronically regarding the study and their request for participation. The survey was imported into the institution's survey tool account, SurveyMonkey, and distributed to instructors who taught a course for which an e-textbook was required. Instructors were asked to self-report demographic data such as gender, age range, highest degree earned, number of years of college-level teaching, number of professional development experiences with e-textbooks, and number of semesters taught with an e-textbook.

Furthermore, historical data were extracted from the college's Student Information System (Banner®) in order to answer the last two research questions. An example of the data collected is shown in Table 3. These data were also sorted by student demographics (age and gender). Ethnicity data were collected for the purpose of describing the student sample of study.

Class enrollment limits at the institution typically result in class sizes from a minimum of 15 students to a maximum of 35 to 40 students. Final grades were reported as letter grades (e.g., A, B, C, D, F, I, or W). Grades of "I" and "W" were excluded in the analyses. In order to numerically analyze the data, a letter grade of "A" was assigned a value of 4, a "B" was assigned a value of 3, a "C" was assigned a value of 2, a "D" was assigned a value of 1, and an "F" was assigned a value of 0.

Table 3

Sample Data Collection Report from Banner®

	Instructor X Course Y *Paper Textbook* Program of Study				Instructor X Course Y *E-textbook* Program of Study			
	Gender	Age	Ethnicity	Final Grade	Gender	Age	Ethnicity	Final Grade
Student 1								
Student 2								
…								
Student n								

Instrumentation

A modified version of Hall et al.'s (1975) LoU interview protocol, adapted by Orr and Mrazek (2010) was used for instructors to self-assess their LoU with eight features of e-textbooks. These eight features were identified through a review of literature on e-textbook features (de Oliveira, 2012; Pageburst®, 2014; VitalSource®, 2014), as well as a review panel consisting of 1) an assistant professor in the School of Nursing at Tuskegee University who had taught with an e-textbook for the past four years, 2) the distance learning coordinator of the institution under study, and 3) the institution's account executive for VitalSource® Technologies. The eight e-textbook features evaluated included the following:

F_1: highlighting text and sharing,
F_2: making notes and sharing,
F_3: exporting text or notes,
F_4: tracking and analysis of e-textbook use,
F_5: interactive practice questions or games,
F_6: web links,
F_7: videos/animations, and
F_8: just-in-time (JIT) learning or performance support.

The LoU descriptors utilized in the original Orr and Mrazek (2010) study are shown in Figure 4.

□ I really don't know anything about this technology, or am not sure that it would be useful for my classes.
□ I have some information about this technology, and am considering whether it might be useful for my classes.
□ I now know enough about this technology that I am preparing to use it for my classes.
□ I am using this technology now and am primarily focused on learning the skills necessary to use it properly and effectively for my classes.
□ I use this technology routinely without much conscious thought, and my use of this technology is fairly routine for my classes.
□ I use this technology regularly, and am implementing ways of varying its use to improve the outcomes derived for my classes.
□ I am collaborating with colleagues to develop ways in which we can use this technology to better meet our common objectives for our classes.
□ I still use this technology but am exploring other technologies to replace it that will better meet the objectives for my class.

Figure 4. LoU descriptors from original instrument.

Three modifications were made to the original Orr and Mrazek (2010) instrument. Not all e-textbooks utilize the reflowable content standard designed for dynamic media and interactive features. Some e-textbooks are the page-fidelity format that offers no interactive features (Rockinson-Szapkiw et al., 2013). Thus, a descriptor indicating the e-textbook feature is not offered was listed as a response choice for instructors. Second, the word "feature" replaced "technology" in order to more accurately describe the context of the study. Finally, the first stem descriptor ("I really don't know anything about this technology, or am not sure that it would be useful for my classes") was separated into two response choices. This change provided more

clarity in instructors' knowledge of the features. However, these two descriptors were combined to represent one level when the data were analyzed. This provided consistency for comparison of results to other LoU studies that employ Hall et al.'s (1975) eight states of use.

The modified LoU descriptors used in this e-textbook study are shown in Figure 5. For each of the eight e-textbook features of study, instructors were given this same set of LoU descriptors from which to choose a response.

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
□ I have some information about this feature, and am considering whether it might be useful for my class.
□ I now know enough about this feature that I am preparing to use it for my class.
□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
□ I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.
□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Figure 5. Modified LoU descriptors for instructor survey.

Instructor demographic data and course data were also collected. These included gender, age, highest degree earned, years of college-level teaching, the number of in-services, workshops, conference sessions, or courses regarding e-textbooks that the instructor has attended, and the number of semesters taught with an e-textbook. If an instructor taught more than one e-textbook course, he or she was given the option at the end of the survey to repeat the survey for a different course. If an instructor taught more than one section of a course, he or she was asked to repeat the survey only if there were sections taught with different course objectives

or different grading assessments. The complete LoU survey presented to instructors can be found in Appendix A.

LoU Descriptions

Each of the stem descriptors for the LoU survey was assigned a numerical value as shown in Table 4. The numerical values were not visible to survey participants to avoid a presumed hierarchical progression of responses. An overall LoU value was calculated for each e-textbook feature by averaging the numerical value of each participant's ranking for that feature.

The LoU state associated with that numerical value was then identified for that feature. For example, if the average numerical value of F_1: highlighting text and sharing was 3.0, this feature would be designated a Level II use by instructors (see Table 4).

Table 4

LoU Descriptions

Assigned Numerical Value for Analysis	Level of Use State	Stem Descriptor
1	0 (Non-Use)	My e-textbook does not offer this feature.
1	0 (Non-Use)	I really don't know anything about this feature.
1	0 (Non-Use)	I am not sure that this feature would be useful for my class.
2	I (Orientation)	I have some information about this feature, and am considering whether it might be useful for my class.
3	II (Preparation)	I now know enough about this feature that I am preparing to use it for my class.
4	III (Mechanical Use)	I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
5	IVA (Routine)	I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.
6	IVB (Refinement)	I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
7	V (Integration)	I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
8	VI (Renewal)	I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

An overall LoU value was also calculated for each instructor by averaging the numerical values of their responses to all the features. The corresponding LoU state was then used to characterize users as non-users, low-level users, mid-level users, and high-level users. Users with overall LoU states of 0 were classified as non-users. Users whose overall average fell within Levels I and II were acquiring information to prepare for use and were classified as low-

level users. At Levels III and IVA, use has become routine and stabilized. Thus, these users were classified as mid-level users. Finally, Levels IVB, V, and VI represented high-level users who are collaborating with others and exploring alternatives to improve the experience for the client. This classification system was developed by the researcher based on descriptions of users' behaviors in the LoU framework and with assistance from an expert in educational change models. Table 5 provides a description of users' behaviors for the eight possible LoU states and the subsequent classification of use.

Table 5

LoU Classifications

Level of Use	Description of Users' Behavior	Classification
0 (Non-Use)	Neither using the innovation nor taking any action to get involved.	Non-use
I (Orientation)	Learning what the innovation is all about.	Low-level use
II (Preparation)	Getting ready to use the innovation for the first time.	Low-level use
III (Mechanical Use)	Focused on the rote aspects of use of the innovation, driven by own convenience.	Mid-level use
IVA (Routine)	Use of the innovation has stabilized and few, if any, changes are considered.	Mid-level use
IVB (Refinement)	Changes in the innovation are considered and made to improve learning outcomes.	High-level use
V (Integration)	Use of the innovation is coordinated with colleagues to improve learning outcomes.	High-level use
VI (Renewal)	Use of the innovation is reevaluated and new innovations examined for better options.	High-level use

Note. Descriptions from J.B. Ellsworth's (2000) "Surviving Change: A Survey of Educational Change Models" (p. 159).

In summary, survey participants selected one of ten given stem descriptors for each of the eight e-textbook features. The stem descriptors were assigned a numerical value in order to calculate an average value by feature and by instructor. The average numerical value was then used to associate the feature and instructor with one of the eight discrete states in the LoU framework. Finally, LoU was classified generally by grouping the eight LoU states into categories of non-use, low-level use, mid-level use, and high-level use. Providing both a specific LoU state and a general classification of LoU allowed for an objective, yet less prescriptive, analysis and discussion.

Original Instrument Validity

Validity refers to the "extent to which a test actually measures what it was intended to measure" (Nolan & Heinzen, 2011, p. 8). Orr and Mrazek (2010) addressed validity of the LoU index used in their study of emergent technologies. Orr and Mrazek (2010) posit that validity of this self-reporting instrument depends primarily on the researcher's skill in framing accurate and focused descriptors for the technology being assessed. Therefore, the stem descriptors were designed to accurately describe the kinds of behaviors associated with the LoU states. Furthermore, radial buttons or check boxes were used with each response so that a hierarchical progression of responses was not assumed.

Original Instrument Reliability

Reliability refers to "the consistency of a measure" (Nolan & Heinzen, 2011, p. 8). Orr (personal communication, October 7, 2014) identified three reasons for not calculating reliability coefficients for the instrument. First, the primary intent of the tool was "to provide aggregated self-reflective information back to communities of professional practice to help inform collaborative and collegial discussions and decisions regarding professional development and/or

systemic change" (D. Orr, personal communication, October 7, 2014). Second, the results allowed respondents to self-compare their level of use to the aggregate. Finally, as a self-reported reflective assessment, the quasi-ordinal scale may not be appropriate for, nor withstand, rigorous statistical analyses.

Modified Instrument Validity

In this study, a list of six e-textbook features was compiled through a literature review (de Oliveira, 2012; Pageburst®, 2014; VitalSource®, 2014) and presented to a review panel consisting of 1) an assistant professor in the School of Nursing at Tuskegee University who had taught with an e-textbook for the past four years, 2) the distance learning coordinator of the institution under study, and 3) the institution's account executive for VitalSource® Technologies. This review panel verified that the descriptions of the e-textbook features were clear and suggested that two features be added: 1) exporting text or notes and 2) tracking and analysis of e-textbook use.

After identifying the features to be studied, three modifications to the stem descriptors were made to the Orr and Mrazek (2010) instrument. First, a descriptor indicating the e-textbook feature is not offered was listed as a response choice for instructors. Second, the word "technology" was replaced with the word "feature" in the stem responses. Finally, the stem descriptor "I really don't know anything about this feature, or am not sure that it would be useful for my class" was separated into two response choices to provide more clarity and detail in understanding non-use. After the three modifications were made to the descriptors in Orr and Mrazek's (2010) instrument, the revised LoU descriptors and the eight e-textbook features were reviewed with the Distance Learning Coordinator of the institution to be studied. Finally, an expert faculty member in Measurement and Statistics assessed the technical quality of the

instrument items. This process of identifying the domain of interest, utilizing the knowledge of an expert panel, integrating feedback into the instrument, and conducting a second analysis by domain experts contributed to establishing content validity (Crocker & Algina, 1986).

Modified Instrument Reliability

Cronbach's alpha was calculated for the instrument using participants' responses for the eight e-textbook features. Cronbach's alpha was found to be .50, indicating a low level of internal consistency. Analysis revealed removal of any feature, except F_3: exporting text or notes, would result in a lower Cronbach's alpha. While an alpha value of .70 or higher is considered acceptable (Nunnally, 1978), a lower value was expected for this instrument. This instrument did not contain multiple questions addressing a single construct. Rather, participants self-identified their level of adoption for a selected e-textbook feature. Given that the modified instrument did not substantially alter the original LoU stem descriptors, reliability can be based on Orr and Mrazek's (2010) conclusion that

> If the descriptor stems and responses are framed carefully and appropriately, the same survey can be repeated at various times during a project and the results can reasonably be expected to provide useful longitudinal information regarding change in professional understanding and practice. (p. 5)

Sample Size

The LoU survey was sent to 57 instructors who taught with an e-textbook during the pilot period, as identified by the institution's distance learning coordinator. While a 100% response rate is ideal, factors such as lack of availability and interest may result in a lower response rate. Fink (2009) states that a response rate of 70% may be considered adequate. Given that participation in this study was voluntary with no direct benefit to participants, a lower response rate was expected. Thirty-one instructors completed the survey, yielding an actual response rate of 54%.

An a priori power analysis was conducted to determine the minimum sample size required to detect group differences for certain research questions. A power analysis exploits the relationships among the sample size, significance criterion, effect size, and statistical power (Cohen, 1992).

The first research question reported descriptive statistics only. For the second research question, an a priori analysis of statistical power was conducted for the analysis of variance (ANOVA). In a four-level analysis of differences in LoU of e-textbook features among the school's divisions, results indicated 89 subjects per level, or 356 instructor surveys, would be required with 0.25 effect size (medium) and 0.05 significance level to achieve a power of 0.8 (Maxwell & Delaney, 2004). Since there were only four responses from the Business/CIS division and no LoU responses were received from the Division of Health, only two levels were used in the final analysis. Evaluation of this scenario indicated 64 subjects per level, or 128 instructor surveys, would be required with 0.25 effect size (medium) and 0.05 significance level to achieve a power of 0.8 (Maxwell & Delaney, 2004). The actual sample size was 27 subjects among the two levels, with 14 subjects in Humanities and Social Science and 13 subjects in Math and Natural Sciences. Therefore, the nonparametric equivalent test was used for statistical analysis.

The regression analysis in research question three utilized two predictor variables (years of college-level teaching and number of e-textbook professional development sessions). This scenario required at least 65 subjects for a 0.15 effect size (medium) and 0.05 significance level (Green, 1991). Based on this effect size, the desired sample size was not achieved. However, the regression was conducted with the available sample ($n = 31$).

The analysis of variance (ANOVA) in the fourth research question indicated a total student sample size of 128 (64 subjects per level) was needed for a two-tailed analysis using a 0.5 effect size (medium) and 0.05 significance level to achieve a power of 0.8 (Maxwell & Delaney, 2004). Working within the constraints of class size limits and course/section offerings during the pilot period, the number of subjects in each test ranged from 31 to 244 students.

Finally, the three-way ANOVA for the last research question required 128 students, or 16 students per group, in order to achieve a power of 0.8, using an effect size of 0.25 (medium) and significance level of 0.05 (Faul, Erdfelder, Lang, & Buchner, 2007). This analysis was based on two levels of text format (e-textbook and paper), two levels of gender (male and female), and two levels of age category (traditional and non-traditional). The actual sample size was 2,432 students.

Procedure

Permission was obtained from Professor Doug Orr at the University of Lethbridge to utilize the LoU survey from his 2010 study to assess professional growth and development of graduate students. With a few additions and modifications, the eight descriptors from his study served as stem responses from which instructors chose in assessing their LoU with e-textbook features.

After approval of the research proposal, the researcher obtained approval from the Institutional Review Board (IRB). The IRB review ensures risk to the study's subjects is minimized, appropriate procedures for the recruitment of subjects are used, and adequate safeguards are included in the research design to protect the privacy and confidentiality of participants.

Following IRB approval, the instructor survey was created in SurveyMonkey by the researcher. It was then released by the Distance Learning Coordinator to all instructors who have taught a course utilizing e-textbooks through the VitalSource Bookshelf® platform. Instructors were given a two-week window during the Spring 2015 semester in which to complete the survey. An email reminder about the survey was sent after one week. After participants responded to the survey, the data were exported into Microsoft Excel for analysis and Statistical Package for the Social Sciences (SPSS®) version 23 for statistical analysis.

Subsequently, historical data on course grades, course format, and student demographics were extracted from Banner® by the Distance Learning Coordinator of the institution under study. The data were exported into a Microsoft Excel file for analysis. SPSS® version 23 was used for statistical analysis of the data. Comparisons in performance between e-textbook sections and traditional print sections were made within a course, but not across different course types.

Research Design

A survey research design was used for the study of instructors' LoU. Survey research is a subset of a quantitative research approach that provides a numerical analysis of trends, behaviors, or opinions with the intent of drawing generalizations from a sample to a population (Creswell, 2014). This cross-sectional design allowed instructors to self-report their LoU with e-textbook features during a specific point in time – the e-textbook pilot period. The advantages of a self-reporting electronic survey design were that it allowed all e-textbook instructors to be contacted at once, was less resource-intensive than individual interviews, and allowed for rapid turnaround in data collection (Creswell, 2014). Disadvantages of the survey design were low response rates due to voluntary participation and incomplete survey responses possibly due to

lack of time, interest, or understanding. Another potential disadvantage was the static design; however, the fairness that a consistent design offers could be considered a strength (Colorado State University, 2014).

This study also employed a non-experimental research design. Utilizing existing historical data on student demographics and final course grades, this study sought to determine if differences in course performance existed between e-textbook and print textbook sections. This design took advantage of existing data, was non-invasive to the classroom, and was less costly and time consuming than an experimental design (Airasian & Gay, n.d.). A drawback to the non-experimental design was that students were not randomly selected and assigned to e-textbook and paper textbook sections. Students had already self-selected into sections before the research began. Measures were taken to control for extraneous variables that could possibly represent alternative explanations for the research findings. However, the non-experimental design is limited in its ability to truly find cause and effect relationships compared to an experimental design (Creswell, 2014).

Assumptions of the Study

Assumptions in this study included the following:

1. It is assumed that prior to the e-textbook initiative, when instructors utilized print textbooks in the classroom, that students purchased and utilized the print text. Likewise, it is assumed that in an e-textbook course, where the cost of the text was incorporated into the students' tuition, students utilized the electronic text; and
2. It is assumed that instructors did not self-inflate their levels of use of e-textbook features in order to give a perceived desired response. LoU is designed to

measure and quantify behaviors and is not intended to be a performance evaluation or final examination of faculty or faculty development programs.

Limitations of the Study

Limitations which applied to this study included the following:

1. Many research designs can and have been used to compare student results between textbook print mediums. In this research, student final grades with each format were compared over different semesters; thus, measures were taken to control for variability between semesters;
2. This study evaluated student performance with e-textbooks during a pilot period at the institution, which was already in progress. Therefore, a student's final course average was the best available quantitative measure and served as the measure of learning. Previous studies have used final grade as the dependent variable as well. While student performance is understood to be a multivariable phenomenon, research by Rockinson-Szapkiw et al. (2013) states, "Throughout the literature, learning is often used as a measure to determine the efficacy of educational strategies and tools, and grades are most commonly used to measure learning" (p. 261);
3. In the first semester that e-textbooks were offered at the institution (Fall 2013), students were notified after enrollment that an e-textbook was assigned for the course. In subsequent semesters, e-textbook courses were designated in the enrollment process. Thus, students self-selected into either e-textbook or traditional print book sections;

4. The study was limited in scope to the cross-sectional design of responses from voluntary participants at one community college in the Alabama Community College System. Thus, results may not be generalizable to the entire population of higher education institutions;
5. Another limitation of the study included a relatively low response rate from the LoU survey design, thus impacting the ability to achieve adequate sample size for inferential statistical analysis; and
6. A non-experimental research design was employed to determine if there was a difference in course performance between e-textbook and paper textbook sections. Measures were taken to control for extraneous variables; however, the non-experimental design is still more limited than an experimental design in its ability to isolate the effect of the treatment.

Delimitations of the Study

This study was bound by the following delimitations:

1. While there are psychomotor and affective measures of learning, this study employed the more cognitive measure of final course grades as the means to compare student learning with e-textbooks and print textbooks; and
2. This study was bound by e-textbooks. Although many publishers now offer supplemental digital learning resources with e-textbooks (e.g., McGraw-Hill's Connect or Pearson's MyLab), the use of these was not considered within the study.

Data Analysis

Descriptive and inferential statistics were used to answer the research questions. See Table 6 for the data management plan.

Table 6

Data Management Plan

Research Question	Measure(s)	Independent or Grouping Variable(s)	Dependent Variable(s)	Analysis
1	Instructor Survey	E-textbook features (F_1 through F_8)	E-textbook feature LoU	Descriptive statistics
2	Instructor Survey	Program of study (Business/CIS or Health or Humanities & Social Sciences or Math & Natural Sciences)	LoU	Mann-Whitney U-Test
3	Instructor Survey	Age, gender, rank, years of teaching, number of e-textbook professional development sessions	Instructor overall LoU	Regression
4		Text format (paper or electronic)	Final course average	Independent samples t-test
5		Text format (electronic, paper); Gender (male, female); Age (traditional, non-traditional)	Final course average	Three-way ANOVA

CHAPTER IV:

RESULTS

Introduction

The purpose of this study was to identify and analyze instructors' LoU of e-textbook features and innovations at a community college in the North Alabama area and determine if there were differences in instructor LoU profiles across the college's four programs of study. Furthermore, this study sought to identify instructor characteristics that were predictive of LoU scores. This study also evaluated the effectiveness of e-textbooks compared to paper textbooks on student achievement during a pilot period of e-textbook implementation. Finally, the influence of text format on student achievement considering age and gender was examined. This chapter presents the results of the study. A descriptive analysis of the sample of instructors is presented, followed by the findings for each research question.

Instructor Sample Demographics

Thirty-one instructors responded to the LoU survey. Of those 31 instructors, 14 were male (45.2%) and 17 were female (54. 8%). The majority of instructors had a master's degree as their highest level of education (n = 20, 64.5%). Instructors were primarily aged 40-49 (n = 12) or over 60 (n = 9). Most instructors were experienced college professors, teaching on average 13 years (*SD* = 8.5, range 1-33). Instructors reported an average of 3.6 professional development experiences (*SD* = 4.0, range 0-15) involving e-textbooks. The average number of semesters taught with e-textbooks ranged from 0-10 with an average of 2.9 (*SD* = 2.2). See Table 7 for

descriptive statistics of the instructors. Records indicate there were 57 e-textbook instructors during the pilot period, yielding a 54.4% survey response rate.

Table 7

Demographic Statistics for Instructors

	n	%
Gender		
Male	14	45.2
Female	17	54.8
Age		
20-29 years	3	9.7
30-39 years	4	12.9
40-49 years	12	38.7
50-59 years	3	9.7
≥60 years	9	29.0
Degree		
Associate's	0	0
Bachelor's	4	12.9
Master's	20	64.5
Doctorate	7	22.6
Years of College-Level Teaching	M = 13.0 (*SD* = 8.5)	
Number of Professional Development Experiences	M = 3.6 (*SD* = 4.0)	
Number of Semesters Using E-textbooks	M = 2.9 (*SD* 2.2)	

Research Question 1

What are the instructors' LoU with e-textbook features? The first research question investigated instructors' self-reported LoU with eight e-textbook features:

F_1: highlighting text and sharing,
F_2: making notes and sharing,
F_3: exporting text or notes,
F_4: tracking and analysis of e-textbook use,
F_5: interactive practice questions or games,
F_6: web links,
F_7: videos/animations, and
F_8: just-in-time learning or performance support.

For each of these eight features, respondents selected one stem descriptor to describe their level of use with the feature. Each of the stem descriptors for the LoU survey was assigned a

numerical value as shown in Table 8. The assigned numerical value for each stem descriptor response was then averaged for each feature across all instructors. The study applied a conservative approach and rounded down any values between whole numbers when determining the average numerical value.

Table 8

LoU Descriptions

Assigned Numerical Value for Analysis	Level of Use State	Stem Descriptor
1	0 (Non-Use)	My e-textbook does not offer this feature.
1	0 (Non-Use)	I really don't know anything about this feature.
1	0 (Non-Use)	I am not sure that this feature would be useful for my class.
2	I (Orientation)	I have some information about this feature, and am considering whether it might be useful for my class.
3	II (Preparation)	I now know enough about this feature that I am preparing to use it for my class.
4	III (Mechanical Use)	I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
5	IVA (Routine)	I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.
6	IVB (Refinement)	I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
7	V (Integration)	I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
8	VI (Renewal)	I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

The average numerical value was used to identify the LoU state (Level 0, I, II, III, IVA, IVB, V, or VI) for each feature and the corresponding use classification (non-use, low-level use, mid-level use, or high-level use). See Table 9 for the use classification of the LoU states. Users with overall LoU states of 0 were classified as non-users. Users whose overall average corresponded with Levels I and II were acquiring information to prepare for use and were classified as low-level users. At Levels III and IVA, use has become routine and stabilized. Thus, these users were classified as mid-level users. Finally, Levels IVB, V, and VI represented high-level users who are collaborating with others and exploring alternatives to improve the experience for the client. Table 9 provides the differences between the LoU states and the use classification.

Table 9

LoU Classifications

Level of Use	Description of Users' Behavior	Classification
0 (Non-Use)	Neither using the innovation nor taking any action to get involved.	Non-use
I (Orientation)	Learning what the innovation is all about.	Low-level use
II (Preparation)	Getting ready to use the innovation for the first time.	Low-level use
III (Mechanical Use)	Focused on the rote aspects of use of the innovation, driven by own convenience.	Mid-level use
IVA (Routine)	Use of the innovation has stabilized and few, if any, changes are considered.	Mid-level use
IVB (Refinement)	Changes in the innovation are considered and made to improve learning outcomes.	High-level use
V (Integration)	Use of the innovation is coordinated with colleagues to improve learning outcomes.	High-level use
VI (Renewal)	Use of the innovation is reevaluated and new innovations examined for better options.	High-level use

Note. Descriptions from J.B. Ellsworth's (2000) "Surviving Change: A Survey of Educational Change Models" (p. 159).

In this study, non-use included three possible scenarios as shown previously in Table 8. First, instructors might not use a feature because their textbook did not offer it. Second, if instructors responded that they did not know anything about the feature, this was considered non-use. Finally, non-use also included the scenario in which instructors did not think the feature would be useful for their class.

Results

Results indicated two features were Level 0 (Non-Use) and six features were Level I (Orientation) low-level use. Specifically, tracking and analysis of e-textbook use and just-in-time learning or performance support were Level 0. While the *average LoU for each feature* was Level 0 (Non-Use) or Level I (Orientation), the *range of LoU for each feature* varied from Level 0 (Non-Use) to Level IVA (Routine) and Level IVB (Refinement). See Table 10 for a summary of LoU for each feature. A frequency table of LoU classification by feature is presented in Table 11 and is presented graphically in Figure 6.

Table 10

LoU Summary by Feature

	Min LoU	Max LoU	Average Value	Average LoU	Average Classification
F_1: highlighting text and sharing	0	IVB	2.26	I (Orientation)	low-level
F_2: making notes and sharing	0	IVB	2.16	I (Orientation)	low-level
F_3: exporting text or notes	0	IVB	2.16	I (Orientation)	low-level
F_4: tracking and analysis of e-textbook use	0	IVB	1.55	0 (Non-use)	non-use
F_5: interactive practice questions or games	0	IVB	2.58	I (Orientation)	low-level
F_6: web links	0	IVB	2.29	I (Orientation)	low-level
F_7: videos/animations	0	IVB	2.26	I (Orientation)	low-level
F_8: just-in-time learning or performance support	0	IVA	1.35	0 (Non-Use)	non-use

Table 11

Frequency Table of LoU Categories by Feature (n=31)

	Non-Use	Low-Level	Mid-Level	High-Level
F_1: highlighting text and sharing	15	8	5	3
F_2: making notes and sharing	17	7	4	3
F_3: exporting text or notes	20	4	3	4
F_4: tracking and analysis of e-textbook use	24	4	2	1
F_5: interactive practice questions or games	16	5	5	5
F_6: web links	16	6	6	3
F_7: videos/animations	17	6	6	2
F_8: just-in-time learning support or performance support	26	3	2	0

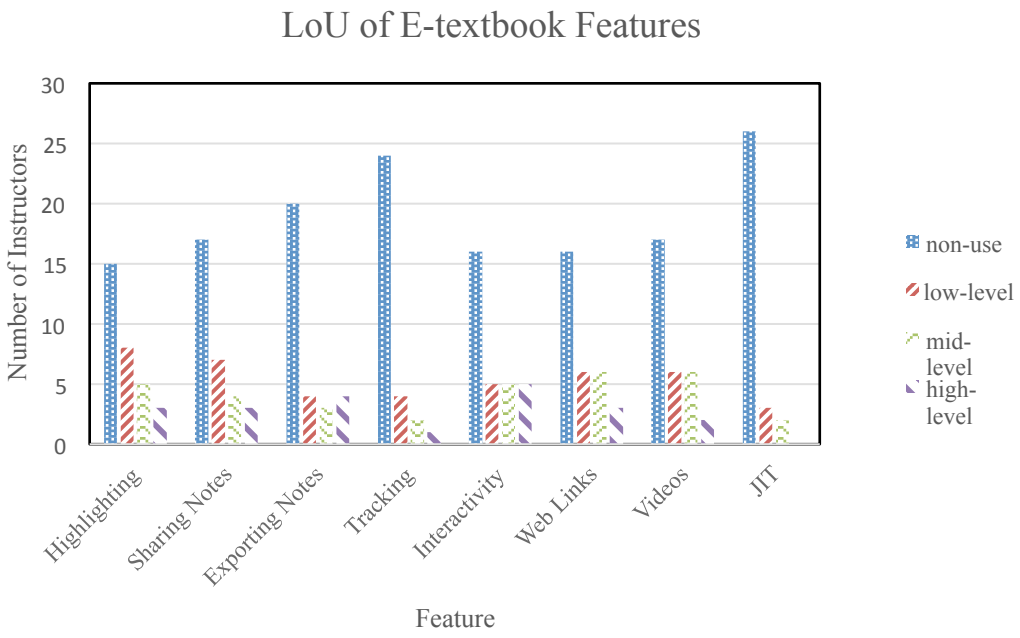

Figure 6. Frequency distribution of LoU classifications by feature.

The classification of non-use was examined to determine if a feature was not offered within the e-textbook, if the instructor did not know anything about the feature, or if the instructor did not think the feature would be useful. Figure 7 provides a frequency distribution of features reported as not being offered within the e-textbook. Results indicated that videos/animations was the feature most often reported as not offered with the instructors' e-textbook (n = 9, 29.0%). Six instructors (19.4%) reported their e-textbook did not offer just-in-time learning or performance support. Five instructors (16.1%) reported that interactive practice questions or games were not available with their e-textbook, and five instructors (16.1%) reported web links were not available with their e-textbook.

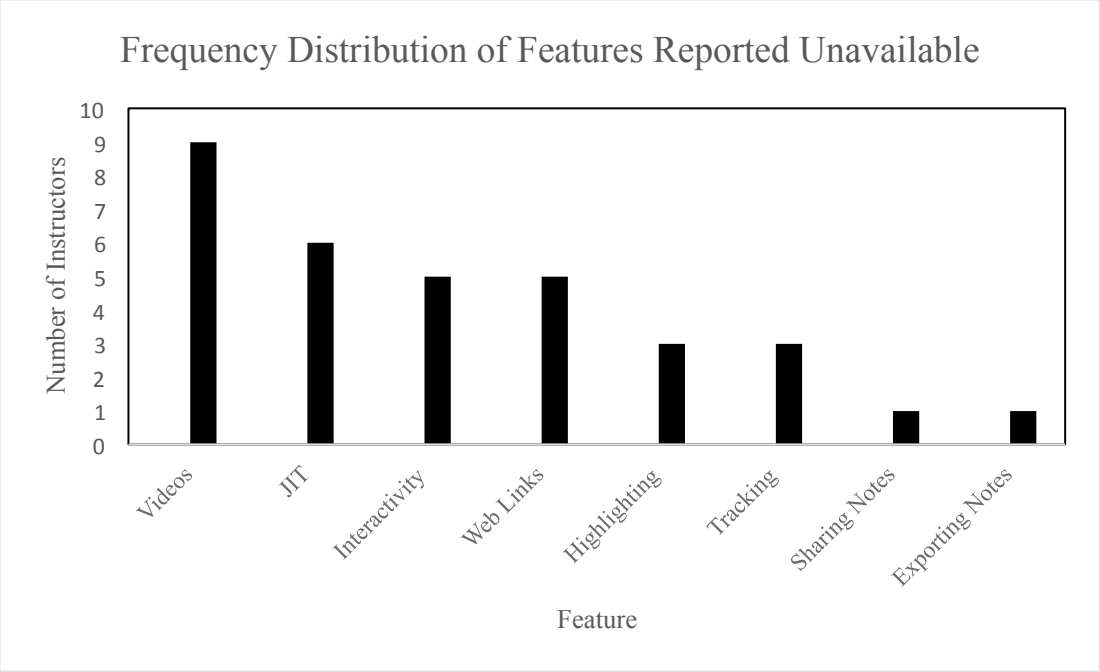

Figure 7. Frequency distribution of unavailable features.

When evaluating the second and third survey stem descriptors ("I really don't know anything about this feature" and "I am not sure that this feature would be useful for my class"), the stem response "I really don't know anything about this feature" was selected most often (70.3% of the time).

Research Question 2

Is there a difference in instructors' e-textbook LoU profile ranking across programs of study? The second research question explored whether there was a difference in instructors' overall LoU profile across the college's academic programs. To examine this research question, instructors' overall profile ranking was calculated by averaging the numerical values of their responses to all the features. The average LoU for all instructors was 2.08 (*SD* = .78), corresponding to Level I Orientation (low-level use). See Table 12 for descriptive statistics of instructor LoU. Instructor LoU ranged from Level 0 Non-Use to Level II Preparation, with the modal LoU being Level 0 Non-Use.

Table 12

Descriptive Statistics of Instructor LoU

	n	%	M	SD
Overall	31	100	2.08	.78
Division				
Humanities and Social Sciences	14	45	1.83	.63
Math and Natural Sciences	13	42	2.31	.85
Business/CIS	4	13	2.22	.99
Health	0	0		

There were 14 LoU responses from the Humanities and Social Sciences division. The mean LoU was 1.83 (*SD* = .63). Within the Math and Natural Sciences division, 13 LoU responses were received. The mean LoU was 2.31 (*SD* = .85). There were four LoU responses from the Business/CIS division with a mean LoU of 2.22 (*SD* = .99). No LoU survey responses were received from the division of Health. See Figure 8 for a graph of the LoU values. Due to the small sample size from the Business/CIS and Health divisions, only differences between the division of Humanities and Social Sciences and division of Math and Natural Sciences were analyzed.

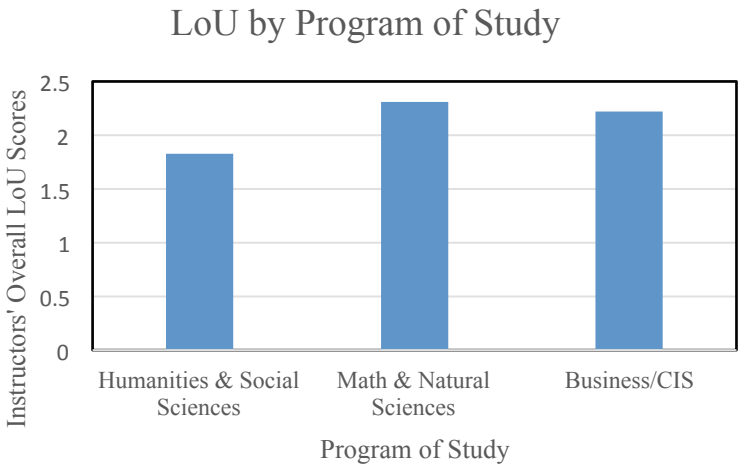

Figure 8. Instructors' overall LoU scores by program of study. No LoU responses were received from the Health Division.

Given the small sample sizes within the Humanities and Social Sciences and Math and Natural Sciences divisions, a nonparametric statistical procedure for independent samples was conducted. The Mann-Whitney U-test assumes that the units of analysis are independent of each other and the responses are continuous or ordinal. Results of the test showed no difference in LoU scores between the two programs of study (z = -1.63, p = .10). While the p value did not show significance, the effect size of .31 indicated a medium association between the two programs. This indicates almost one-third of a difference in standard deviation units was observed between the two groups. Therefore, a potential difference in LoU exists between the division of Humanities and Social Sciences and the division of Math and Natural Sciences, but the small sample size may have limited the ability to detect a difference.

Research Question 3

What demographic characteristics of instructors (age, gender, rank, years of college-level teaching, and number of e-textbook professional development experiences) are related to LoU of e-textbook features? The third research question sought to identify whether certain variables were related to LoU of e-textbook features. Independent variables were instructors' age, gender, education level, years of college-level teaching, and number of professional development experiences involving e-textbooks. Refer to Table 7 for instructor demographic data.

First, each categorical variable was examined to determine the relationship to LoU using an ANOVA analysis. Test results showed no significant relationship for all three variables (F(4,26) = 1.04, p = .41 for age; F(1,29) = 2.36, p = .59 for gender; F(2,28) = .90, p = .42 for education level).

Because previous research has identified relationships between LoU and the variables of years of teaching and number of professional development experiences, these two variables were carried forward for regression analysis.

Multiple linear regression is based on the assumptions that the regression of the dependent variable on the independent variable is linear, and that the independent variables are fixed and measured without error. Furthermore, the residuals are normally distributed and independent. At each setting of the independent variables, the mean of the residuals is zero and the variance is constant.

Regression diagnostics were run with the data set to determine if there were any potential outliers and influencers. The studentized deleted residual was used to determine if there were any potential outliers among the observations at a *t* critical absolute value of 2.048. Results of that analysis indicated no observations were potential outliers. Cook's D and the standardized DFBETA were used to identify global and specific potential influencers, respectively, at the lower level significance criterion. These tests identified a few observations as potential influencers. However, no observations were deleted in the regression model as it is believed that these observations reflect true representations of participants' self-assessment.

The Pearson correlation coefficient revealed a weak, negative relationship between LoU and years of teaching (r = -.01, p = .48, R square = .0001). There was a moderate, positive relationship between LoU and number of professional development experiences (r = .35, p = .03, R square = .122). The R square value indicated 12.2% of the variation in LoU could be accounted for by the number of e-textbook professional development sessions an instructor attended.

The multiple regression line relating the two variables to LoU revealed years of teaching and number of professional development experiences together were not significant predictors of LoU ($F(2,28) = 2.36$, $p = .11$, adjusted R square = .083). Table 13 contains the ANOVA SPSS output.

Table 13

ANOVA Table for Regression Model

	SS	df	MS	F	p
Regression	2.663	2	1.331	2.364	.113
Residual	15.767	28	.563		
Total	18.430	30			

A test of each individual variable was considered next. The relationship between years of teaching and LoU, controlling for professional development experiences, was not significant ($t(28) = -.80$, $p = .43$). However, results showed the number of professional development experiences, controlling for years of teaching, was a significant predictor of LoU ($t(28) = 2.17$, $p = .04$). LoU increased by .08 for every professional development experience, controlling for years of teaching. See Table 14 for the regression model coefficients.

Table 14

Regression Model Coefficients

	B	SE	t	p
Years Teaching	-.01	.02	-.80	.43
Professional Development	.08	.04	2.17	.04

Research Question 4

Is there a difference in student achievement level, as measured by the final course average, for students using e-textbooks compared to paper textbooks?

Descriptive Statistics of Courses

Twenty-seven possible cases were identified through the survey for comparing e-textbook section grades with paper textbooks. The 27 course comparisons were divided among the Humanities and Social Sciences (n = 14, 51.9%), Math and Natural Sciences (n = 7, 25.9%), Business/CIS (n = 3, 11.1%), and Health (n = 3, 11.1%) divisions. See Table 15 for descriptive statistics of the courses.

Table 15

Descriptive Statistics of Division Courses

	n	%
Humanities & Social Sciences	14	51.9
Math & Natural Sciences	7	25.9
Business/CIS	3	11.1
Health	3	11.1

This research question evaluated the effectiveness of e-textbooks compared to paper textbooks. Twenty-seven comparisons were identified through the survey as being courses taught with both the traditional print textbook and e-textbook by the same instructor, with the same textbook title, in the same format (classroom, hybrid, or online), and utilizing the same grading plan. The final course average was defined as a student's final letter grade. To numerically evaluate achievement, a letter grade of "A" was coded a value of 4, a "B" was coded a value of 3, a "C" was coded a value of 2, a "D" was coded a value of 1, and an "F" was coded a value of 0. Grades of "I" and "W" were excluded in the analyses. In an effort to minimize

variability across disciplines, the research question was tested by conducting independent samples t-tests for each of the 27 course comparisons.

Results

Table 16 displays the course names along with the sample size, mean grade value, and standard deviation for the e-textbook section and paper textbook section of each course. Some courses appear more than once in the table. This is due to the fact that the course was taught by more than one instructor and/or the course had multiple semesters for comparison.

Table 16

Descriptive Statistics for Course Comparisons

Set	Course Name	E-text Section			Paper Text Section		
		n	M	SD	n	M	SD
1	Theatre Appreciation	95	2.31	1.60	115	2.96	1.33
2	General Microbiology	17	3.29	1.05	49	3.00	1.19
3	Business Communications	19	2.05	1.55	37	2.54	1.28
4	Music Appreciation	54	2.48	1.46	17	2.24	1.56
5	Art History I	48	2.23	1.39	33	3.09	.98
6	U.S. History II	37	3.03	1.21	31	2.58	1.65
7	Microcomputer Applications	36	3.50	1.30	58	3.31	1.37
8	English Composition	62	2.85	1.50	93	2.58	1.54
9	Music Appreciation	132	3.11	1.39	112	2.70	1.68
10	Music Appreciation	99	2.53	1.72	112	2.70	1.68
11	General Microbiology	28	2.86	1.21	56	3.02	1.15
12	General Microbiology	53	3.02	1.32	56	3.02	1.15
13	General Microbiology	75	3.40	.81	56	3.02	1.15
14	General Microbiology	24	2.96	1.23	27	3.00	1.04
15	U.S. History I	44	2.86	1.32	32	2.47	1.63
16	Computer Programming	21	2.71	1.52	10	2.60	1.58
17	Principles of Biology I	43	2.65	1.23	35	2.60	1.75
18	General Psychology	86	1.86	1.42	82	2.12	1.25
19	Principles of Biology I	61	2.51	1.25	63	2.35	1.27
20	Intro to Criminal Justice	41	2.39	1.39	50	2.08	1.29
21	Intro to Criminal Justice	23	2.78	1.65	21	2.29	1.74
22	Intro to Criminal Justice	46	2.33	1.62	50	2.08	1.29
23	Intro to Criminal Justice	25	2.64	1.63	21	2.29	1.74
24	Intro to Criminal Justice	12	2.00	1.60	21	2.29	1.74
25	Medical Terminology	104	2.95	1.03	66	3.32	.98
26	Medical Terminology	98	2.94	1.06	66	3.32	.98
27	Medical Terminology	41	2.80	1.03	66	3.32	.98

The independent samples t-test assumes scores are normally distributed and are independent within and between groups. Another assumption of the independent samples t-test is equal variances between the two groups. Levene's test for equality was used to test this assumption at the .10 level of significance. When Levene's test was significant, equal variances were not assumed between the groups and the appropriate statistical results were used. The results of the t-tests are reported in Table 17. Since multiple tests were conducted, the family-wise error rate was controlled to achieve a combined alpha of .05. Therefore, significance was evaluated at $p = .002$. Effect size was interpreted using Cohen's *d* with small effect sizes (.20), medium effect sizes (.50), and large effect sizes (.80) (Cohen, 1992).

Table 17

Statistical Results for E-Textbook and Paper Textbook Comparisons

Set	Course Name	t	df	p	d
1	Theatre Appreciation	-3.16	183.24	.002	.47
2	General Microbiology	.90	64	.37	.23
3	Business Communications	-1.26	54	.21	.34
4	Music Appreciation	.60	69	.55	.14
5	Art History I	-3.28	78.92	.002	.74
6	U.S. History II	1.25	54.11	.22	.34
7	Microcomputer Applications	.67	92	.51	.14
8	English Composition	1.10	153	.27	.18
9	Music Appreciation	2.05	216.39	.04	.28
10	Music Appreciation	-.73	209	.47	.10
11	General Microbiology	-.59	82	.56	.13
12	General Microbiology	.004	107	1.0	.00
13	General Microbiology	2.23	129	.03	.39
14	General Microbiology	-.13	49	.90	.04
15	U.S. History I	1.13	58.27	.26	.30
16	Computer Programming	.19	29	.85	.07
17	Principles of Biology I	.14	59.12	.89	.04
18	General Psychology	-1.27	164.92	.21	.20
19	Principles of Biology I	.70	122	.48	.13
20	Intro to Criminal Justice	1.10	89	.27	.23
21	Intro to Criminal Justice	.97	42	.34	.30
22	Intro to Criminal Justice	.82	85.99	.42	.18
23	Intro to Criminal Justice	.71	44	.48	.21
24	Intro to Criminal Justice	-.47	31	.64	.17
25	Medical Terminology	-2.31	168	.02	.36
26	Medical Terminology	-2.31	162	.02	.36
27	Medical Terminology	-2.58	105	.01	.50

Although the analysis showed no significant difference in course performance ($p < .002$) between e-textbook and paper textbook sections in any of the 27 comparisons, significant differences may exist but be masked by the multiple testing approach. Data indicated a medium effect size (.47) for the Set 1 analysis of Theatre Appreciation and a medium effect size (.50) for the Set 27 analysis of Medical Terminology. A marginally large effect size (.74) existed for the Set 5 comparison of Art History I.

Research Question 5

What relationship do age and gender have on a student's achievement level, as measured by the final course average, considering textbook format?

Student Demographics

From the data set of 27 courses used in Research Question 4, student demographic and grade data were collected for all 2,432 students. Overall, 1,424 students (58.6%) were enrolled in e-textbook sections and 1,008 students (41.4%) were enrolled in print textbook sections. For the student sample, 837 were male (34.4%) and 1,595 were female (65.6%). The average student age was 24.8 with 79.4% of the students being age 29 or younger and 92.2% being age 39 or younger. Student age ranged from 15 to 71 years old. Ethnicity data revealed 69% of the students were White (n = 1,677), 16.7% were Black/African American (n = 405), and the remaining 14.3% (n = 350) were of various minority groups. See Table 18 for a detailed breakdown of student demographics.

Table 18

Demographic Statistics for Students

	n	%
Textbook Format		
E-textbook	1,424	58.6
Paper	1,008	41.4
Gender		
Male	837	34.4
Female	1,595	65.6
Age		
<20 years	752	30.9
20-29 years	1,180	48.5
30-39 years	311	12.8
40-49 years	132	5.4
50-59 years	48	2.0
≥60 years	9	0.4
M = 24.8 (*SD* 8.4)		
Ethnicity		
American Indian or Alaskan Native	54	2.2
Asian	56	2.3
Black/African American	405	16.7
Hawaiian or Other Pacific Islander	3	0.1
Hispanic	93	3.8
Multi-Racial	80	3.3
Non-resident Alien	14	0.6
Unknown	50	2.1
White	1,677	69.0

Research question five was examined to determine if age and gender had an effect on student grades between the digital and paper text formats. To answer this question, a three-way analysis of variance was conducted with the student data set. Age, gender, and text format were the independent variables and course grade was the dependent variable. Because student ages at the college ranged from 15 to 71 years old and a large concentration was age 39 and younger, age was categorized as traditional (24 years and younger) and non-traditional (25 years and

older) in the analysis. See Table 19 for the sample size of each group. Letter grades of A, B, C, D, and F were assigned values of 4, 3, 2, 1, and 0, respectively.

Table 19

Demographic Statistics for ANOVA Analysis

Text	Age	Gender	n	% by gender	% by age
E-textbook	Traditional	Male	357	37.5	
		Female	595	62.5	
		Total	952		66.9
	Non-traditional	Male	135	28.6	
		Female	337	71.4	
		Total	472		33.1
	Total	Male	492	34.6	
		Female	932	65.4	
		Total	1,424		
Paper	Traditional	Male	217	34.8	
		Female	407	65.2	
		Total	624		61.9
	Non-traditional	Male	128	33.3	
		Female	256	66.7	
		Total	384		38.1
	Total	Male	345	34.2	
		Female	663	65.8	
		Total	1,008		

Results

Table 20 displays the sample size, mean grade, and standard deviation among gender and age group for the e-textbook and paper textbook sections.

Table 20

Descriptive Statistics for ANOVA Analysis

	Age	Gender	n	M	SD
E-textbook	Traditional	Male	357	2.68	1.41
		Female	595	2.70	1.39
		Total	952	2.69	1.40
	Non-traditional	Male	135	2.38	1.58
		Female	337	2.93	1.32
		Total	472	2.78	1.42
	Total	Male	492	2.60	1.47
		Female	932	2.79	1.37
		Total	1,424	2.72	1.40
Paper	Traditional	Male	217	2.53	1.42
		Female	407	2.68	1.43
		Total	624	2.63	1.43
	Non-traditional	Male	128	2.78	1.50
		Female	256	2.83	1.39
		Total	384	2.81	1.43
	Total	Male	345	2.63	1.45
		Female	663	2.74	1.42
		Total	1,008	2.70	1.43

The factorial ANOVA test assumes that the units of analysis are independent of each other, populations are normally distributed, and population variances are equal. Levene's test for equality was used to test for equal variances at the .10 level of significance. When Levene's test was significant, the *p* value was evaluated at an alpha of .01 to avoid Type I errors (Nolan & Heinzen, 2011).

Test results revealed a marginally significant interaction between age, gender, and text format ($F(1,2424) = 6.06$, $p = .014$). Since the omnibus test revealed a violation in the assumption of equal variances, the *p* value was evaluated at a .01 level of significance. The

partial eta squared was .002, indicating 0.2% of the variation in course performance could be explained by age, gender, and text format. See Figure 9 for a plot of the means.

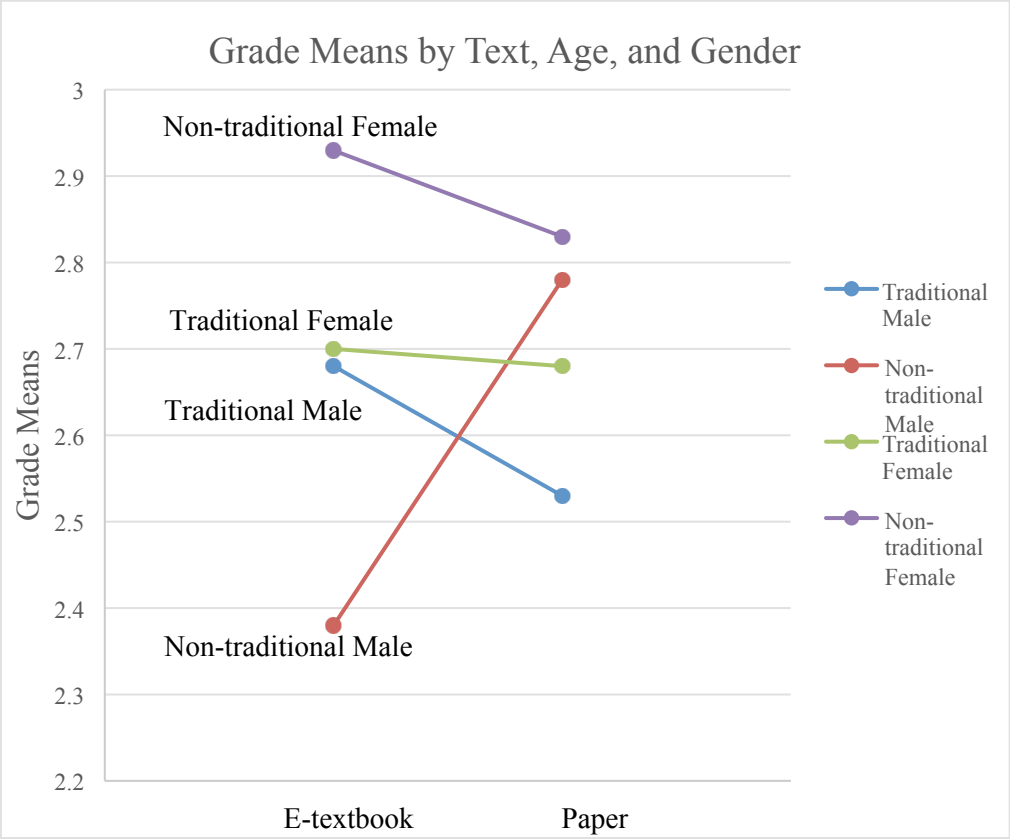

Figure 9. Grade means by text format, age, and gender.

To further explore the three-way interaction, a univariate analysis was run with the file split by text format. Test results revealed a main effect of age with paper textbooks ($F(1,1004) = 4.01$, $p = .046$). (Levene's test was not significant for the paper textbook sections so alpha was evaluated at .05.) Scores for non-traditional age students ($M = 2.81$, $SE = .08$) were higher than scores for traditional age students ($M = 2.61$, $SE = .06$) with the paper textbook. The effect size was .004, indicating 0.4% of the variation in course grade could be explained by age.

In the e-textbook sections, there was a violation in the assumption of equal variances so p was evaluated at .01. Results indicated a two-way interaction between age and gender in the e-

textbook sections ($F(1,1420) = 9.87$, $p = .002$). The effect size was .007, indicating .7% of the variation in course performance could be explained by age and gender.

To further explore the two-way interaction, the e-textbook data were split by age. Results showed no effect of gender in the traditional age group of e-textbook courses ($F(1,950) = .06$, $p = .82$). (Due to a violation of Levene's test, significance was evaluated at .01 for the traditional age group.) Levene's test was not significant for the non-traditional age group; therefore, .05 was used as the significance criterion. This analysis showed a main effect of gender in the non-traditional age group of e-textbook courses ($F(1,470) = 15.27$, $p < .001$). Non-traditional age female scores ($M = 2.94$, $SE = .08$) were higher than non-traditional age male scores ($M = 2.38$, $SE = .12$) in the e-textbook sections. The effect size of .031 indicated 3.1% of the proportion of variability for course grade could be accounted for by gender.

To further investigate the nature of the three-way interaction, the data set was also split by gender. Test results revealed a main effect of age with females ($F(1,1591) = 6.74$, $p = .01$). (Levene's test was significant for males and females so alpha was evaluated at .01.) Scores for non-traditional age females ($M = 2.88$, $SE = .06$) were higher than scores for traditional age females ($M = 2.69$, $SE = .05$). The effect size was .004, indicating 0.4% of the variation in course grade could be explained by age. Results indicated a two-way interaction between age and text in the male group ($F(1,833) = 6.29$, $p = .012$). The effect size was .007, indicating .7% of the variation in course performance could be explained by age and text.

To further explore the two-way interaction, the data for males were split by age. (Levene's test was not significant for either age group so p was evaluated at .05.) Results showed no effect of text in the traditional age group ($F(1,572) = 1.44$, $p = .23$). However, the analysis showed a main effect of text in the non-traditional age group ($F(1,261) = 4.51$, $p = .04$).

The effect size was .017, indicating 1.7% of the variation in course grades for non-traditional males could be explained by text. Non-traditional age male scores were higher with paper textbooks (M = 2.78, SE = .14) compared to e-textbooks (M = 2.38, SE = .13).

In summary, courses utilizing e-textbooks showed no significant difference in achievement level between males and females of traditional age. However, female grades were higher than male grades in the non-traditional age group for the e-textbook sections. Furthermore, non-traditional males fared better with the paper textbook compared to the e-textbook. In courses utilizing paper textbooks, there was no difference in performance between the genders. However, non-traditional students significantly outperformed traditional students in the paper textbook sections.

Summary of Findings

Instructors' LoU of eight e-textbook features was studied. Two features were found to be Level 0 Non-Use (tracking and analysis of e-textbook use and just-in-time learning or performance support). The six remaining features were Level I Orientation (highlighting text and sharing, making notes and sharing, exporting text or notes, interactive practice questions or games, web links, and videos/animations). Instructors' LoU scores did not differ significantly between the divisions of Humanities and Social Sciences, and Math and Natural Sciences. However, the effect size indicates a larger sample size could possibly detect statistical significance. The number of professional development experiences involving e-textbooks was found to be a significant predictor of instructor LoU scores. Regarding student learning, there was insufficient evidence to support that there was a difference in student achievement level, as measured by final course grade, between e-textbook sections and paper textbook sections in 27 course comparisons. Analysis of the student grade data further revealed interactions between

text format, age, and gender. Non-traditional age female scores were higher than non-traditional age male scores in the e-textbook sections. Non-traditional age males earned higher grades with paper textbooks compared to e-textbooks. Finally, non-traditional age students outperformed traditional age students with paper textbooks.

CHAPTER V:

DISCUSSION OF RESULTS

Introduction

A study was conducted at a community college in the North Alabama area that was piloting an e-textbook initiative. Utilizing Hall et al.'s (1975) LoU for analyzing innovation adoption as the framework, the study examined the LoU of eight features found in e-textbooks. The LoU for these features was further used to determine the overall LoU of instructors individually and by division. Differences in student achievement, as measured by final course grade, were tested between e-textbook and traditional print courses. Finally, any differences in achievement between the textbook formats considering age and gender were explored. This chapter presents a review of the theoretical framework and a discussion of the findings from each research question. Additionally, implications for practice and for further research are shared, followed by a summary of the study.

Theoretical Framework

Hall et al.'s (1975) LoU for analyzing innovation adoption served as the framework for this study. LoU is one dimension of the overarching Concerns-Based Adoption Model (CBAM) proposed by Hall et al. (1973). CBAM explores the affective and behavioral changes of key adopters during the adoption of educational innovations. The LoU component of CBAM is specifically focused on the behaviors and actions of key adopters during this change process. In this study, instructors were considered the key adopters and the educational innovation being adopted was e-textbooks. Behaviors and actions of adopters fall within one of eight discrete

levels in the LoU index: Level 0 (Non-Use), Level I (Orientation), Level II (Preparation), Level III (Mechanical Use), Level IVA (Routine), Level IVB (Refinement), Level V (Integration), and Level VI (Renewal). For this study, a modified version of Orr and Mrazek's (2010) LoU survey was used to allow instructors to self-assess their own LoU with eight e-textbook features. One central axiom of CBAM and LoU is that the existence of an innovation does not infer the use of an innovation (Hall et al., 1973). Secondly, the successful adoption of an innovation must be considered a process that develops over time, rather than an instantaneous success or failure (Hall et al., 1975). As such, the LoU survey data and the student performance data collected for this study allowed for the comparison of results to previous literature and for the development of recommendations for practice.

Research Question 1

The first research question asked, "What are the instructors' LoU with e-textbook features?" Results showed that on average six e-textbook features were Level 1 (Orientation) and thus were classified as a low-level use. These six features were highlighting text and sharing, making notes and sharing, exporting text or notes, interactive practice questions or games, web links, and videos/animations. Two features were Level 0 (Non-Use) on average. These features were tracking and analysis of e-textbook use and just-in-time learning or performance support. The overall non-existent to low level of use of features may indicate instructors are not using e-textbooks any differently than paper textbooks; thus, e-textbooks would be mere PDF documents of print textbooks. Previous research indicated these static mediums are not perceived favorably by students (Shepherd et al., 2008). Research by Stone and Baker-Everleth (2013) concluded that instructors' verbal persuasion to use e-textbook features had a positive influence on students' attitudes toward and intentions to use e-textbooks. In this

case, if instructors are not incorporating the features into their methods of teaching, they are likely not encouraging students to utilize the features either. Research has also shown that this lack of use of e-textbook features by students may be related to a lack of satisfaction with e-textbooks (Ciampa et al., 2013).

It does not appear that the average of three to four professional development experiences related to e-textbooks that instructors reported has resulted in significant LoU. Perhaps these were not enough exposure opportunities, perhaps the sessions did not address e-textbook features, or perhaps there is a combination of both. Instructors reported just under three semesters of teaching with an e-textbook on average. It may be necessary to design and conduct professional development specifically targeted to the promotion of e-textbook features to assist instructors and students.

It should be noted that while the average LoU for each feature was either non-use or low-level use, each feature did have from two to six instructors whose actions were categorized as mid-level use. Moreover, each feature except just-in-time learning had between one and five instructors categorized as high-level users of that feature. These instructors may be good sources of information if they are willing to share their experience with using e-textbook features in the aforementioned professional development opportunities.

Some non-use of e-textbook features can be attributed not to an instructor's lack of training or initiative, but instead to the lack of availability of that feature. The growing market of digital learning content has forced textbook publishers to reevaluate their business models and whether they will be content experts or platform experts (Reynolds, 2012). As such, some textbooks do not offer the interactivity of others. In this study, nine instructors (29%) reported their e-textbook did not offer videos/animations. Five instructors (16.1%) reported their e-

textbook did not offer interactive practice questions or games. Five instructors (16.1%) also reported their e-textbook did not offer web links. The institution may want to consider alternative e-textbooks or publishers that offer these multimedia capabilities.

Among the eight features evaluated, just-in-time learning or performance support was the feature overwhelmingly not used by instructors (n = 26, 83.9%). This feature was also the only one with no high-level users. The overall non-use of just-in-time learning or performance support indicates instructors and students may not be exploiting the mobility of e-textbooks. Access to e-textbooks on mobile devices by mobile learners creates new learning opportunities. These include situated learning and collaborative learning in a learner-centric environment outside the classroom (Traxler, 2009). The college may want to consider exploring mLearning pedagogy with instructors, given the ubiquity of mobile devices and students' expectations to access their instructional materials on mobile devices (Smith & Caruso, 2010).

Research Question 2

While the first research question addressed the LoU of e-textbook features, the second research question explored the overall LoU of instructors. Specifically, research question two asked, "Is there a difference in instructors' e-textbook LoU profile ranking across programs of study?" The average numerical value for instructors' LoU was 2.08 (*SD* = .78), corresponding to Level I Orientation (low-level use). Instructor LoU ranged from Level 0 Non-Use to Level II Preparation, with the modal LoU being Level 0 Non-Use. This finding does not align with the expectation that most users are at Level III-IVA in the first one to three cycles of implementation (Hall et al., 1975). This may indicate inadequate preparation of instructors during the rollout of the e-textbook initiative. Bearing in mind that technology tools should be used to facilitate

learning and not merely used because they are novel, instructors may benefit from learning about ideas for potential incorporation of e-textbook features into their pedagogy.

This research question sought to determine if there were differences in instructor LoU among the school's four programs or divisions. The mean LoU for Humanities and Social Sciences was 1.83 (*SD* = 0.63), while Math and Natural Sciences was 2.31 (*SD* = 0.85), and Business/CIS was 2.22 (*SD* = 0.99). Unfortunately, there were no LoU responses from the division of Health for comparison. Due to the small number of responses from the Business/CIS division, only differences between the division of Humanities and Social Sciences and the division of Math and Natural Sciences were analyzed. The analysis revealed no significant difference in the LoU values. It appears LoU is similar among instructors and no single division is excelling in the integration of e-textbook features. However, the medium effect size (.31) indicates a possible difference in LoU exists between the two divisions analyzed, wherein instructor LoU of e-textbook features is higher in the Math and Natural Sciences program compared to the Humanities and Social Sciences program.

It should be noted that these results represent a single self-assessment of instructors at a single point in time of the e-textbook initiative. Paramount to the CBAM and LoU frameworks is the principle that the successful adoption of an innovation is a process that occurs over time. As such, the college may find value in conducting prescribed interventions and repeating the evaluation.

Research Question 3

After identifying instructors' overall LoU, the third research question attempted to determine what instructor characteristics might be related to LoU. Research question three asked, "What demographic characteristics of instructors (age, gender, rank, years of college-level

teaching, and number of e-textbook professional development experiences) are related to LoU of e-textbook features?" ANOVA test results showed no significant difference in LoU by age ($F(4,26) = 1.04$, $p = .41$), gender ($F(1,29) = 2.36$, $p = .59$), or education level ($F(2,28) = .90$, $p = .42$).

Two variables were selected for multiple linear regression: years of teaching and number of professional development experiences. These variables had been found to have positive relationships with LoU in previous studies. The Pearson correlation coefficient revealed a weak, negative relationship between LoU and years of teaching ($r = -.01$, $p = .48$, R square = .0001). There was a moderate, positive relationship between LoU and number of professional development experiences ($r = .35$, $p = .03$, R square = .122). Regression analysis revealed the number of professional development sessions was a significant predictor of LoU, controlling for years of teaching ($t(28) = 2.17$, $p = .04$).

Previous research by Bouchelle (2002) found a positive relationship between years of teaching and teacher LoU with a state-sponsored science kit in northern Delaware elementary schools. The e-textbook study found a weak, negative relationship between years of teaching and instructor LoU. This may indicate the relationship between LoU and years of teaching is context specific. While some technologies may be more readily adapted by experienced teachers, others are more readily adapted by less experienced and perhaps younger teachers. The ability to attribute the LoU of a technology to years of teaching appears inconclusive.

Forsgren (1997) found a significant relationship between teachers' LoU of United States History standards and their opportunities for professional development in the standards. The e-textbook study found a significant, positive relationship between professional development

opportunities and LoU as well. Therefore, the college may find it worthwhile to invest resources into the expansion of instructor knowledge with e-textbooks.

While LoU values in this study could potentially range from 1.00 to 8.00, the range of values was actually clustered between 1.00 and 3.38. Perhaps a wider range of responses and/or a higher number of responses could identify other significant relationships.

Research Question 4

After identifying instructors' LoU of e-textbook features, the study then investigated student learning during the pilot period with e-textbooks. The fourth research question was, "Is there a difference in student achievement level, as measured by the final course average, for students using e-textbooks compared to paper textbooks?" Based on responses from the LoU survey and with assistance from the institution's Distance Learning Coordinator, 27 cases were identified for comparison of student achievement between text formats. To minimize variability between e-textbook and print textbook sections, only cases in which the same instructor taught the same course using the same textbook and with the same grading assessments were used. In all cases, there was no difference in final course grades between e-textbook and paper textbook sections. This finding aligns with the majority of research studies on e-textbook efficacy (Daniel & Woody, 2012; Johnson, 2013; Shepperd et al, 2008; Taylor, 2011). A positive finding from the e-textbook trial is that student grades were not negatively impacted during the pilot period.

There were two cases showing a marginally significant difference in performance between the text formats using an alpha controlled for the family-wise error rate of .002. The set 1 comparison of Theatre Appreciation showed the e-textbook grade average ($M = 2.31$, $SD = 1.60$) was lower ($p = .002$) than the paper text section ($M = 2.96$, $SD = 1.33$) with a .47 effect size (medium). The set 5 comparison of Art History I showed the e-textbook grade average ($M =$

2.23, *SD* = 1.39) was lower (p = .002) than the paper text section (*M* = 3.09, *SD* = .98) with a .74 effect size (medium to large). This finding supports previous research which suggests some subjects are more amenable to the electronic format than others (Bailey, 2006). Data collected from the libraries of several large, higher education institutions reveal that the most popular subjects for electronic access were computer science, technology/engineering, economics/business, medicine/health/wellness, and literature. Dillon (2001) postulates that subjects such as these "lend themselves to the quick reference-style look-ups that are already part of Web behavior" (p. 119). The libraries found that subjects such as film/media studies and fine arts had little to no electronic use during the study period (Bailey, 2006). Thus, leaders should exercise prudence when implementing institution-wide mandates for e-textbook use.

Studies have shown that higher LoU of an innovation can result in higher student learning (George et al., 2000). Thus, the institution may want to investigate whether higher LoU of e-textbook features could result after professional development, and if a higher LoU translates into higher student success in e-textbook sections.

Research Question 5

Utilizing the student data set in research question four, the final question in this study asked, "What relationship do age and gender have on a student's achievement level, as measured by the final course average, considering textbook format?" The impact of age was evaluated by dichotomously classifying students as either of traditional age (24 years and younger) or non-traditional age (25 years and older) as defined by the National Center for Education Statistics. Results of a factorial ANOVA analysis revealed an interaction between age, gender, and text format. When considering e-textbooks, non-traditional age female scores (*M* = 2.94, *SE* = .08) were higher than non-traditional age male scores (*M* = 2.38, *SE* = .12). Furthermore, non-

traditional age males earned higher grades with paper textbooks (M = 2.78, SE = .14) compared to e-textbooks (M = 2.38, SE = .13). In the paper textbook sections, non-traditional age students (M = 2.81, SE = .08) outperformed traditional age students (M = 2.61, SE = .06).

In this study, performance levels indicated varying success rates between text formats among the demographic characteristics. This finding counters previous research in which there was no difference in outcomes based on age or gender (Ditmeyer et al., 2012; Johnson, 2013; Woody et al., 2010). Course grades of males and females in the traditional age group using e-textbooks were comparable. This may not be surprising given that both genders are receiving exposure to digital curriculums at early ages as more and more school systems across the nation move to all-digital learning environments (Grunwald Associates LLC, 2013). However, the data collected during this pilot period indicated non-traditional age males using e-textbooks may warrant further study. Non-traditional age students are typically characterized as "adult students who often have family and work responsibilities as well as other life circumstances that can interfere with successful completion of educational objectives" (National Center for Education Statistics, n.d., "Nontraditional Undergraduates / Definitions and Data", para 1).

Education systems should be mindful of the amalgam of digital natives and digital immigrants in the classroom. Prensky (2001) defines digital natives as "native speakers' of the digital language of computers, video games and the Internet" (p. 1), while digital immigrants are those who have adopted these new technologies. While some critique such a demarcation and consider the concept of the digital native flawed (Koutropoulos, 2011), the community college of study must consider that it embodies learners from ages of 15 to 71 years old. As such, the range of technological exposure, comfort, and skill level will vary. Any academic support services the

college offers regarding e-textbooks should strive to normalize success potential among the broad span of age groups.

Conclusions

This study revealed e-textbook features were used at a low to non-existent level by instructors. The instructors' overall average LoU was low as well at Level 1 (Orientation) and there were no differences in instructor LoU across the programs of study analyzed. Neither age, gender, rank, or years of college-level teaching was related to LoU; however, instructors' number of e-textbook professional development experiences was a significant predictor of LoU. Since survey participants were not asked about the type or quality of professional development received, it is feasible that professional development specifically directed at e-textbook features could result in higher LoU scores.

The low LoU values for features and instructors should not be construed as negative. The LoU model is not intended to be a performance evaluation, but a method of quantifying behaviors and actions. The LoU values represent one point in time during the college's e-textbook pilot period and can serve as a baseline for future measurements.

The second part of the study evaluated student learning during the e-textbook initiative. There was no difference in student grades between e-textbook and paper textbook sections in all of the cases analyzed. Therefore, the pilot period did not have a negative impact on student performance and demonstrated that students could be equally successful with both textbook formats. When evaluating the effect of age and gender on textbook format, data showed grades of non-traditional age males were lower than non-traditional age females with e-textbooks. Furthermore, course grades of non-traditional age males were higher in the paper textbook sections compared to the e-textbook sections. While the pilot period did not have a negative

impact on student learning, the LoU of e-textbook features was low, indicating there is a potential to have a positive impact as the features and functions of e-textbooks and mLearning are leveraged for student success.

Recommendations for Practice

The following recommendations are suggested for this institution and others as they make strategic decisions regarding e-textbook initiatives. The first recommendation is to offer both traditional print textbooks and e-textbooks as options until the institution is positioned to make e-textbooks a success. While some stakeholders might see challenges in accommodating two different formats, the institution should not force a digital conversion if the key adopters are not ready, nor should the institution stop supporting e-textbooks. K-12 schools have been incorporating e-textbooks into their curriculum. This student body will serve as future customers to higher education institutions and expects access to course materials on digital devices (Smith & Caruso, 2010). Furthermore, the public still sees value in the textbook. While many agencies face annual budget cuts, the Alabama State Senate unanimously approved an education budget in April 2015 that increased spending on textbooks by $13 million (Phillips, 2015). Higher education institutions should continuously vet the value of new technologies, such as e-textbooks, for learning efficacy.

The second recommendation is to evaluate the current menu of e-textbooks. Some instructors reported their e-textbooks did not offer highlighting and sharing capability, interactivity, web links, or videos. The school may want to explore alternate textbooks that offer these features. This might be accomplished through other publishers and vendors, or through Open Educational Resources (OER). The Hewlett Foundation (n.d.) defines OER as "teaching, learning, and research resources that reside in the public domain" and are free to use (para. 2).

These include "full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge" (Hewlett Foundation, n.d., para 2). OER allow instructors to personalize the curriculum and embed desired multimedia links (Allen, 2014).

The third recommendations is to cultivate relationships with e-textbook publishers and technology platform vendors. This might allow instructional technology staff and faculty members to stay on the cusp of new e-textbook features. Furthermore, education professionals could collectively voice their concerns and requests regarding the evolution of e-textbooks. If institutions do enter into e-textbook contracts with publishers and vendors, there are recommendations to consider from early adopters of digital textbooks such as Virginia's Fairfax County Public Schools. They advise considering short-term contracts, no longer than two to three years in length, to take advantage of new options that enter the market (Axelson, 2015).

The fourth recommendation is to conduct professional development specifically targeted toward e-textbook features. One of the underlying assumptions of CBAM is that "change can be facilitated by interventions directed toward the individuals, innovations, and contexts involved" (Anderson, 1997, p. 333). In this study, instructors reported between three and four professional development experiences related to e-textbooks; however, the type, content, and quality of the professional development is unknown. Thus, higher LoU of the technology could emerge after specifically planned interventions. Another learning from the Fairfax County School system was to give teachers "substantial time to learn the features and resources of a new, digital platform before sharing it with students" (Axelson, 2015, p.10). Thus, professional development coupled with implementation time could prime the path for digital success. E-textbook representatives and technology platform vendors should be encouraged to develop and lead such professional

development opportunities. Furthermore, higher LoU users at the institution could share their experiences to assist lower LoU users.

The fifith recommendation is to educate students on e-textbook features and functions. After an institution has the infrastructure and support structure for an e-textbook initiative, and after instructors have had time to adopt the technology, e-textbook features should be demonstrated to students. This could occur during an orientation type of course or instructors could demonstrate use during class. According to research, it is this type of encouragement to use e-textbook features that promotes student satisfaction with and utilization of e-textbooks (Ciampa et al., 2013).

Recommendations for Future Research

The findings of this study reveal the following opportunities for future research. The first recommendation is to repeat the LoU survey after instructor professional development. A second administration of the survey after a professional development opportunity and time for incorporation of learnings could determine the effectiveness of the professional development experience. It could also lead to a longitudinal study of instructor LoU and identify patterns over time. Furthermore, the institution would be able to evaluate the relationship between LoU and student achievement. Any future studies should strive to solicit participation from all of the college's divisions as well.

The second recommendation is to repeat the study with new or different e-textbook features. As e-textbooks continue to evolve, the impact of new technologies and capabilities should be explored and leveraged for student success.

The third recommendation is to conduct a complete CBAM analysis. This study explored LoU, which is one of three components of the CBAM framework. The LoU analysis provided a

description of instructors' behaviors and actions with e-textbook technology features. However, supplementing the study with a SoC analysis would allow instructors' feelings and concerns to be identified. This may prove to be especially important if the institution decides to fully transition to digital textbooks. Furthermore, an IC map could be a useful tool for evaluating the use of e-textbook features against standards, or for accountability in an overall digital textbook implementation.

The fourth recommendation is to utilize an experimental research design to evaluate the difference in student achievement level between textbook formats. Course comparisons found no difference in student achievement between e-textbook and paper textbook sections. To further verify the findings of the study, an experimental design could be constructed. This design could also specify a variable other than course grade to compare student performance between text formats and pinpoint keys to student success with digital material.

The fifth recommendation is to conduct a qualitative study of instructor LoU. In this study, instructor LoU was evaluated on a numerical index and categorical ranking system based on self-reflection of instructor behavior. Narrative or case study research on individuals with various LoU rankings could provide deeper explanations on why and how e-textbook technology features are used or not used.

The sixth recommendation is to evaluate student preferences. The voice of both faculty and students should be considered in a change process. Information on student preferences and student use of e-textbook features could be coupled with faculty data to present a balanced perspective.

The seventh recommendation is to research student usage reports. One of the technology features of e-textbooks considered in this study was the tracking and analysis of student e-

textbook use. Through the VitalSource Bookshelf® platform, instructors are capable of tracking the number of unique visits, pages viewed, pages printed, highlights made, and notes made by students. Overall, this feature was not used by instructors in this study. Research on the relationship between these tracked variables and student performance or learning could offer insight on e-textbooks and self-regulated study behaviors.

The eighth recommendation is to explore the impact of digital supplemental resources to the textbook provided by publishers. This study explored instructors' use of technology features for teaching that were within e-textbooks alone. Another popular option for instruction today is digital learning content provided by publishers, such as Pearson's MyLab or McGraw-Hill's Connect, which offer adaptive learning strategies. Research into the integration of e-textbooks and these types of digital products could provide further insight into student learning with digital content.

Summary of Study

The purpose of this study was to evaluate instructors' LoU of e-textbook features during a pilot period of e-textbook implementation in an Alabama community college. Furthermore, the study sought to determine if instructor LoU profile scores were different across the college's four divisions and what demographic characteristics might be related to LoU. The second part of the study compared student achievement, as measured by the final course grade, between e-textbook and traditional print book sections. The study also sought to determine the impact of age and gender on student achievement, considering textbook format.

Analysis of the data indicated six e-textbook features were Level I (Orientation), corresponding to a low-level use. Two features were Level 0 (Non-Use). The average overall instructor LoU was Level I (Orientation), corresponding to a low-level user. There was no

difference in instructor LoU between the Humanities and Social Sciences division and the Math and Natural Sciences division. (The sample size was too small to evaluate the Business/CIS programs and Health programs.) The strength of the relationship between LoU and the following variables were tested: instructor age, gender, rank, years of college-level teaching, and number of e-textbook professional development experiences. Instructors' number of e-textbook professional development experiences was found to be a significant predictor of LoU.

Among 27 comparisons of student achievement in e-textbook sections versus paper textbook sections, no significant difference was found between the two formats in all cases. Analysis of the overall student data set indicated interactions between age, gender, and text format. Grades of non-traditional age males were lower than females of the same age group when using e-textbooks. In addition, grades of non-traditional age males were lower with e-textbooks compared to paper textbooks. There was no difference in achievement based on gender for the paper textbook sections; however, non-traditional age students earned higher final grades than traditional age students with paper textbooks.

The findings of this study can be used to assist with the path forward for this particular institution's e-textbook initiative. Findings suggest the college could design professional development interventions aimed at increasing the LoU of e-textbook features among instructors and then subsequently students. The college may also want to explore alternative e-textbooks that offer more interactivity and multimedia functions. Findings of this study can be used to assist other institutions investigating a digital transition and to guide future research as e-textbooks continue to evolve with advancements in technology.

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APPENDIX A

INSTRUCTOR LEVEL OF USE SURVEY

IRB # 6295
INFORMED CONSENT

Kim Roberts, Principal Investigator from the University of Alabama, is conducting a study called "Electronic Versus Traditional Print Textbooks: An Evaluation of Student Achievement and Instructor Levels of Use of the Innovation in a Community College." She wishes to find out more about instructor use of e-textbook features and student learning.

You were selected as a possible participant for this study because you have utilized an e-textbook in your course(s). Approximately 50 people will be asked to participate in this voluntary study. You must be 19 years of age or older to participate in this study. If you decide to participate, you will be asked to complete a three-part survey, estimated to take about 15 minutes of your time. Part 1 will ask you some demographic questions. Part 2 will ask for course information. Part 3 will ask you to rate your level of use with eight different e-textbook features. The level of use index is intended to evaluate programs and processes and is not designed for performance evaluation.

Any information obtained in connection with this study will remain confidential. Results will be presented in the form of aggregate data, which will not identify the school or specific individuals. Raw data will be secured in a password-protected format and access will be restricted to the research team only.

Although you will not benefit personally from completing the survey, your participation will add to the body of knowledge regarding e-textbooks. The results of this study are part of a doctoral dissertation and will help administration and faculty understand better ways to help students as e-textbook initiatives are implemented.

There are no known risks involved with this study. The study does not intend to impose any type of treatment upon participants or change your point of view. Instead, the research explores instructors' self-reported behaviors and actions with e-textbook technology features.

If you have any questions at this time, please contact [Distance Learning Coordinator] at [phone number] or [email address] and she will be happy to answer them. If you have questions about the study you may also contact Kim Roberts at 256-318-2536. If you have questions about your rights as a research participant, please call Ms. Tanta Myles, the University Compliance Officer at the University of Alabama at 205-348-8461 or toll-free at 1-877-820-3066.

If you have complaints or concerns about this study, please file them through the UA IRB outreach website at http://osp.ua.edu/site/PRCO_Welcome.html. Also, if you participate, you are encouraged to complete the short Survey for Research Participants online at this web site. This helps UA improve its protection of human research participants.

YOUR PARTICIPATION IS COMPLETELY VOLUNTARY. Your decision whether or not to participate will not prejudice your relation with [college name] or the University of Alabama. If you decide to participate, you are free to discontinue participation at any time without prejudice.

Thank you.

If you understand the statements above, are at least 19 years old, and freely consent to be in this study, click on the Continue button to begin.

► CONTINUE

PART 1: DEMOGRAPHIC DATA

Please indicate your gender.

☐ Male ☐ Female

Please indicate your age range.

☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 or over

Please indicate your highest degree earned.

☐ Associate's ☐ Bachelor's ☐ Master's ☐ Doctorate

Please indicate your number of years of college-level teaching.

☐

Please indicate your number of professional development experiences with e-textbooks (e.g., in-services, workshops, conference sessions, courses, etc.).

☐

How many semesters have you taught with an e-textbook during your career?

☐

PART 2: COURSE INFORMATION

Please complete Parts 2 and 3 for an e-textbook course you have taught. The survey will give you the opportunity to complete Parts 2 and 3 again if you have taught more than one e-textbook

course. It is assumed that all sections of a course had similar objectives and similar grading assessments. If this is not correct, please repeat the survey for sections covering different objectives or using different grading assessments.

Course abbreviation (e.g., BUS 275)	
Section #s (e.g., 100)	
Term (e.g., Fall 2014)	

Have you taught this course at any time using a traditional print textbook as well?	☐ Yes	☐ No
Did you use the same textbook in the e-textbook section and the traditional print section?	☐ Yes	☐ No
Were the e-textbook section and traditional print section taught in the same format? (e.g., classroom, hybrid, online, etc.)	☐ Yes	☐ No
Did you use the same grading plan in the e-textbook section and the traditional print section?	☐ Yes	☐ No

PART 3: LEVELS OF USE OF E-TEXTBOOK FEATURES

Please respond to each of the following descriptors of specific e-textbook features to self-assess and self-report your own level of use of each feature within your educational context, by checking the appropriate descriptor for each feature. Remember there is no "best" response. It is "OK" to authentically report your use or non-use of these features.

Please read each identifier and descriptor carefully and select the single descriptor that best describes your use of the e-textbook feature identified.

Highlighting e-textbook text and sharing with students

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
□ I have some information about this feature, and am considering whether it might be useful for my class.
□ I now know enough about this feature that I am preparing to use it for my class.
□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
□ I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.
□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Making e-textbook notes and sharing with students

□ My e-textbook does not offer this feature.

□ I really don't know anything about this feature.

□ I am not sure that this feature would be useful for my class.

□ I have some information about this feature, and am considering whether it might be useful for my class.

□ I now know enough about this feature that I am preparing to use it for my class.

□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.

□ I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.

□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.

□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.

□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Exporting e-textbook text or notes into PowerPoint or other formats

□ My e-textbook does not offer this feature.

□ I really don't know anything about this feature.

□ I am not sure that this feature would be useful for my class.

□ I have some information about this feature, and am considering whether it might be useful for my class.

□ I now know enough about this feature that I am preparing to use it for my class.

□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.

□ I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.

□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.

□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.

□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Tracking and analysis of student e-textbook use (e.g., number of: unique visits, pages viewed, pages printed, highlights made, notes made)

□ My e-textbook does not offer this feature.

□ I really don't know anything about this feature.

□ I am not sure that this feature would be useful for my class.

□ I have some information about this feature, and am considering whether it might be useful for my class.

□ I now know enough about this feature that I am preparing to use it for my class.
□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
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□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our class.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Using interactive practice questions or games from the e-textbook

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
□ I have some information about this feature, and am considering whether it might be useful for my class.
□ I now know enough about this feature that I am preparing to use it for my class.
□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
□ I use this feature routinely without much conscious thought, and my use of this technology is fairly routine for my class.
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□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Using web links in the e-textbook

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
□ I have some information about this feature, and am considering whether it might be useful for my class.
□ I now know enough about this feature that I am preparing to use it for my class.
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□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.

□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Using videos/animations in the e-textbook

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
□ I have some information about this feature, and am considering whether it might be useful for my class.
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□ I am using this feature now and am primarily focused on learning the skills necessary to use it properly and effectively for my class.
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□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Using the e-textbook for just-in-time learning or performance support (e.g., in the field or on the job)

□ My e-textbook does not offer this feature.
□ I really don't know anything about this feature.
□ I am not sure that this feature would be useful for my class.
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□ I use this feature regularly, and am implementing ways of varying its use to improve the outcomes derived for my class.
□ I am collaborating with colleagues to develop ways in which we can use this feature to better meet our common objectives for our classes.
□ I still use this feature but am exploring other technologies to replace it that will better meet the objectives for my class.

Have you taught another e-textbook course?

Yes. You will be asked to repeat this survey for that course.

No. Thank you for your participation.

APPENDIX B

IRB APPROVAL

Office for Research

Institutional Review Board for the Protection of Human Subjects

THE UNIVERSITY OF ALABAMA RESEARCH

February 23, 2015

Kim Roberts
ELPTS
College of Education
Box 870302

Re: IRB #: EX-15-CM-024, "Electronic Versus Traditional Print Textbooks: An Evaluation of Student Achievement and Instructor Levels of Use of the Innovation at a Community College"

Dear Ms. Roberts:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given exempt approval according to 45 CFR part 46.101(b)(2) as outlined below:

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

This approval expires on February 22, 2016. If the study continues beyond that date, you must complete the appropriate portion of the Continuing Review Form. If you modify the application, please complete the Modification of an Approved Protocol Form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, please complete the appropriate Closure form.

Should you need to submit any further correspondence regarding this application, please include the assigned IRB application number.

Good luck with your research.

Sincerely,

Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama

358 Rose Administration Building
Box 870127
Tuscaloosa, Alabama 35487-0127
(205) 348-8461
FAX (205) 348-7189
TOLL FREE (877) 820-3066

Research Invitation

IRB # 6295
INFORMED CONSENT

Kim Roberts, Principal Investigator from the University of Alabama, is conducting a study called "Electronic Versus Traditional Print Textbooks: An Evaluation of Student Achievement and Instructor Levels of Use of the Innovation in a Community College." She wishes to find out more about instructor use of e-textbook features and student learning.

You were selected as a possible participant for this study because you have utilized an e-textbook in your course(s). Approximately 50 people will be asked to participate in this voluntary study. You must be 19 years of age or older to participate in this study. If you decide to participate, you will be asked to complete a three-part survey, estimated to take about 15 minutes of your time. Part 1 will ask you some demographic questions. Part 2 will ask for course information. Part 3 will ask you to rate your level of use with eight different e-textbook features. The level of use index is intended to evaluate programs and processes and is not designed for performance evaluation.

Any information obtained in connection with this study will remain confidential. Results will be presented in the form of aggregate data, which will not identify the school or specific individuals. Raw data will be secured in a password-protected format and access will be restricted to the research team only.

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There are no known risks involved with this study. The study does not intend to impose any type of treatment upon participants or change your point of view. Instead, the research explores instructors' self-reported behaviors and actions with e-textbook technology features.

If you have any questions at this time, please contact [Distance Learning Coordinator] at [phone number] or [email address] and she will be happy to answer them. If you have questions about the study you may also contact Kim Roberts at 256-318-2536. If you have questions about your rights as a research participant, please call Ms. Tanta Myles, the University Compliance Officer at the University of Alabama at 205-348-8461 or toll-free at 1-877-820-3066.

If you have complaints or concerns about this study, please file them through the UA IRB outreach website at http://osp.ua.edu/site/PRCO_Welcome.html. Also, if you participate, you are encouraged to complete the short Survey for Research Participants online at this web site. This helps UA improve its protection of human research participants.

UA IRB Approved Document
Approval date: 2-23-15
Expiration date: 2-22-16

YOUR PARTICIPATION IS COMPLETELY VOLUNTARY. Your decision whether or not to participate will not prejudice your relation with [college name] or the University of Alabama. If you decide to participate, you are free to discontinue participation at any time without prejudice.

Thank you.

If you understand the statements above, are at least 19 years old, and freely consent to be in this study, click on the Continue button to begin.

► CONTINUE

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