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EXAMINING STUDENT COURSE OUTCOMES IN FIRST YEAR ANATOMY AND
PHYSIOLOGY USING E-BOOKS VERSUS TRADITIONAL TEXTBOOKS

by

HOWARD MARQUISE

A DISSERTATION

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DEDICATION

I dedicate this work to the woman who saw something in me thirty-two years ago and saved me from the self-destructive path I was on: Maria Eliza (Lisa) Silva Marquise, my soul mate. You have been by my side for the good times and the bad, but your love for me has never wavered.

I would also like to dedicate this accomplishment to my mother, Janie Teel Marquise, who, from my earliest memories, told me I was going to college and then made it possible. Although she only made it through the sixth grade in school, she worked long hours to provide for my brothers and me. May you rest in peace. I hope that I have made you proud.

EXAMINING STUDENT COURSE OUTCOMES IN FIRST YEAR ANATOMY AND
PHYSIOLOGY USING E-BOOKS VERSUS TRADITIONAL TEXTBOOKS

Howard Marquise, PhD

University of the Incarnate Word, 2015

Over the last several years, use of e-books in higher education has increased significantly and is projected to continue through the next decade. Institutions of higher learning have implemented use of e-books without any data that verified the impact on student learning outcomes. The purpose of this ex post facto, quantitative study was to compare student learning outcomes in Human Anatomy and Physiology I courses using e-books versus using traditional textbooks at a two-year public community college in South Texas. With a participant population of 686 students, data were analyzed by their final grades comparing the differences between those who used an e-book with those who used traditional textbooks. Analysis of the data indicated that student learning outcomes (success) in Human Anatomy and Physiology I were independent of the type of book used. Whether students used a traditional textbook or an e-book, no significant difference was found for student learning outcomes (success).

Student learning outcomes in Human Anatomy and Physiology were at the same level for students using e-books because of built-in features of the books. These features, which have been termed the e-book effect by this author, combine aspects of constructivist, social constructivist, and active learning that allowed a student to progress through Bloom's Taxonomy to gain mastery of the subject matter.

TABLE OF CONTENTS

Table of Contents—Continued

Table of Contents—Continued

LIST OF TABLES

LIST OF FIGURES

List of Figures—Continued

Chapter 1: E-Books for Academia?

Background

In the late 1990s, Massachusetts Institute of Technology Professor Joseph Jacobson was on vacation and had exhausted his supply of reading material (Harris, 2010). He developed an idea that has since turned into a multimillion-dollar industry, impacting both academic and private sectors (Agee, 2003; Harris, 2010). Jacobson's idea was to develop a book that could update itself with new content, hence, the birth of the electronic book (e-book) (Harris, 2010). While similar to a traditional book that contains written prose, an e-book does not contain numerous pages bound by two hard or soft covers. It has all of the content of a traditional book, but that content is delivered on an electronic device or reader (Koychev, Nikolov, & Dicheva, 2009). From Jacobson's initial idea, many companies have expanded upon his original concept and marketed e-books and e-book devices such as Amazon's Kindle®, Sony's Reader Digital Book®, and applications that run on personal computers, tablets, and cellular phones (Larson, 2009).

Companies initially marketed e-books to consumers as a replacement for leisurely reading; i.e., to replace novels, romance books, and the reading for pleasure that everyone does (Gall, 2005; Harris, 2010; Larson, 2009). The concept was soon introduced to schools and academia as a way better than traditional books to educate students (Gall, 2005; Harris, 2010; Hoseth & McLure, 2012; Larson, 2009). Academic publishing companies, recognizing the potential revenue from publishing e-books as a replacement or an alternative to traditional textbooks, have become the leaders in promoting use of e-books in schools and colleges (Gall, 2005; Harris, 2010; Hoseth & McLure, 2012; Lamothe, 2013; Larson, 2009). Because e-books can provide students with a less expensive alternative to traditional textbooks, many college and

university administrators and leaders are pushing professors to adopt e-books in their courses (Gregory, 2008).

As the push to move students from using traditional textbooks to e-books occurs, a very important question must be asked. Do students perform as well in their courses using e-books as they do using traditional textbooks? Will student learning outcomes, as measured by final grades in a course, be the same regardless of the type of book used?

The Problem

E-books have the power to provide individuals with information that reaches far beyond traditional brick-and-mortar libraries and classrooms (Gall, 2005). Through the use of massive open online courses (MOOCs) and the e-books that support these courses, students can obtain an education from anywhere there is Internet access by using a device that can download the material (Band, 2013; Gall, 2005). The implication of this innovation is staggering; a student can be thousands of miles from a university and instructor, yet can be exposed to the same educational content as individuals on campus sitting in the classroom (Band, 2013). However, will the online student learn as well as the student in a traditional course using a traditional textbook?

Educators in elementary schools are also using e-books to encourage students to read (Siegle, 2012). Cost-conscious school districts have begun making deals with publishers to provide e-books to K–12 schools in an effort to lower operating expenses (Band, 2013). Introduction of e-books in K–12 environments has created an expectation by students entering universities that professors will use e-books (Giacomini et al., 2013).

The perception is that e-books enhance student learning. Martinez-Estrada and Conaway (2012) conducted a study questioning students about whether or not e-books "had improved their

classroom learning experience" (p. 131). The majority of individuals felt that they did; however, no empirical data exists to determine if use of e-books translated into better learning outcomes for the students.

With increased use of e-books in K–12 and in support of MOOCs, by 2018 e-books will be the dominant type of textbooks used in higher education courses in the United States (Reynolds, 2011). The problem is that institutions of higher learning are implementing use of e-books without any data verifying the impact on student learning outcomes (Olsen, Kleivset, & Langseth, 2013). Educators must determine the effect on students' knowledge and understanding in academic courses during this transition from traditional textbooks to e-books (O'Brien & Voss, 2011).

The Purpose

The purpose of this ex post facto, quantitative study was to compare student learning outcomes, as measured by final grades, in Human Anatomy and Physiology I courses using e-books versus Human Anatomy and Physiology I courses using traditional textbooks at a two-year public community college in South Texas.

Research Questions

Thus, the following research questions were proposed:

1. To what extent does using an e-book, instead of a traditional textbook, make a difference on student learning outcomes in Human Anatomy and Physiology I?

2. To what extent do demographic variables such as gender, age, and ethnic background make a difference in student learning outcomes in Human Anatomy and Physiology I if they use an e-book instead of a traditional textbook?

Theoretical Background

Investigating how an individual learns is essential for examining what affects student success in Human Anatomy and Physiology I, and for determining whether this success is due to the student or the instructional factor. Skinner (1953), Piaget (1973), Vygotsky (1978), Bandura (1977), and most psychologists believe that learning occurs as a result of external stimuli that shape the individual's behavior. Behaviorism is based on the premise that positive and negative reinforcements mold the person's conduct and that learning occurs through this process. Whether students are learning material for personal betterment, to get a certain grade, or to obtain a degree, a certain amount of behavior modification occurs (Ormrod, 2008). If students make a bad grade, most will tend to change study habits; students will use certain metacognitive techniques if such strategies produce better results (McLeod, 2015). Behavior is not the only factor affecting how individuals learn; the learner is still a participant in the learning process (Piaget, 1973; Vygotsky, 1978).

Bloom (1956) classified learning as a series of progressive thinking behaviors exhibited by individuals. His theory consists of three domains: cognitive, affective, and psychomotor. Each domain is further broken down into classes. The cognitive domain consists of knowledge, comprehension, application, analysis, synthesis, and evaluation. The affective domain comprises receiving, responding, valuing, organization, and characterization. The psychomotor domain includes motor skills.

For the purpose of this research study, Bloom's (1956) cognitive domain (Figure 1) is most significant. The classes are progressive and demonstrate a more in-depth degree of learning. In learning human anatomy and physiology, one cannot comprehend the concept of how different tissues combine to form organs until an understanding of the cells has been

achieved. A student must transition through the steps in Bloom's cognitive domain: first learning the terminology of the cells parts and the function of each part, next learning how the cells come together to form tissues, and finally how tissue combines to form organs. If students use an e-book for the Human Anatomy and Physiology I course, will they progress through the levels of Bloom's Taxonomy (1956) and have the same learning outcomes as students using a traditional textbook?

Vygotsky, Piaget, and other constructivists utilize the premise that learners construct knowledge for themselves (Ormrod, 2008; Piaget, 1973; Vygotsky, 1978). The student's mind is not a blank slate but acquires new knowledge by building on previous learned information (Ormrod, 2008). This learning theory is crucial in the study of human anatomy and physiology. Both Vygotsky (1978) and Piaget (1973) documented that learning occurs through developmental stages in which the student builds on prior knowledge and experience. The very paradigm of the education system in the United States is based on this notion. Children begin school in kindergarten or pre-kindergarten and progress through the first to twelfth grades. As the student progresses to higher grade levels, new information builds on previously learned concepts and material. One cannot remove from the paradigm that learning is an active process in which the learner uses sensory input and constructs meaning from it (Ormrod, 2008).
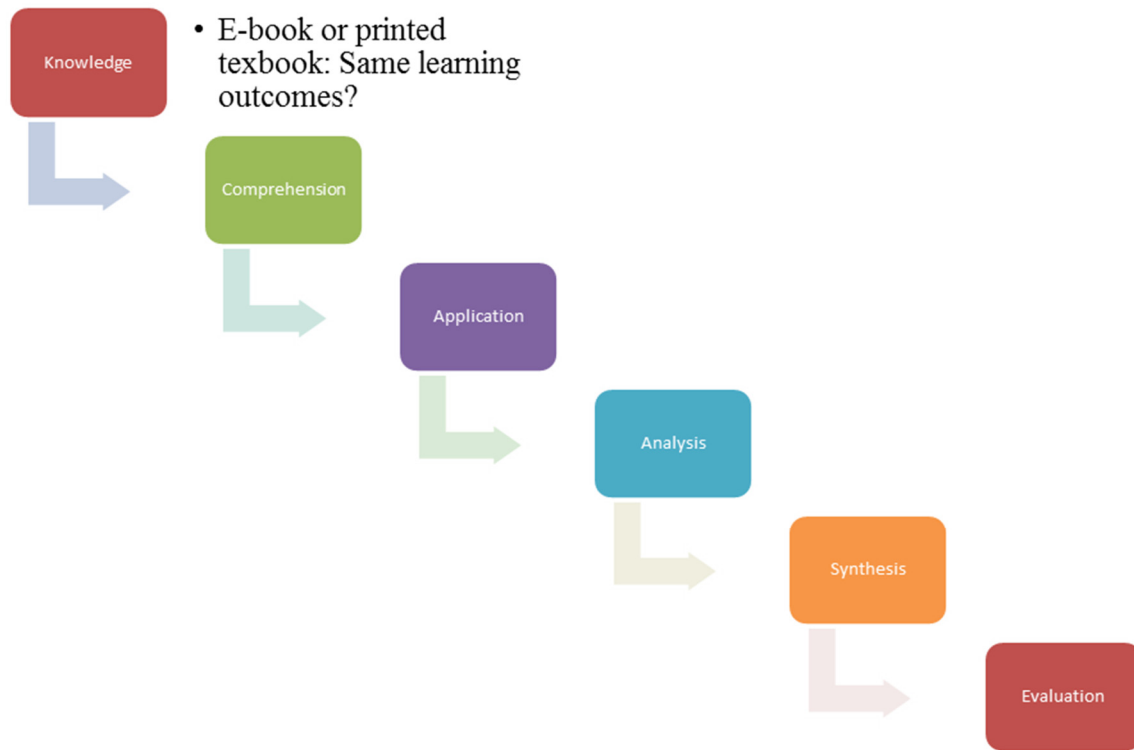
Figure 1. Bloom's levels of cognitive processes. In Bloom's Taxonomy, six levels of cognitive processes, from the simplest to the most complex, involve degrees of difficulty, with the first ones normally mastered before the next one can occur (Bloom, 1956).

Significance of the Study

This study is significant to higher education policy makers who must decide whether to mandate change from traditional textbooks to electronic versions at the colleges and universities they govern. The study is important to college administrators who must budget additional funds to cover the cost of added tutoring services, or supplemental educational material for courses that adopt e-books.

The study is important to instructors of Human Anatomy and Physiology I courses who must determine if they need to modify their pedagogical technique, or provide additional materials, if they use e-books instead of traditional textbooks. Finally, it is important to future students of Human Anatomy and Physiology I courses who may decide on a different metacognitive approach to studying if their professor uses an e-book.

Definition of Terms

The Human Anatomy and Physiology I course is defined as a course focusing on the study of the structure and function of cells, tissues, and body systems with emphasis on the integumentary, skeletal, muscular, and nervous systems including the special senses.

Definitions of an e-book and traditional textbook are as follows: An e-book is a publication whose text is available for reading in a digital format accessed on a computer, laptop, tablet, Smartphone, or e-book reader (Denoyelles, Raible, & Seilhamer, 2015; E-book, n.d.). A traditional textbook is a printed manuscript bound (either hard or soft cover) as a paper copy.

Learning outcomes were measured by students' final course grades in Human Anatomy and Physiology I. A successful outcome was defined as the student's receiving a grade of A, B, or C. An unsuccessful outcome was defined as the student's receiving a grade of D, F. or W (withdrawing from the course).

Methodology

This study was an ex post facto, quantitative study using a causal comparative design (McMillan, 2011). Several parameters were examined to ascertain their effect on the participants' learning outcomes as measured by their final course grades in Human Anatomy and Physiology I. These analyses were accomplished by comparing differences between students who used an e-book versus those who used traditional textbooks.

Study Limitations

The population of students attending a two-year public community college in South Texas was the study's limitation. Although unlikely, it is possible that the same students could take the Human Anatomy and Physiology I course in the spring semester of 2014 and repeat it in the fall semester of 2014 to improve their grades.

Chapter 2: Review of the Literature

The purpose of this ex post facto, quantitative study was to compare student learning outcomes, as measured by final grades, in Human Anatomy and Physiology I courses using e-books versus courses using traditional textbooks at a two-year public community college in South Texas.

As early as 1988, the Oxford English Dictionary cited from the *American Libraries Magazine* that "The E-book, a small, hand-held, flat recording device able to replay text as a portable cassette player replays sound" would become part of our future. (E-book, n.d.). In actuality, e-books have been around for slightly over a decade and have only recently been used in academia as a replacement for traditional textbooks (Larson, 2009). A void exists in the research investigating the impact on students of adopting e-books as a replacement to traditional textbooks in higher education (Doering, Pereira, & Kuechler, 2012; Rockinson-Szapkiw, Courduff, Carter, & Bennett, 2013). The current literature regarding e-books does not examine a student's learning outcomes in courses using an e-book as a text; research focuses instead on six general subject areas (Figure 2). These are listed below in the order they will be discussed:

1. The e-book system of delivery for the subject matter; essentially the device and the content format.

2. The user's attitude towards e-books.

3. The advantages e-books have over traditional textbooks.

4. The examination of an individual's active reading skills and reading comprehension using e-books compared to traditional textbooks.

5. The increasing use of e-books in public libraries, and in elementary and secondary education.

6. The inevitable transition of higher education from traditional textbooks to e-books due to the efforts of publishers of e-books and the manufacturers of e-book readers.

The E-book Device

A discussion of e-books must start by recognizing that the term *e-book* describes a portable electronic device on which the contents of a printed book may be downloaded in digital format and read (E-book, n.d.). A large portion of the articles researching e-books focused on aspects of the e-book delivery device, including discussions on the file format of the e-book content, the type of device displaying the e-book content, the technical knowledge required of the user to operate the e-book device, and the visual strain experienced by e-book users. McCarthy (2011) wrote that the use of e-books in higher education consisted of three aspects, the device itself, the software that controlled the delivery of and student interaction with the material, and the content subject.

Hoseth and McLure (2012), Larson (2009) and Siegle (2012) have discussed various file formats utilized by e-book readers. Lamothe (2013) stated that in its simplest form, an e-book is printed text converted to a digital form that may or may not require a special reader. Siegle (2012) wrote that e-book content is delivered on formats from

> "simple text files (txt) to portable document files (pdf), to formatting that is created specifically for certain e-book readers" because "many of the e-book readers developed their own files (txt) to portable document files (pdf), to formatting that is created specifically for certain e-book readers" because "many of the e-book readers developed their own format." (p. 137)
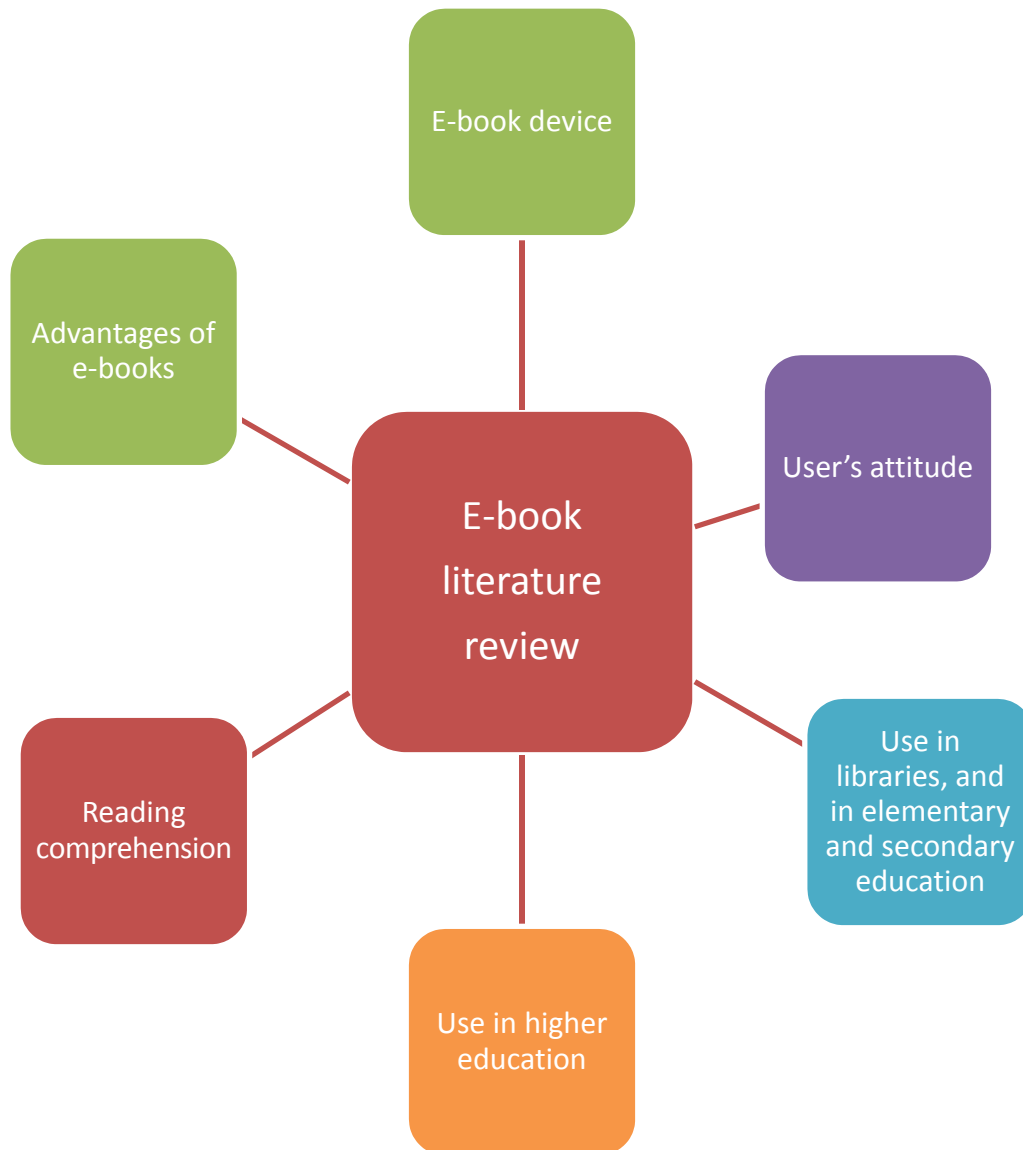
Figure 2. Topics of literature on e-books.

In their article, Raynor and Iggulden (2008) discussed e-book content delivery systems created by publishers such as Elsevier or John Wiley & Sons, Inc., of academic textbooks, which were essentially an "interactive. . . virtual learning environment" (p. 98).

The wide range of file types illustrated the major issues associated with the word *e-book*. "The term e-book means different things depending on the context" (Gall, 2005, p. 26). It could be as simple as a text document or as complex as an interactive file containing hyperlinks and audio/video content. The content could be web-based and not require unique viewing equipment; one could simply use the browser standard on most personal computer operating systems to view the text (Lamothe, 2013).

The other major component of using an e-book was the device that delivered and displayed the text. Larson (2009) stated that "a wide range of portable devices (i.e., the Amazon Kindle®, Sony's Reader Digital Book®, iPods®, PDAs, …cell phones)" offers "instant access to thousands of books" (p. 257). The Barnes & Noble Nook® and numerous apps developed by Apple and Google are also used to download and utilize e-book content on desktop, laptop, and tablet computers, as well as Smartphoness (Hoseth & McLure, 2012; Larson, 2009; O'Brien & Voss, 2011; Ohler, 2001; Siegle, 2012). Hoseth and McLure (2012) wrote that because of the large number of platforms available to deliver e-book content, "navigation, printing, and note-taking functions may work differently" (p. 279) on the various systems. Users may have to learn a new system if they change devices, thereby creating problems for libraries and academic institutions attempting to provide technical support for their patrons and students.

McCarthy (2011) argued that the use of e-books by college students is vastly different from individuals using e-books for pleasure reading. He stated that "college students don't just read their books; they literally consume books through highlighting, underlining, dog-earing pages, and note taking" (p. 22). Use of e-books in higher education will require that the access device attains a certain technical standard that encompasses all of the built in utensils required by college students (Hoseth & McLure, 2012; Larson, 2009; McCarthy, 2011; O'Brien & Voss,

2011; Siegle, 2012). The current goal of higher education publishers is an e-reader that duplicates features most attractive to students in a traditional textbook along with high-tech qualities associated with e-books is (McCarthy, 2011).

Moreover, an important aspect of replacing traditional textbooks with e-books in academic classrooms is the technical knowledge required of the end user. Ohler (2001) stated that "e-books require readers to be trained to operate the hardware and optimize the features" (p. 19) of the particular device being utilized. Hoseth and McLure (2012) write that "the lack of interoperability of e-book hardware requires libraries" (p. 279) and other institutions to become knowledgeable in multiple platforms in order to provide support and training to their users.

Instructors and professors who adopt the use of an e-book for courses must be technically savvy enough to assist students who encounter problems with accessing course content on the e-book device (Hoseth & McLure, 2012). A major issue is that students using academic publishers' interactive e-books often lack the technical knowledge required to fully utilize the features in the e-book (Raynor & Iggulden, 2008). Use of e-books in higher education may also be examined through the lens of the digital divide. Students who can afford the latest technological devices were more at ease using e-books, whereas those who were not exposed to computers, Smartphones, and technology at home felt uncomfortable with e-books (Larson, 2009).

A final aspect explored in the literature on e-book devices is the problem of visual strain experienced by users. A reader's visual strain results from the backlighting of text on e-book readers, unlike traditional books where light reflects off the pages (Folb, Wessel, & Czechowski, 2011; Gregory, 2008 ; Harris, 2010; Siegenthaler et al., 2012). In fact, Siegenthaler et al. (2012) state that "compared to reading on electronic displays, reading on paper is faster and requires fewer fixations per line" (p. 367), thus causing less eye strain and allowing a reader to spend a

longer time reading. Harris (2010) wrote that manufacturers of e-book readers are aware of the issues with backlit technology. They are in the process of developing readers that will eliminate or greatly reduce the need for using a backlit display and will resemble the properties of traditional book pages reflecting ambient light. As Siegenthaler et al. (2012) point out, "it is not the technology itself, but rather the image quality" (p. 367) that is of utmost importance in preventing eye fatigue and strain.

The User's Attitude Towards E-Books

Numerous studies have investigated users' attitudes towards e-books within and outside of academic sectors (Folb et al., 2011; Gregory, 2008; Hoseth & McLure, 2012; Raynor & Iggulden, 2008; Shepperd, Grace, & Koch, 2008; Siegenthaler et al., 2012; Simon, 2002). Gregory (2008) summed up the vast majority of the results of various studies: "Students have mixed feelings about using e-books; students will use e-books but prefer using traditional print books" (p. 266). Marmarelli and Ringle (2010) found that students do not consider the e-book to be of the same academic caliber as a traditional textbook because they are not able to write notes in the margin, dog-ear pages for easy access to content, or rapidly flip back and forth between sections.

Shepperd et al. (2008) examined students' opinions and preferences when they were able to choose between an e-book and a traditional textbook for a psychology course. Students who had experience using an e-book for a prior academic course chose a traditional textbook for the psychology course. Furthermore, at the end of the psychology course, those students who elected to use an e-book, even though there was no significant difference in the students' final grades in the course regardless of the type of book used, did not like using the e-book and would not do so in future courses (Shepperd et al., 2008).

Hoseth and McLure (2012) found similar results in their research: when students were able to choose between an e-book and a traditional textbook, their preference was for the hard copy textbook. Some reasons they gave for preferring the traditional textbook were that it did not create eye strain, it was easier to navigate to different sections of the text, and a perception that their reading comprehension would be better using the traditional textbook. It appears, however, as more and more colleges and universities are making the transition to e-books, students are cautiously accepting their use (Hoseth & McLure, 2012).

Smith (2008) writes in his dissertation, which examined students' approval of and satisfaction with e-book use in higher education that the e-book delivery method and the student's age impacted whether they liked or disliked using an e-book. He found that older students, those from the baby boomer generation, disliked using an e-book for their course and preferred to use a traditional textbook. The older students favored printing up the content from the e-book and reading the hard copy as they would a traditional textbook. Younger students, those from Generation X, prefer "working with electronic materials as opposed to use of paper textbooks" (Smith, 2008, p. 110). He also found that these students want to be able to download the content of the e-book and be able to view it without having to be connected to the Internet.

Walton (2012) examined in his dissertation reasons students would choose and use an e-book. He found that when students were reading for pleasure they would pick the digital format, or when they were conducting research they were okay with using an e-book. However, for required reading in their academic courses they preferred a traditional textbook and would only use the e-book over the traditional textbook if it was a mandatory requirement for the class.

The financial savings from using an e-book over a traditional textbook is the biggest factor in students' increased acceptance of e-books (Folb et al., 2011; Gregory, 2008; Hoseth &

McLure, 2012; Marmarelli and Ringle, 2010; Raynor & Iggulden, 2008; Siegenthaler et al., 2012; Simon, 2002). Besides the cost savings, students liked the fact that they could access the material from their residence and obtain the book right away through a digital download (Gregory, 2008). Many users of e-books also liked the fact that several e-books could be stored and accessed all at once on their e-book readers, eliminating the need to carry around a backpack full of 300-page textbooks (Gregory, 2008; Unsworth, 2004).

Gregory (2008) and Hoseth and McLure (2012) also found that users would only print what they feel is the minimum required content of an e-book (which may be of concern for academic instructors); whereas readers of a traditional textbook would expose themselves to the entire content of the text. Some users also thought it was difficult to earmark certain sections of an e-book like they do with a traditional textbook; they also found it impossible to compare several pages at once (Hoseth & McLure, 2012; Marmarelli and Ringle, 2010; Raynor & Iggulden, 2008). Students found that it was difficult to search the index to examine the content of an e-book to find sections or pages of related topics (Gregory, 2008). Rickman, Von Holzen, Klute, and Tobin (2009) reported that in many cases students spent fewer hours studying for a course using an e-book because it was too technically challenging.

McCarthy (2011) discovered that a major problem that students of higher education found when using an e-book was the inability to spread out several textbooks across their desk and go back and forth between the content of the texts. Although you can flip back and forth in an e-book, unless you are using multiple readers it is difficult to compare between the pages of two different books. This issue is perceived as more of a problem for students in a technical discipline like science and engineering as opposed to a liberal arts course like English (Hoseth & McLure, 2012; McCarthy, 2011).

Wang (2015) examined in his dissertation the dynamics behind an instructor choosing to use an e-book in a course over a traditional textbook. He found several aspects that swayed faculty choices. Wang (2015) states, "most instructors thought that printed textbooks still played a primary role in teaching, which is the major reason that prevented them from using e-Textbooks" (p. 90). Even instructors who used an e-book in their courses wanted a printed version of the content available as a backup.

The irony is that the majority of people preferring traditional textbooks over e-books knew they had to accept technological advances even though they preferred not to use e-books. McCarthy (2011) lists several features that college students will expect in order for e-books to serve as a replacement for traditional textbook. They are "highlighting and annotation, content tagging, full-text search within and across content, faculty sharing of annotation and highlights, integration with other content sources and learning management systems, integrated web resource lookup," and "study tools such as study-guide creators or flashcards" (McCarthy, 2011, p. 24). Olsen et al. (2013) state that even students with a positive attitude towards e-books preferred traditional textbooks for "serious academic study" (p. 1). They knew they had to "move forward with the rest of the world and keep up with their peers" (Hoseth & McLure, 2012, p. 284).

The Advantages of E-Books Over Traditional Textbooks

Even with all the negative aspects of e-books, many believe e-books are a vast improvement over traditional textbooks (Koychev et al., 2009; Park & Helsel, 2008; Su, 2008; Unsworth, 2004; Walton, 2007). The recurring themes encountered in the literature related to the advantages of using an e-book over a traditional textbook are cost, the ability to incorporate

hyperlinks in the e-book text, and the ability of readers to provide rapid feedback to author's drafts and newly published books (Koychev et al., 2009; Su, 2008; Unsworth, 2004).

The cost savings realized by students using e-books versus the costs of traditional textbooks are substantial (Doering et al., 2012; Reynolds, 2011). Buying books for courses is one of the biggest expenses encountered by college students; moreover, Reynolds (2011) reports that prices have increased more than 25% since 2005. According to Gall (2005), the biggest misconception associated with the introduction of e-books in academia was that they would cost more. E-books are a cheaper option for students because publishers can pass along cost savings to students associated with not having to physically produce and distribute a hard copy text to its customers (Gall, 2005; Ohler, 2001; Reynolds, 2011).

Another advantage of an e-book is the ability of a publisher to include hyperlinks in the body of a textbook, which greatly improves the educational value of the book (Unsworth, 2004). In complex science disciplines, Su (2008) states the benefit of incorporating hyperlinks into the book that employs "computer-based multimedia (animations, images, sounds) teaching while utilizing constructivist design principles to facilitate students' understanding and attitude toward … learning …" (p. 225) is a great aid to pedagogy. Hyperlinks can also link course content to other publications or online learning resources and to email links to textbook authors or university tutors (Srivastavaa & Gray, 2012). Unsworth (2004) stated that hyperlinks "provide scaffolding from simpler to more complex accounts of elements within explanations" (p. 296).

Porter (2010) writes in her dissertation that e-books

"offer multimedia cognitive and collaborative learning opportunities-multimedia, social networking, collaborative problem-based learning" because e-books "are not limited by

the graphic and physical constraints of a hardcopy text and could be developed much as a website with navigation and a user-interface." (p. 131)

She states that because of the additional capabilities of e-books, instructors can modify their pedagogical approach, which will translate into a better learning outcome for the student.

Professors have also found that enhanced e-books can be of great value to students with limited educational backgrounds. By using the hyperlinks provided to remedial course material, the student can catch up with the rest of the class (Raynor & Igguldent, 2008). In fact, Koychev et al. (2009) refer to a hyperlinked e-book as a "SmartBook" that is in essence a "re-conceptualization of the book as rich-media, interactive, intelligent content serving as a focus point for community discussion" (p. 19).

The other big advantage to e-books is the speed at which a publishing company and an author can get their product distributed to their audience (Koychev et al., 2009; Unsworth, 2004). Koychev et al. (2009) state that "e-book authors can publish drafts of their books online to get early feedback, thus transforming book writing into a form of collective brainstorming" (p. 16). In much the same manner, errors in electronic textbooks can be corrected much faster than a traditional textbook that has to undergo reprinting.

Reading Comprehension Using E-books

A question that is raised and examined by several authors is whether an individual's reading comprehension differs using an e-book compared to a traditional textbook. Will the same metacognitive processes and reading strategies be utilized whether the individual is reading an e-book or a print textbook?

Schugar, Schugar, and Penny (2011) described "no discernible differences in reading comprehension levels" (p. 174) among students using an e-book compared to a traditional

textbook. They did, however, find that students did not use active reading skills (highlighting, underlining, note taking) when using e-books (Schugar et al., 2011). Whether or not this would translate into a student's poor performance in an academic course has yet to be established. Although many e-book readers have built-in functionality for highlighting, underlining, and note taking, users' technical savvy may limit their ability to use these tools.

Wells (2012) wrote in his dissertation that there was no difference in reading comprehension of middle and high school English students who used an e-book instead of a traditional textbook in their course. His study used an experimental design and compared students' scores using a standardized (Gates-MacGinitie Reading Tests®) reading comprehension test. Stevens (2014) conducted a similar study for his dissertation and also found that junior high school students who used an e-book instead of a traditional textbook for an English reading assignment showed no significant difference in their reading comprehensive of the material.

Baker's (2010) dissertation also compared student's reading comprehension using content delivered on two different types of e-book readers (Kindle and a iTouch) and printed on paper. Her study confirmed the results of the other studies that there was no significant difference in a student's reading comprehension regardless of content delivery on an e-book or a printed copy. She also found that students uncomfortable with technology and using an e-book perceived that their reading comprehension levels would decrease even though they did not.

Olsen et al. (2013) not only found that they are many "unsatisfactory aspects of the e-readers in regard to the active learning process" (p. 2), but they also reported that most students surveyed felt they did not learn as much from the content in their e-book as they would have had they used a traditional textbook. For instructors in higher education, this admission is disturbing

if indeed the same level of learning is not attained using an e-book as a traditional textbook (Olsen et al., 2013). Pollock (2012) also reported that "none of the e-reader models on the market have been able to offer full support for the active reading of scientific and technical" (p. 193) content. Marmarelli and Ringle (2010) likewise state that students' "ability to reflect on and retain complex information" declines when using e-books (p. 6).

Most authors agree that using active reading skills is crucial to gaining an adequate understanding of reading content. Whether or not students can gain another skill set to substitute for traditional active reading skills with e-readers remains to be seen and is a topic for further research.

E-Books in Libraries, and in Elementary and Secondary Education

Introduction to e-books for baby boomers, individuals from Generation X, and the Millennials (Generation Y) occurred through pleasure reading on a device marketed by major book distributors like Amazon and Barnes and Noble. For the Generation Z population, however, e-books and digital media have been part of their lives from a very early age, even from birth. In Smith's (2008) dissertation it was reported that technology in the form of e-books was being used in grades K–12. Burritt (2010) stated that "the emergence of e-books is beginning to shape book culture" (p. 3). Thus, for students of this youngest generation, using e-books in school is not the exception but the norm. As a result of Generation Z's using e-books during their elementary and secondary education, it is a natural progression for these students to expect to use e-books in college and to be able to access e-books through public libraries (Balas, 2006; Hoseth & McLure, 2012; MacCormack, 2015; O'Brien & Voss, 2011).

Maynard and Cheyne (2005), Siegle (2012), and Weber and Cavanaugh (2006) have documented the use of e-books in elementary schools. Part of the initial impetus to use e-books

in elementary schools was to capture a student's interest in material that they found boring if presented in a printed book. Siegle (2012) wrote that having students use e-books, or creating e-books with their own content encourages students to read and write. He stated that "educators and parents are often disappointed in the written products students produce," but when they create their own e-books "the quality of their work improves" (Seigle, 2012, p. 140).

Maynard and Cheyne's (2005) research examined whether using e-books with eleven- and twelve-year-old children, instead of print books, would facilitate their learning. They found that using an e-book increased the student's interest in the subject matter, but did not change the outcome on individual assessments of the covered material. The group of students who used the e-book showed more enthusiasm to learn and were better focused than the group of students who were assigned the printed textbook (Maynard and Cheyne, 2005). They stated that "the e-textbook can change and influence creativity and motivate learning" (Maynard & Cheyne, 2005 p. 113); the results of their research, however, is very limited due to the small participant population.

Weber and Cavanaugh (2006) inspected the impact using e-books had on select groups of elementary school students; gifted and talented children, underperforming gifted children, and special needs children who required accommodations. They found that e-books provided multiple avenues of access to subject matter and provided "new and challenging information" (Weber & Cavanaugh, 2006, p. 59) to gifted readers. E-books kept the child stimulated and intellectually challenged. For underachieving gifted children, they found the use of the required technology to access e-books increased their enthusiasm to read and explore subject matter in depth. Special needs students utilized the e-book readers' text-to-speech ability that "synchronized highlighting of the text being read," which "can aid the student in recognizing the

structure of written language" and improve the child's reading aptitude (Weber & Cavanaugh, 2006, p. 60).

The McAllen Independent School District located in the Rio Grande Valley, Texas, where a large number of residents live in poverty, has started issuing tablet computers to the students to provide them with a tool to access e-books and other digital media (Sherman, 2012). This practice is occurring in school districts across the United States as administrators implement strategies to provide access to technology for disadvantaged socioeconomic students. Pepitone (2014) quoted Darryl Adams, PhD, superintendent of Coachella Valley (California) Unified School District: "The technological divide between the rich and the poor is the civil rights issue of the 21st century…. Education can be the equalizer" (p. 1). Smith (2011) wrote that "textbooks have been replaced by an Apple iPad" (p. 1) for all of elementary and secondary students in the Zeeland (Michigan) Public Schools. Giving these students tablet computers allows them the ability to access thousands of e-book titles.

Generation Z students expect learning to take place anywhere they can access the Internet, not just in a brick-and-mortar building in a traditional classroom (Paredes, Pennington, Pursell, Sloop, & Mai Yin, 2010). The creation of all-digital libraries allows students to access thousands of book titles from their computers, tablets, e-book readers, and Smartphones (Denoyelles et al., 2015). Communities with high numbers of students living in poverty who may not own a computer, tablet, e-book reader, or Smartphones are building technology centers that house computers to access e-books but also to provide interactive e-readers for check out (MacCormack, 2015). These media centers allow individuals from all economic backgrounds the opportunity to use educational materials they may not be able to access anywhere else.

The Inevitable Transition to E-Books in Higher Education

It is evident from the current literature that e-books are not a passing fad. Publishers and other business firms are putting an enormous amount of money into the technology; e-books are the future of the written word (Lamothe, 2013). Even though several authors found that most individuals prefer traditional textbooks, the majority of people recognized that e-books are the future of education. As the technology of e-book devices improves and with the conversion of older literary works into electronic versions, libraries are becoming more than a brick-and-mortar facility where people can come in, check out books, and conduct research. They also are a virtual world where individuals can access digital books from any location that has an Internet connection allowing access to libraries (Ahmad & Brogan, 2012).

Large corporations like Amazon and Barnes & Noble have funded studies at universities and colleges (Arizona State University, Phoenix; Case Western Reserve University, Cleveland, Ohio; Pace University, New York City; Princeton University, New Jersey; the University of Washington, Seattle; Darden School of Business at the University of Virginia, Charlottesville; and the University of Agder, Norway) across the world to determine not just the suitability of using e-books in higher education (McCarthy, 2011; Olsen et al., 2013; Schugar et al., 2011), but also what modifications they need to make to e-book readers to gain greater acceptance in the higher education arena (McCarthy, 2011; Olsen et al., 2013; Schugar et al., 2011). Foster and Remy (2009) conducted a study at Gettysburg College in Pennsylvania, soliciting the opinion of faculty and students on "what does an e-book for academe need to do?" (p. 7). As a result of their research, they make several recommendations to manufacturers of e-book readers, from including navigation features between sections of books to adding active reading tools to the devices (Foster & Remy, 2009).

Perhaps the most important factor contributing to the transition to e-books in higher education is the cost savings recognized by students. Reynolds (2011) wrote that cost is prompting the increased use of e-books in higher education. He reported that "cost of textbooks…remains a strong determining factor in the purchase decision for most students" (p. 180), and e-books are less expensive than the printed version. In addition, free and open source digital materials are increasingly available to students. Course textbooks that have only been available in hardback are being scanned and converted to pdf files and are being shared by students (Reynolds, 2011). Other cost factors contributing to this trend are the acceptance of textbook rentals by students, the growth and approval of online merchandizing, and the lower cost of tablet devices and Smartphones (Reynolds, 2011).

Band (2013) reported that the cost of textbooks had increased by more than 800% during the last thirty years, far outpacing the inflation rate for other goods and services. Using an e-book instead of a traditional textbook will greatly lower the cost to students in higher education (Foster & Remy, 2009; Koychev et al., 2009; Olsen et al., 2013; Schugar et al., 2011; Unsworth, 2004). Publishers save money by not having to print up thousands of books; they also can make corrections and publish further editions by simply modifying the electronic file content. They are still able to make a profit and pass savings on to student customers (Band, 2013).

Giacomini et al. (2013) point out that K–12 schools have already widely adopted e-books. In order for higher education to keep pace, they will also have to ride the "swelling tide of interest in e-textbooks" (p. 1). They further discuss the many advantages that e-books have for professors by giving them the ability to link lecture slides to reading assignments and using other web tools to facilitate their pedagogical approach. Giacomini et al., (2013) make one of the most

compelling arguments: since e-books are unquestionably going to replace traditional textbooks in higher education, instead of fighting this change professors can become part of it and "influence the direction of the e-textbook market" (p. 10).

The other factor that greatly advances use of e-books is development of open universities and massive open online courses (MOOCs) (Ahmad & Brogan, 2012; Lamothe, 2013). Reynolds (2011) wrote that "online education" is "the fastest growing major trend in college learning" and is "the area with the highest demand for digital content due to the lower costs of materials and enhanced distribution capabilities" (p. 181). Individuals from around the world may thus access educational content and resources without ever leaving home; all they need is an Internet connection.

In addition to the specific sources cited in these chapters, many similar investigations of the use of e-textbooks were foundational for this research study (Bansal, 2011; Berg, Hoffmann, & Dawson, 2010; Bishop & Visser, 2013; Broadhurst & Watson, 2012; Cassidy, Martinez, & Shen, 2012; Cavanaugh, 2002; Chartier, 1997; "Cognitive aspects," 2008; Cortiella, 2005; Coyle, 2008; Dominick, 2005; Foust, Bergen, Maxeiner, & Pawlowski, 2007; Giacomini et al., 2013; Hermida, 2009; Lane, 2006; Love-Rodgers, 2001; Marrone, 2014; Matthes, Herzig, Müller, & Stosch, 2012; Muir & Hawes, 2013; Priemer & Ploog, 2007; Ratten, 2010; Schwartz, 1997; Sharma & Pitale, 2012; Smith & Caruso, 2010; Su & Chen, 2009; Stevens, 2014; Svinicki & McKeachie, 2011; Ugaz & Resnick, 2008).

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Chapter 3: Research Design and Methodology

Purpose of Research Study

The purpose of this ex post facto, quantitative study was to compare student learning outcomes, as measured by final grades, in Human Anatomy and Physiology I courses using e-books versus courses using traditional textbooks at a two-year public community college in South Texas.

Research Questions

The following research questions were investigated:

1. To what extent does using an e-book, instead of a traditional textbook, make a difference on student learning outcomes in Human Anatomy and Physiology I?

2. To what extent do demographic variables gender, age, and ethnic background make a difference on student learning outcomes in Human Anatomy and Physiology I if they use an e-book instead of a traditional textbook?

Study Design

This study was an ex post facto, quantitative study using a causal comparative design (McMillan, 2011). Gender, age, and ethnic background were examined to ascertain their effect on the participants' learning outcomes (success) in Human Anatomy and Physiology I if they used an e-book instead of a traditional textbook. Bivariate statistical analysis was utilized to compare group differences between classes that used an e-book versus those who used traditional textbooks.

Population and Participants

The population for this study was 686 students enrolled at a public two-year community college located in South Texas. Students from Human Anatomy and Physiology I classes from spring and fall semesters in 2014 were the participants about whom the data was collected. The

study compared data from the spring semester of 2014 when traditional textbooks were used, to data collected at the end of the fall semester 2014 when e-books were used.

Thirty total classes included 14 sections from spring 2014 and 16 sections from fall 2014. The participants were the entire student population of the Human Anatomy and Physiology I classes from each semester. The post hoc data was provided by the Institutional Research Department of the public two-year community college located in South Texas. The Institutional Research Department removed information that could identify the student participants.

Data Collection

The Institutional Research Department provided the data from all 30 sections of Human Anatomy and Physiology I classes taught during the spring and fall 2014 semesters. The data included the student's gender, ethnic heritage, age, and final course grade (Alamo Colleges, 2015).

Data Analysis

Statistical Package for the Social Sciences (SPSS) version 23 for Windows was used to analyze the data and determine differences. Data was coded according to the student's gender, ethnic heritage, age, and course outcome. A chi-square test of association was used to discover if there was a relationship between the student's learning outcome (success) and whether or not they used an e-book or a traditional textbook for the course. A Kruskal-Wallis test was also conducted comparing the student's grade to the book type (two categorical variables).

A Mann-Whitney U test, a Kruskal-Wallis test, and a chi-square test of independence were performed to compare group differences between gender and course grade, ethnicity and course grade, and to compare student learning outcomes to ethnicity. Finally a logistic regression analysis was performed to determine if the student's learning outcome (success) could be

predicted on whether or not they used an e-book or a traditional textbook for the course. The alpha level for each test was determined and p values calculated to determine if the results were significant.

Protection of Human Subjects

Ethical issues were limited because the student's identity was not released to the investigator. The students were assigned an arbitrary ID number before the data was released to the investigator.

Chapter 4: Results

Purpose of Research Study

The purpose of this ex post facto, quantitative study was to compare student learning outcomes, as measured by their final grade, in Human Anatomy and Physiology I courses using e-books (during the fall 2014 semester) versus courses using traditional textbooks (during the spring 2014 semester) at a two-year public community college in South Texas.

The data was coded (see Appendix C for code book) and entered into IBM® SPSS version 23 statistical program for the purpose of performing descriptive and inferential analyses. There were no missing values or outliers in the data set ($n = 686$).

Descriptive Analysis of Data

The total number of students whose data was used for this study was 686. Unlike the general college population, the males were the minority in this study, which was skewed toward the female gender (Figure 3). All data from the general college population was retrieved through the Office of Institutional Research and Effectiveness Services (Alamo Colleges, 2015). For the spring 2014 semester, the total number of students who used a traditional textbook was 324 (Figure 4). For the fall 2014 semester, the total number of students who used an e-book was 362 (Figure 4).

As shown in Figure 5, organizing the ages of the total study participants into three groups (under 25, 25 to 39, 40 and over), and comparing the values to the general population of the college demonstrates the populations are similar.
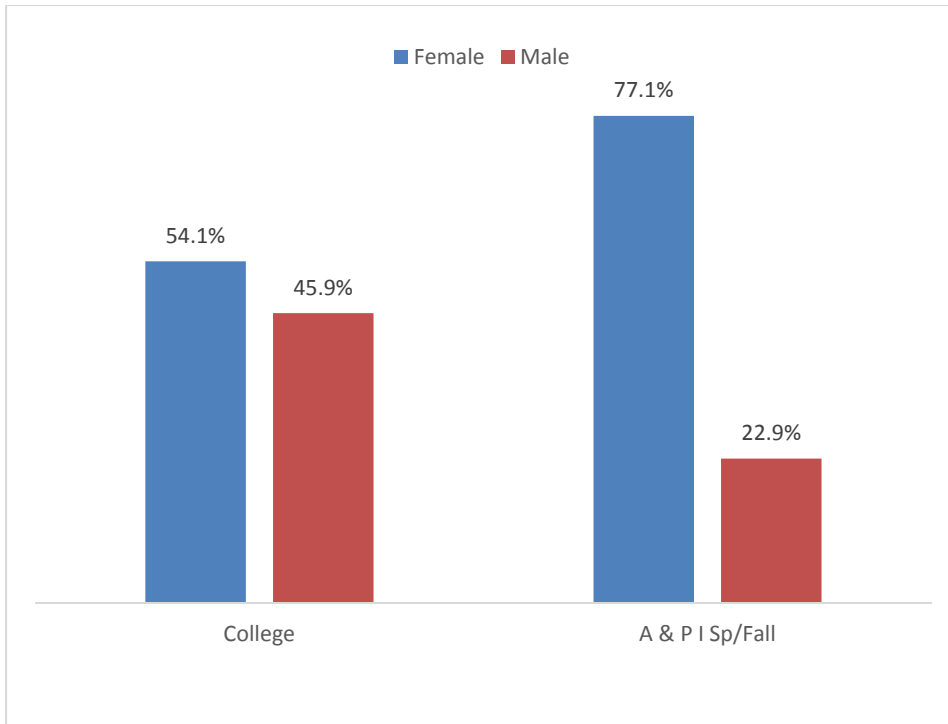
Figure 3. Gender comparison of college population with students using textbooks & e-books combined
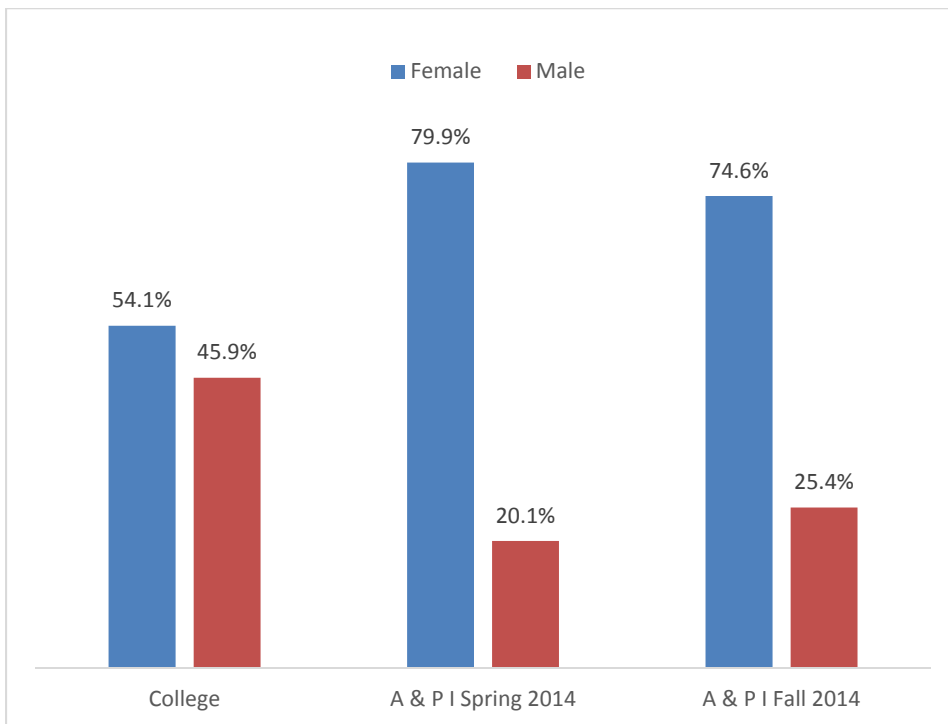
Figure 4. Gender comparison of college population with students using textbooks (spring 2014) & e-books (fall 2014), separated by semesters.
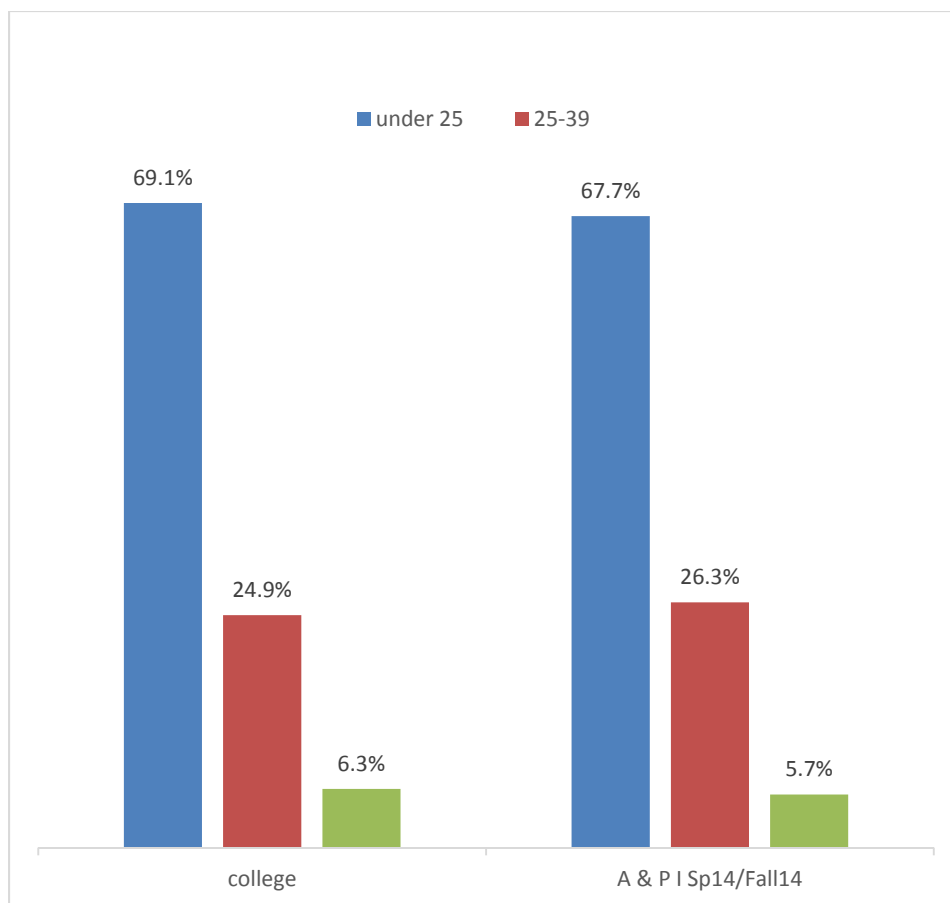
Figure 5. Age comparison of college population with students using textbooks & e-book combined.

As shown in Figure 6, sorting the ages of the spring 2014 and fall 2014 study participants into three groups (under 25, 25 to 39, 40 and over), and comparing the values to the general population of the college demonstrates the populations are also similar.

The average age of students for this study was 24.6 years with the youngest participants being 18 years and the oldest participant 66 years (Table 1 and Figure 7).

Of the students using a traditional textbook (spring 2014), the mean age was 25 years with the youngest participants being 18 years and the oldest participant 66 years (Table 2 and Figure 8). Of the students using an e-book (fall 2014), the mean age was 24
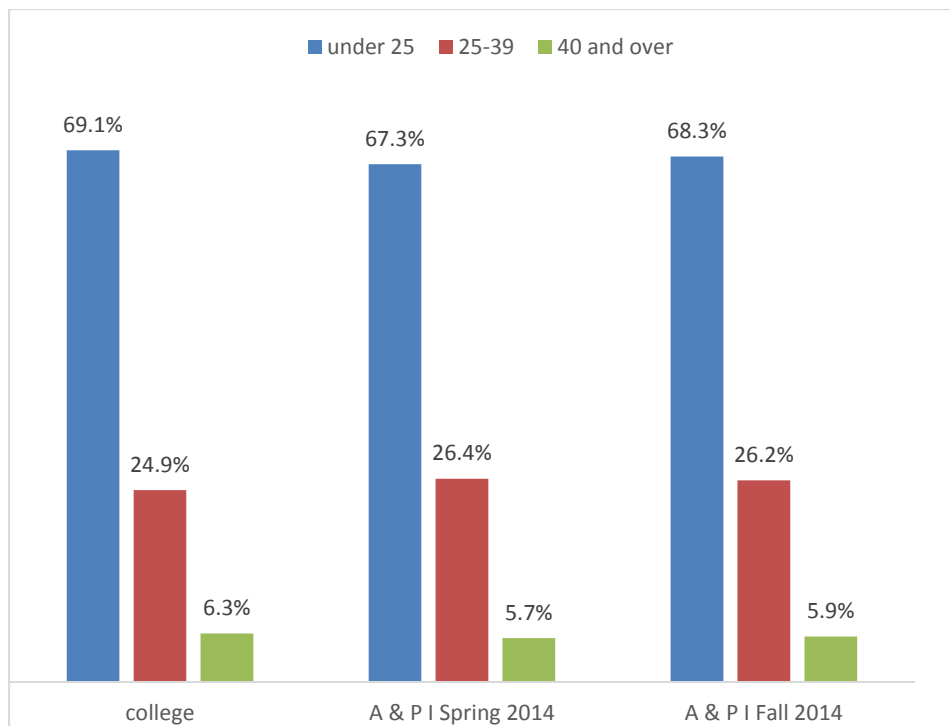
Figure 6. Age comparison of college population with students using textbooks (spring 2014) & e-book (fall 2014), separated by semesters.
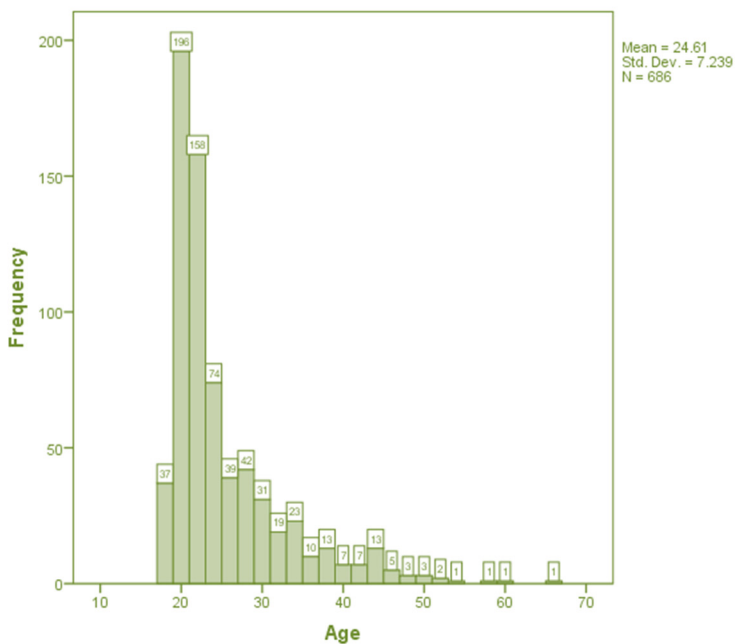
Figure 7 Frequency distribution of students' ages, spring 2014 (textbooks) & fall 2014 (e-book) combined.

years with the youngest participants being 18 years old and the oldest participant 57 years (Table

3 and Figure 9).

Table 1

Statistics for Ages of All Study Participants.

	Age of Students
Mean (n = 686)	24.61
Median	22.00
Std. Deviation	7.239
Skewness	1.984
Skewness Ratio to Std. Error	.093
Kurtosis	4.446
Kurtosis Ratio to Std. Error	186
Range	48
Minimum	18
Maximum	66
Kolmogorov-Smirnov	223

Table 2

Statistics for Ages of Spring 2014 Study Participants.

	Age of Students
Mean (n = 324)	24.75
Median	22.00
Std. Deviation	7.473
Skewness	2.027
Skewness Ratio to Std. Error	135
Kurtosis	4.992
Kurtosis Ratio to Std. Error	270
Range	48
Minimum	18
Maximum	66
Kolmogorov-Smirnov	.231
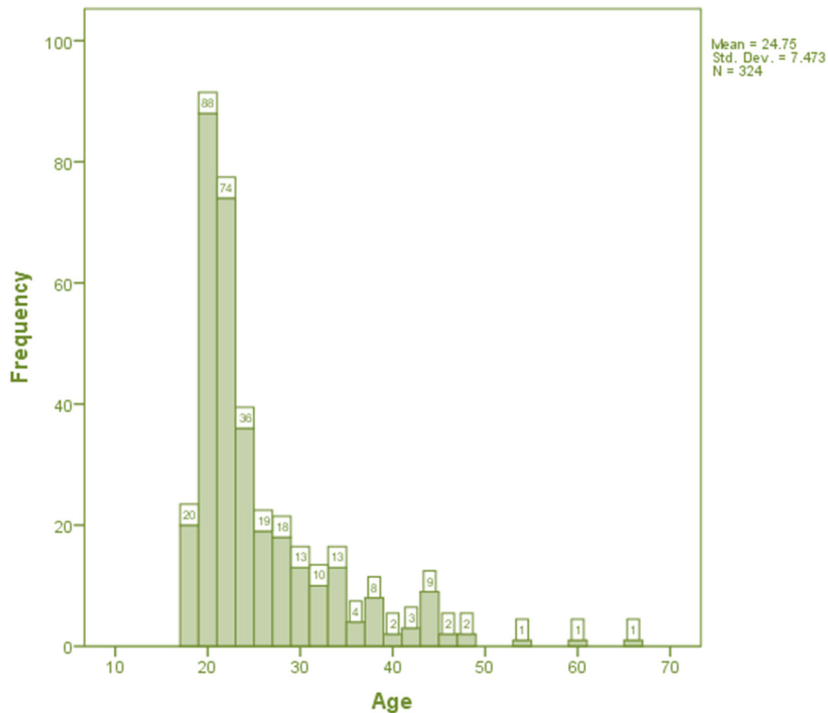
Figure 8. Frequency distribution of students' ages, spring 2014 (textbooks).

Table 3

Statistics for Ages of Fall 2014 Study Participants.

	Age of Students
Mean (n =362)	24.48
Median	21.50
Std. Deviation	7.031
Skewness	1.937
Skewness Ratio to Std. Error	128
Kurtosis	3.825
Kurtosis Ratio to Std. Error	.256
Range	39
Minimum	18
Maximum	57
Kolmogorov-Smirnov	.216
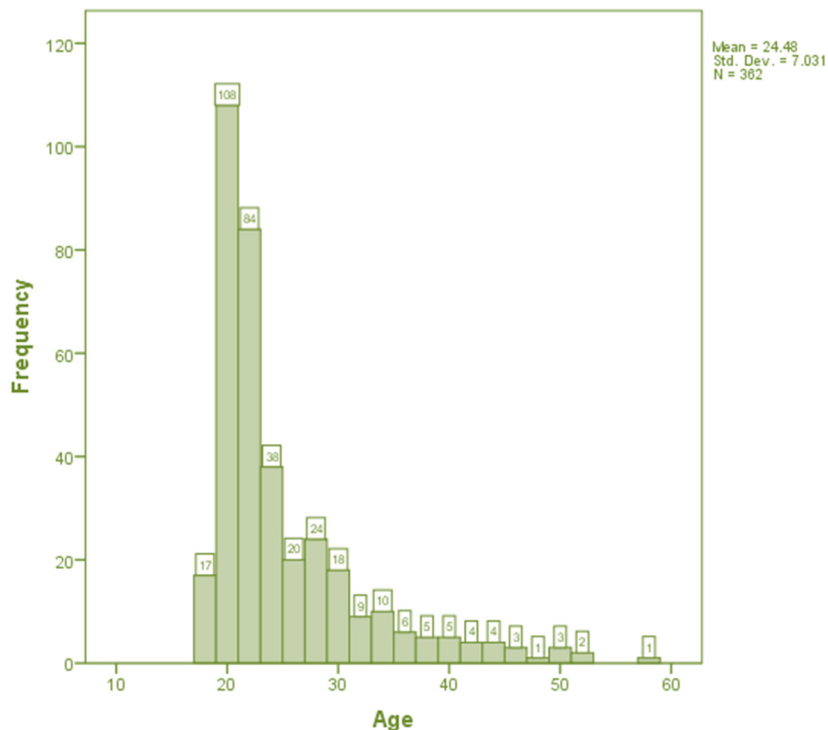
Figure 9. Frequency distribution of students' ages, fall 2014

As shown in Figure 10, the percent of Caucasian, African American, and Other participants combined was less than that of the Hispanic population. The ethnicities of students using traditional textbooks (spring 2014) followed the trend shown above, as did the ethnicities of students using an e-book (fall 2014). These values are comparable to the general population of the college as shown in Figure 11.

Inferential Analysis of Data

The goal of this study was to determine if the type of textbooks a student used for Human Anatomy and Physiology I made a difference with learning outcomes (success) in the course. For the purpose of this study, success is defined as the student receiving a final course grade of A, B, or C. An unsuccessful outcome in the course is defined as the student receiving a final course grade of D, F, or withdrawing from the class.
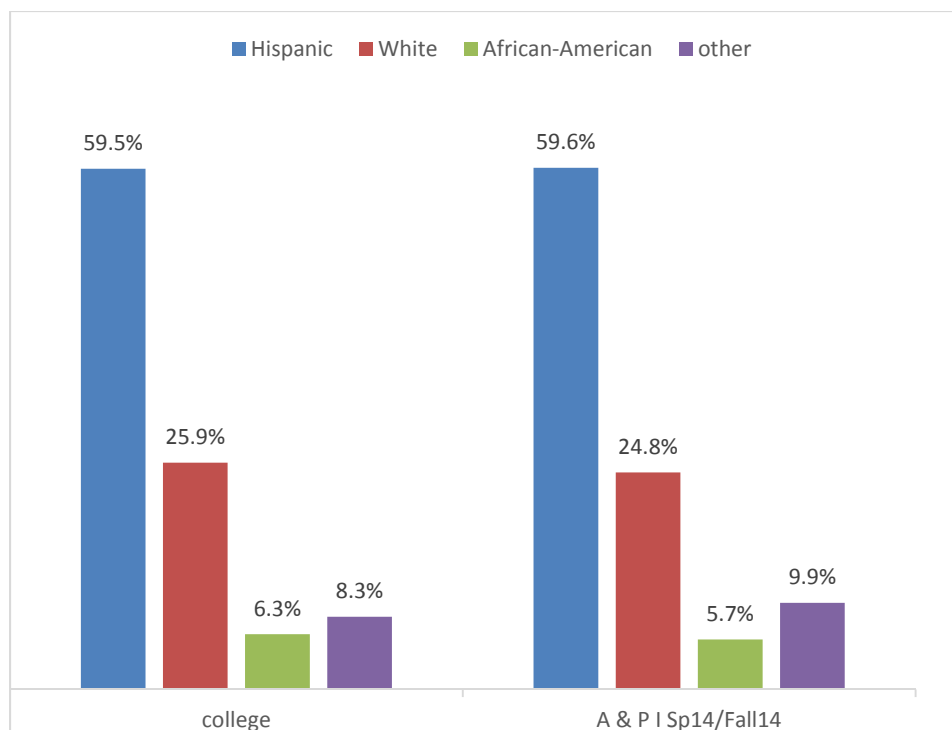
Figure 10. Ethnicity comparison of college population with students using textbooks & e-book combined.
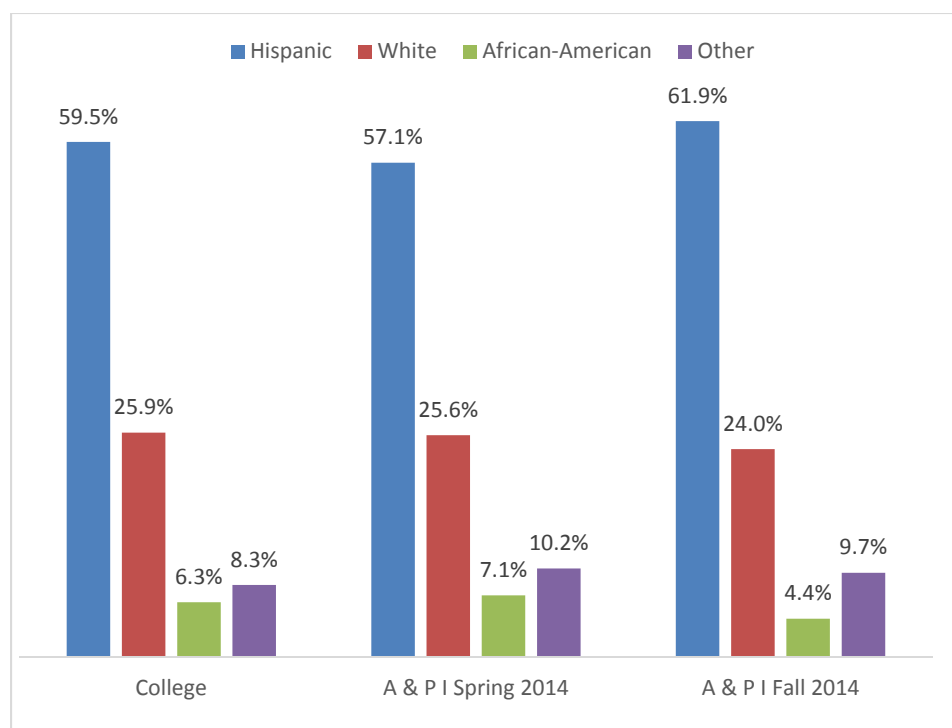
Figure 11. Ethnicity comparison of college population with students separated by spring 2014 (textbooks) and fall 2014 (e-books).

Success, therefore, is the dependent variable and has been coded as "successful outcome" and "unsuccessful outcome."

The independent variable is the type of book used in the Human Anatomy and Physiology I course. A traditional textbook was used for the spring 2014 semester and has been coded *textbook (Sp14)*. An e-book was used for the fall 2014 semester and has been coded *e-book (Fall 14)*. The variables gender, age, and ethnicity have also been examined as covariates to ascertain the possible impact on student success.

Research question 1. To what extent does using an e-book, instead of a traditional textbook, make a difference on student learning outcomes in Human Anatomy and Physiology I?

In order to research question 1, a chi-square test of independence was calculated to compare student learning outcomes to the type of textbooks used. The results of the analysis showed no significant relationship (χ^2 (1) = 1.241, n = 686, p = .265) between the student learning outcomes and the type of textbooks used for the course (Table 4). The student learning outcomes (success) were independent of the type of textbooks used. An additional illustration that student learning outcomes (success) were independent of the type of books used may be seen in Figure 12. The chart shows a similar success rate regardless of the type of books used.

To investigate further whether using an e-book instead of a traditional textbook made a difference on student learning outcomes in the Human Anatomy and Physiology I courses, a Kruskal-Wallis test was conducted comparing the student's grade to the book type. No significant difference was found (H(1)= 0.346, p > .05), indicating that the

Table 4

Book Type Versus Outcomes and Chi-Square Tests of Independence

	Variable	*Textbook (Sp14) (n = 324)*	*E-book (Fall14) (n = 362)*	*Test statistics*
OUTCOMES	Successful (63%)	197 60.8%	235 64.9%	$\chi^2(1) = 1.241$, p = .265, Cramer's V = .043
	Unsuccessful (37%)	127 39.2%	127 35.1%	n = 686

Note. 0 cells (.0%) have expected count less than 5.
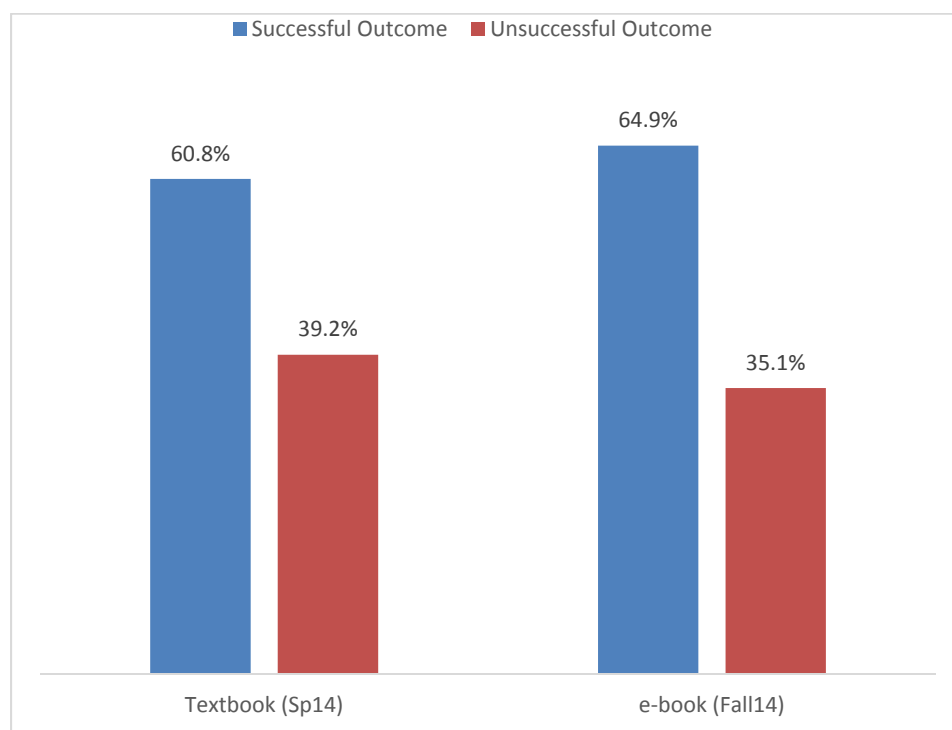
Figure 12. Learning outcomes of students using textbooks versus e-book.

groups did not differ from one another. Using an e-book instead of a traditional textbook did not

influence the student's grade in Human Anatomy and Physiology I (Figure 13).
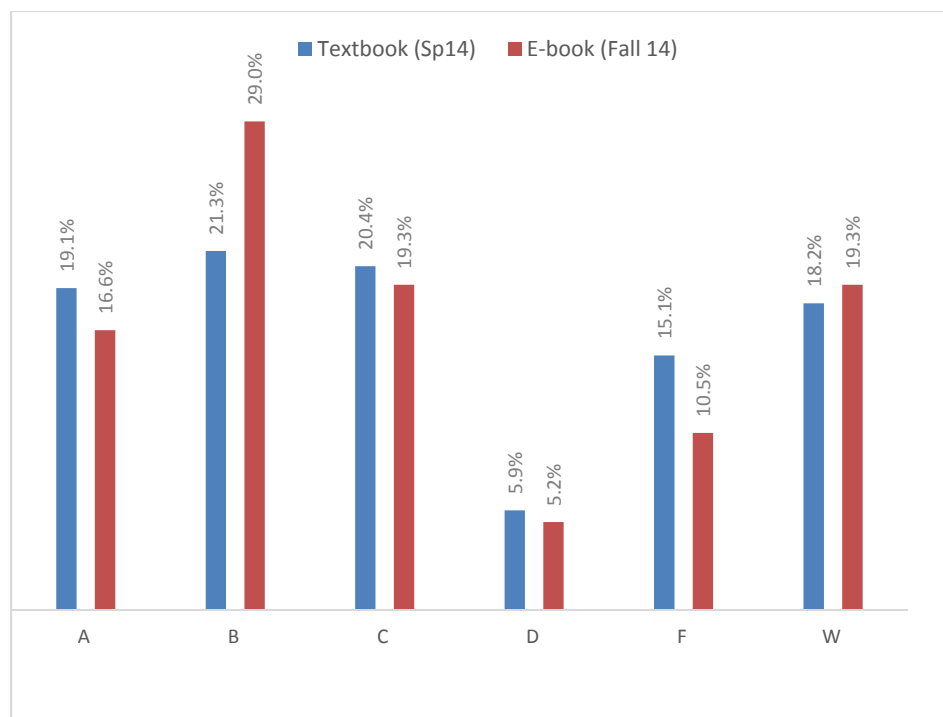
Figure 13. Grades of spring 2014 (textbooks) and fall 2014 (e-book) students.

Research question 2. To what extent do demographic variables such as gender, age, and ethnic background make a difference in student learning outcomes in Human Anatomy and Physiology I if they use an e-book instead of a traditional textbook?

In order to determine if the covariates gender, age, and ethnic background affected student learning outcomes in Human Anatomy and Physiology I if they use an e-book instead of a traditional textbook, bivariate and multivariate analyses were performed. A Mann-Whitney U test, a Kruskal-Wallis test, and a chi-square test of independence were performed to compare group differences between gender and course grade, ethnicity and course grade, and to compare student learning outcomes to ethnicity.

Finally a logistic regression analysis was performed to measure prediction of whether student learning outcomes (success) in Human Anatomy and Physiology I differed if students used an e-book instead of a traditional textbook, based on gender, age, and ethnic background.

A Mann-Whitney *U* test was calculated examining whether gender impacted a student's grade in Human Anatomy and Physiology I if they use an e-book instead of a traditional textbook. No significant difference in a student's grade in Human Anatomy and Physiology I was found (U = 37691.50, p > .05). A student's gender has no effect on their grade in Human Anatomy and Physiology I (Figure 14).
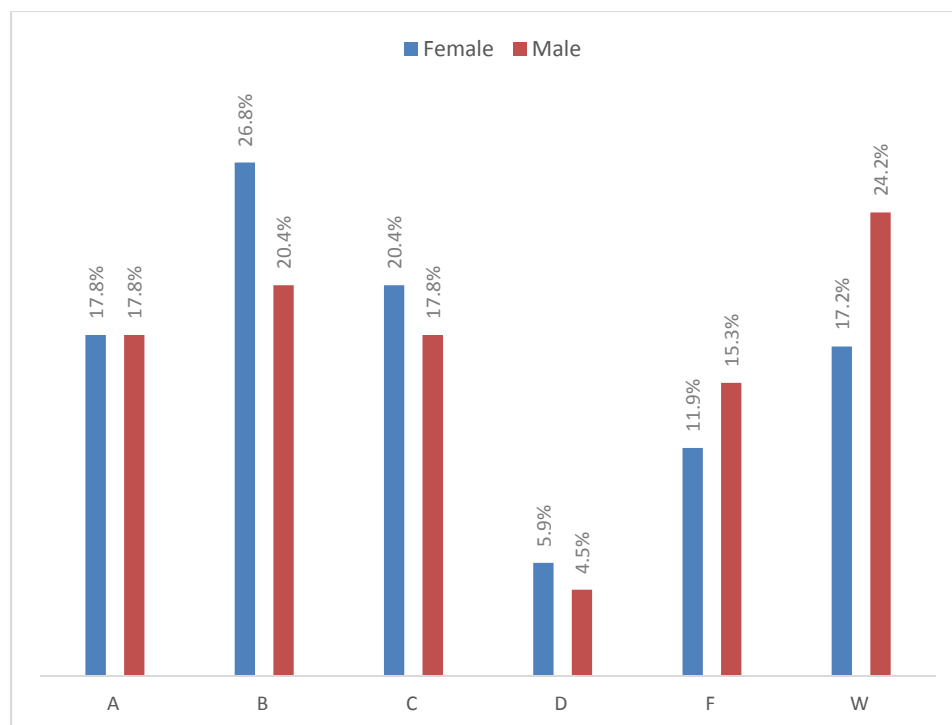
Figure 14. Gender comparison with grades of students.

A Kruskal-Wallis test was conducted comparing students' ethnic backgrounds and grades in Human Anatomy and Physiology I. A significant result (H(3)= 31.69, $p < .01$) indicated that the groups differed from each other. Ethnic background did influence the student's grade in Human Anatomy and Physiology I (Figure 15).

A chi-square test of independence was performed to demonstrate further that ethnicity does impact a students' learning outcomes in Human Anatomy and Physiology I. The results of the analysis showed a significant relationship ($\chi^2(1) = 19.353$, $n = 686$, $p = .000$) between

students' learning outcomes and ethnicity (Table 5), but this is independent of the type of book used.
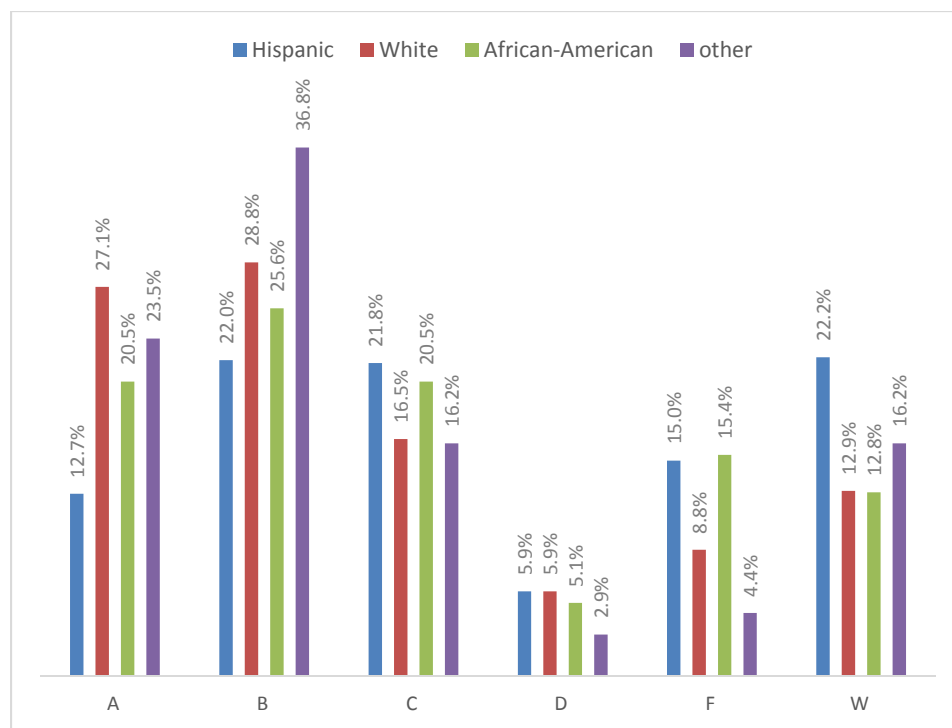
Figure 15. Comparison of Ethnicity and Grades of A & P I spring 2014 and fall 2014 semester students

Hispanic and African American students have a higher percentage of an unsuccessful outcome in Human Anatomy and Physiology I than the ethnic groups White and Other (Figure 16).

A logistic regression analysis was performed to determine the effects gender, age, and ethnic background had on students' learning outcomes in Human Anatomy and Physiology I, based on whether they used an e-book instead of a traditional textbook. A histogram for age is presented in the descriptive analysis section of this chapter (Figure 7). Frequency tables for gender (Table 6), ethnic background (Table 7), and for student learning outcomes (Table 8) are presented below.

Table 5

Outcomes Versus Ethnicity and Chi-Square Tests of Independence

	Variable	*Successful Outcomes (n = 432)*	*Unsuccessful Outcomes (n = 254)*	*Test statistics*
Ethnicity	White (24.8%)	123 72.4%	47 27.6%	$\chi^2(3) = 19.353$, p = .000, Cramer's V = .168 n = 686
	Hispanic (59.6%)	231 56.5%	178 43.5%	
	African Amer (5.7%)	26 66.7%	13 33.3%	
	Other (9.9%)	52 76.5%	16 23.5%	

Note. 0 cells (.0%) have expected count less than 5.
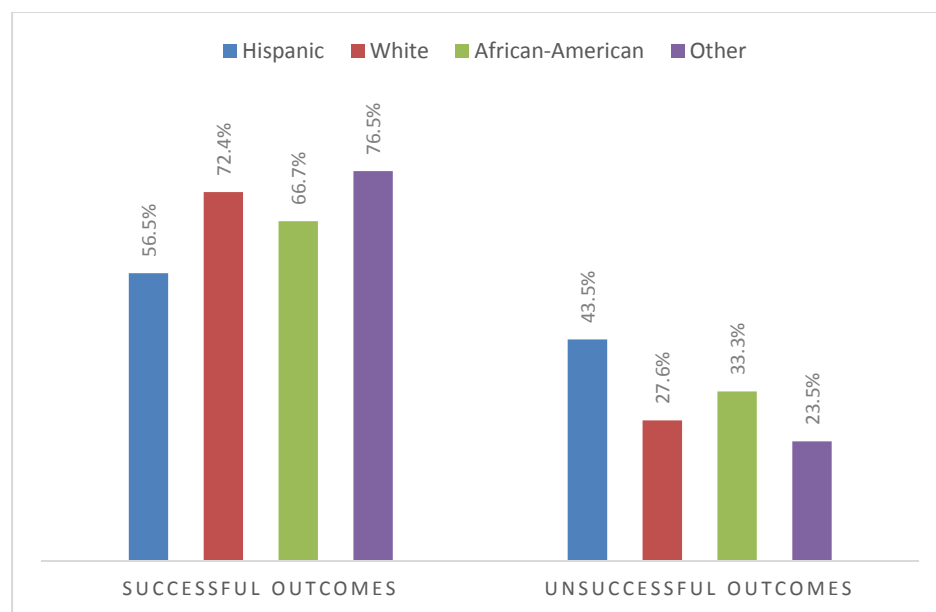
Figure 15. Ethnicity Comparison With Learning Outcomes of Students

Without the inclusion of any of the independent variables (gender, age, ethnic background, and type of textbooks used), the logistic regression produced a model that predicted the student learning outcome in Human Anatomy and Physiology I 63.0% of the time. By including just the independent variable type of book used the predicted value of the model decreased to 61.7% (Table 9). By including the independent variables gender, age, ethnic background, and type of textbooks used, the predicted value of the model slightly rose to 63.4% (Table 10).

Although the independent variables gender and ethnicity were significant (Table 11) the student's learning outcome was independent of the type of book used with or without the impact of the covariates (gender, age, and ethnic background). The significant gender result was due to the participant population being skewed heavily towards females (Figure 3). The significant ethnicity results have been previously reported (Table 5; Figures 15 and 16).

Summary

The data from this study indicate that the student learning outcomes (success) in Human Anatomy and Physiology I were independent of the type of textbook used. No significant difference was found for the student learning outcomes (success) whether the student used a traditional textbook or an e-book. While gender (because of the skewed nature of this data set) and ethnicity did affect students' learning outcomes in Human Anatomy and Physiology I, the results were not because of the type of textbooks used for the course.

Table 6

Frequency Table of Students' Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	157	22.9	22.9	22.9
	Female	529	77.1	77.1	100.0
	Total	686	100.0		

Table 7

Frequency Table of Students' Ethnic Background.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	170	24.8	24.8	24.8
	Hispanic	409	59.6	59.6	84.4
	African American	39	5.7	5.7	90.1
	Other	68	9.9	9.9	100.0
	Total	686	100.0		

Table 8

Frequency Table of Students' Learning Outcomes.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Successful Outcome	432	63.0	63.0	63.0
	Unsuccessful Outcome	254	37.0	37.0	100.0
	Total	686	100.0		

Table 9

Classification Table for Logistic Regression.

Observed		Without Predictors			Predicted (with book type included)		
	Outcome			Percent Correct	Outcome		Percent Correct
		Successful Outcome	Unsuccessful Outcome		Successful Outcome	Unsuccessful Outcome	
Outcome	Successful Outcome	432	0	100.0	386	46	89.4
	Unsuccessful Outcome	254	0	.0	217	37	14.6
	Overall Percent			63.0			61.7

Note: Constant is included in the model, the cut value is .500, $R^2 = .048$ (Nagelkerke).

Table 10

Classification Table for Logistic Regression.

Observed		Without Predictors			Predicted (with covariates included)		
	Outcome			Percent Correct	Outcome		Percent Correct
		Successful Outcomes	Unsuccessful Outcomes		Successful Outcomes	Unsuccessful Outcomes	
Outcome	Successful Outcomes	432	0	100.0	415	17	96.1
	Unsuccessful Outcomes	254	0	.0	234	20	7.9
	Overall Percent			63.0			63.4

Note: Constant is included in the model, the cut value is .500, $R^2 = .052$ (Nagelkerke).

Table 11

Logistic Regression Predicting Student Learning Outcomes.

	Predictor	B	S.E.	Wald	df	Sig.	Exp(*B*)
	Gender	.409	.190	4.658	1	.031	1.505
	Age	-.008	.011	.449	1	.503	.992
Ethnicity	White			19.047	3	.000	
	Hispanic	.238	.335	.506	1	.477	1.269
	African American	.934	.305	9.408	1	.022	2.546
	Other	.423	.447	.895	1	.344	1.527
	Book type	.238	.162	2.143	1	.143	1.268
	Constant	-1.213	.412	8.661	1	.003	.297

Chapter 5: Discussion and Recommendations

Purpose of Research Study

The purpose of this ex post facto, quantitative study was to compare student learning outcomes, as measured by final grades, in Human Anatomy and Physiology I courses using e-books (fall 2014 semester) versus courses using traditional textbooks (spring 2014 semester) at a two-year public community college in South Texas.

The findings of this study indicate that the type of textbooks used in Human Anatomy and Physiology I courses does not impact students' learning outcomes. Students using an e-book were as successful in the course as students who used a traditional textbook. The implications of these results will be discussed by examining subsequent topics in the remainder of this chapter. These topics will connect constructivist learning theory to why using an e-book does not affect students' success in the course; examine why Hispanic students in this study exhibited the lowest success rate in the Human Anatomy and Physiology I course; discuss the future of textbooks in higher education; and explore current trends that textbook publishers are pursuing. The chapter will conclude by looking at the repercussions of using e-books for students and educators, and recommendations for future research.

Summary of Results

The results of this study indicate that the student learning outcomes (success) in Human Anatomy and Physiology I were independent of the type of textbooks used. No significant difference was found for student learning outcomes (success) whether the students used traditional textbooks or e-books. While gender (because of the skewed nature of this data set) and ethnicity did make a difference in students' learning outcomes in Human Anatomy and Physiology I, these results were not because of the type of textbooks used for the course.

Theoretical Inferences

As discussed in chapter 1, learning a subject as difficult as human anatomy and physiology involves mastering basic concepts and definitions, as well as building upon that information to gain a conceptual understanding of more complex material. This process of constructing knowledge from prior learning is key to understanding human anatomy and physiology. Human anatomy and physiology textbooks, whether in electronic or printed form, are organized in this manner: the first chapters of the book present simple, less complex material and definitions; the middle to the latter half of the book present more complicated and difficult, conceptual material.

Human Anatomy and Physiology I is one of the most difficult courses to complete successfully and has a high failure rate (Hopper, 2011). In addition to using constructivist pedagogy to teach Human Anatomy and Physiology I, educators have found that using active instructional techniques is key to students' success (Nottingham & Verscheure, 2010). Publishers of human anatomy and physiology books are very aware of the importance of incorporating active learning practices into the content of the textbook (Hopper, 2011). Traditional textbooks use self-tests and other metacognitive devices in the text to help facilitate student learning.

E-books have the ability to include not only traditional content used in printed textbooks, but can also incorporate hyperlinks, animation, and multimedia in the body of the narrative. In this study, students using an e-book had just as successful learning outcomes as did students who used a traditional textbook, quite possibly because of the additional digital features of e-books. Although there were no significant differences in success between the two groups of students in this study, the participants who used an e-book had a 65% successful outcome in the course versus 61% (Figure 12) for those students who used a traditional textbook.

Another important aspect of the successful leaning outcomes of students using an e-book was the social media connection. Over one-third of the students surveyed by Denoyelles et al. (2015) found that the ability to link and share course content on social media—sites like Facebook—an important feature in the decision to use an e-book. Social media sites are the 2015 version of Social Constructivist learning theory and directly incorporate Vygotsky's (1978) zone of proximal development principle. Hyperlinks incorporated into e-books facilitate this principle allowing a less knowledgeable student to reach out to a more proficient student on social media for help and support.

The outcomes of this study demonstrate that the advantages of e-books outweigh the negative aspects discussed in chapter 2. Student learning outcomes in Human Anatomy and Physiology I were at the same level for students using e-books because of the book's built-in features. These features, termed the e-book effect, combine aspects of constructivist, social constructivist, and active learning that allow students to progress through Bloom's Taxonomy to gain mastery of the subject matter (Figure 17). Further research needs to be conducted in order to validate this approach to explaining e-book efficacy.
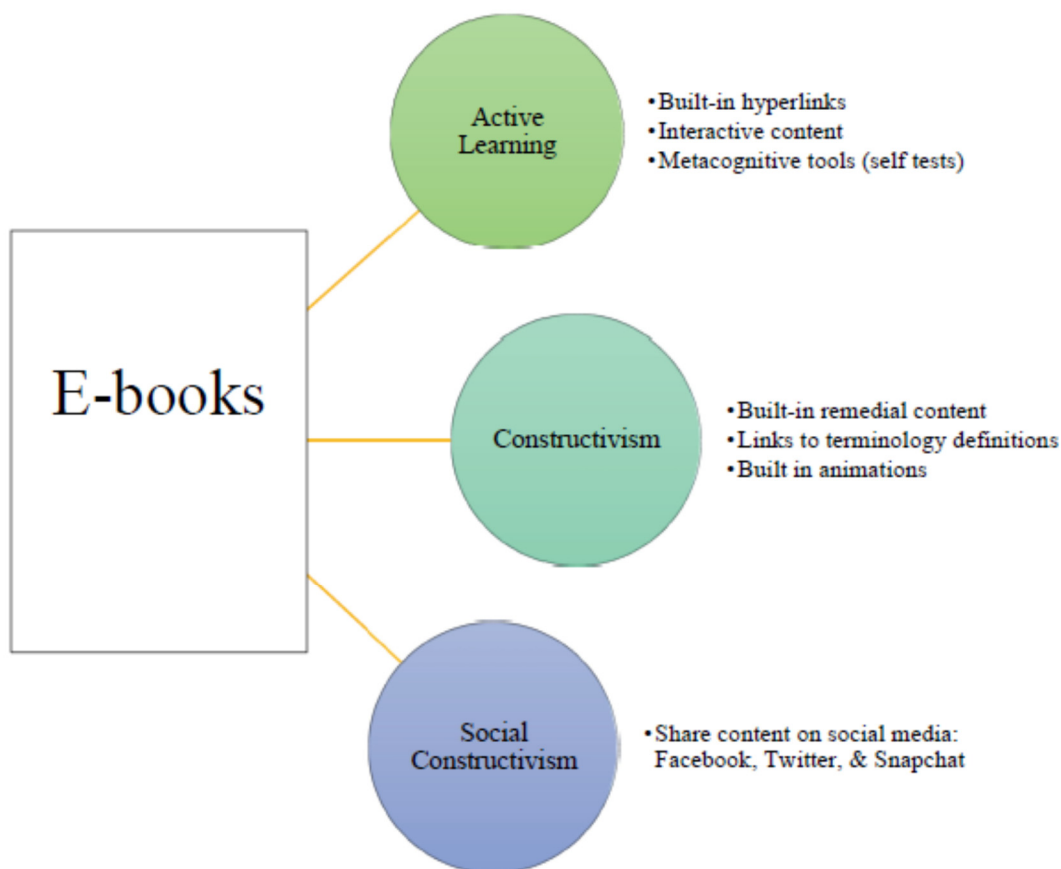
Figure 16. E-book Effect.

Higher education textbook publishers must never lose sight of how an individual learns. In this study, students who used an e-book were slightly more successful than students who used a traditional textbook because e-books better incorporate active learning of the content. The other important factor is e-books' insertion of hyperlinks into the narrative, allowing students to review concepts they may be lacking but find necessary to attain in order to construct new knowledge.

Hispanic Students' Success Rate

Hispanic students in this study exhibited the lowest success rate in the Human Anatomy and Physiology I course. The Hispanic students had the highest percentage unsuccessful outcome

(43.5%) in Human Anatomy and Physiology I, and the lowest percentage successful outcome (56.5%) in Human Anatomy and Physiology I than any other ethnic group (Figure 16). This result could be due to several influences unique to the Hispanic culture. These factors include socioeconomic status as first generation college students and family commitments.

Much has been written about the digital divide and the information technology literacy hurdle that Hispanic students encounter when they begin in higher education. Jones, Johnson-Yale, Millermaier, and Pérez (2009) conducted a study that found Hispanic students' first computer use and exposure to the Internet was at school, not at home, due to socioeconomic standing. Further exacerbating this issue is the quality of secondary education that Hispanic students receive in schools located in areas of high poverty with inadequate funding due to a low tax base. This situation results in the Hispanic student not being college ready: requiring remedial courses, which increases the overall cost of college, increases the time it takes to graduate, and produces higher attrition rates (Alkhasawneh & Hargraves, 2014; Fike & Fike, 2008).

Another difficulty that many Hispanics face is being a first generation college student, receiving no guidance or empathy from parents (Maceli & Box, 2010). Because the family does not understand what is required to be a successful college student, students are often required to keep prior family commitments, such as working at a part-time job and caring for younger siblings or grandparents (Cox, Joyner, & Slat, 2011).

In many cases, the combined effect of these obstacles results in a Hispanic student performing poorly in higher education courses (Alkhasawneh & Hargraves, 2014; Cox et al., 2011; Jones et al., 2009). As demonstrated in this study, these roadblocks in all likelihood

contributed to Hispanic participants' unsuccessful outcomes in the Human Anatomy and Physiology I course.

Current Trends and the Future of Textbooks in Higher Education

Publishers of higher education books are recognizing students' desire to use Smartphones, tablet computers, and laptop computers to integrate and access course content across mobile, digital devices. More and more institutions of higher learning will be more receptive to adopting e-books as research like this study validates the lack of difference in student learning outcomes with e-book use. The following section will discuss CourseSmart. a tool used by publishers to provide e-books and digital course material to students (Vitalsource Technologies, 2015). This part will also briefly examine use of Learning Management Systems such as Canvas and Blackboard, which integrate e-book content into college courses, and it will conclude with a brief discussion of the future of textbooks in higher education.

CourseSmart. In 2007, several publishers of higher education textbooks (Bedford, Cengage Learning, Freeman & Worth Publishing Group [Macmillan], McGraw-Hill Education, John Wiley & Sons, and Pearson) collaborated to form a company that would provide a digital platform and mechanism to deliver e-books to its customers (Vitalsource Technologies, 2015). The creation of CourseSmart saved the publishers millions of dollars by providing instructors electronic copies of evaluation textbooks instead of printed textbooks.

The real genius of CourseSmart resided in transitioning students into using online, supplemental, digital course material by including access codes in printed textbooks. This hybrid system between the printed textbook and the additional online learning resources introduced not only students to the power of digital content, but also instructors and administrators at institutions of higher education. Professors could now link online publisher resources into

lectures, reading assignments, and homework. Colleges could now include the cost of the students' textbook in tuition fees and simply email the student a hyperlink to access the e-book without ever waiting in line at the bookstore.

There are three aspects to delivering digital content to students: the access device, the software on the access device, and the content itself (McCarthy, 2011). The genius of the CourseSmart system is that it does not matter what type of device or software the consumer uses to view the material. The content is the critical product provided by the publishers.

Proponents for the use of e-books in higher education courses will argue that this study (and others like it) indicates that it is time for the transition away from traditional textbooks to occur; however, publishers realize that many students still prefer to hold a printed book in their hands. CourseSmart provides this function with a hybrid system that can be all digital, or partly digital, whatever the student and instructor desire.

Learning management systems. Most colleges and universities use some type of Learning Management System (LMS), such as Blackboard, Canvas, Moodle, Skillsoft or the hundreds more currently available (Pappas, 2014). These systems allow instructors to post content, create discussion boards, give exams, and to give access to reading material. With the use of LMS, instructors can provide links to particular passages or content in students' e-book. Educators can also link in-class lectures to book content, have students access homework keys with direct links to the pertinent section of the course e-book, and have linked to the course e-book other e-books that provide review material necessary for understanding current subject matter.

Future of textbooks in higher education. Use of e-books in higher education is one of the most important aspects of e-learning. E-learning allows individuals anywhere in the world to

access educational content that once was only available in brick and mortar buildings on college campuses. A user of an e-book does not have to be connected constantly to the Internet to view content. Once the e-book is downloaded on a reading device, access is available as long as the reader is functioning. This system is the future of textbooks in higher education—content delivered in an electronic format that is viewable on numerous devices ranging from Smartphones to smart video monitors, and dozens of devices in-between (iPad, Kindle, Nook, and so on).

Repercussions of E-Book Use

Reynolds (2011) states that by 2018 the e-book will be the most prevalent type of book used in higher education. While this study has shown that using an e-book instead of a traditional textbook does not affect a student's learning outcomes, but what other consequences of transitioning to e-books are there for students, faculty, and administrators of institutions of higher education? The following section will examine the advantages and disadvantages of using e-books instead of a traditional textbook.

Advantages. E-books offer many benefits over traditional textbooks to students, instructors, and administrators of institutions of higher education, as well as to publishers and authors of higher education books. The cost savings associated with using an e-book is significant to all parties involved. Because publishers do not have to manufacture and distribute a printed book, the cost of production is greatly reduced. Publishers no longer have to distribute hard copies of evaluation textbooks to instructors; they simply send links to professors and ask them to access the textbook virtually in online bookshelves. To create a new edition or correct errors in a book, a publisher simply modifies a file. There is no need to distribute errata or

redistribute new edition books. These cost savings, realized by the publisher, are passed to students, colleges, and universities.

Students not only save money on books, but also enjoy the many conveniences that e-books offer. Instead of carrying a heavy backpack with a different printed textbook for each class, a student can simply have one e-book reading device that can access content for all of their courses. The student can even access the e-book on a Smartphone while at the gym, on a bus, or waiting in line to make a purchase. Students can use social media platforms, like Facebook, Instagram, Snapchat, and Twitter, to share and discuss the course content of the e-book, which is already uploaded in a digital format.

Professors and instructors may effortlessly link content from their course e-books to lecture slides and class notes. Through LMS, they can stimulate discussion board conversation using hyperlinks to e-book content. Educators can incorporate more reading assignments into their courses by accessing resources available in free massive open online courses (MOOCs). The methodology of retrieving digital content is essentially the same and would not require any additional skill set from students.

Disadvantages. Although this study demonstrated that student learning outcomes did not depend on the type of book used, the results only apply to this particular population of students in a Human Anatomy and Physiology I course. Many students have difficulty using technology of any type. Because there are numerous variations of e-book readers, each with its own subtleties, a student may find it difficult to get help with the device. Help resources may or may not be available on every campus.

Saving students money has been listed as an advantage of using e-books over traditional textbooks. Economically disadvantaged students, however, may not be able to afford the initial

cost of an e-book reader or have computer access at home. They also lose the ability to resell the used textbook to the bookstore at the end of the semester. Furthermore, many colleges transitioning to e-books have already negotiated contracts with publishers to include the e-book in the tuition cost for a particular course. For all intents and purposes, this practice takes away the opportunity for students to find a lower price for the book. Also, if students drop the course or withdraw from school after the last refund date, they are unable to recoup any cost associated with the book.

Recommendations for Future Research

This study focused on freshmen and sophomore students at a public two-year community college enrolled in a Human Anatomy and Physiology I course. Future research should look at students enrolled in different disciplines. It should also examine junior and senior level courses along with graduate level courses. Changing the setting from a public institution to a private institution should also be studied; likewise from a two-year college to a four-year university.

Instead of a comparative approach, researchers might incorporate a more rigorous quantitative approach, such as an experiment design with control groups using traditional books and the experimental group using an e-book. Such factors as exam scores and homework grades could be considered along with students' final course grades.

Another recommendation is to include a qualitative aspect to the research design. This mixed methodology could provide insight into students' performance based on the type of book they used.

Conclusion

The implications of this research study by itself are very limited. For this particular set of students at this particular community college, using an e-book verses a traditional textbook did

not make a difference in the students learning outcomes (success) in their Human Anatomy and Physiology I course. Together with other studies such as Doering et al. (2012), McCarthy (2011), and Rockinson-Szapkiw et al. (2013), however, the theme of e-books as educational tools just as effective as a traditional textbook begins to emerge.

As more research studies and data are published to confirm or contradict the results of this study, higher education policy makers will have the information available to make knowledgeable choices regarding adoption of e-books in college and university classrooms.

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Appendices

Appendix A

Institutional Review Board Approval Form University of the Incarnate Word

UNIVERSITY OF THE
INCARNATE WORD

4/15/2015

Howard Marquise
440 Irongate Ridge
San Antonio, Texas 78253

Dear Howard:

Your request to conduct the study titled *Examining Student's Course Outcome in First Year Anatomy and Physiology Using E-Books Versus Traditional Textbooks* was approved by exempt review on 4/15/2015. Your IRB approval number is 15-04-011. Any written communication with potential subjects or subjects must be approved and include the IRB approval number. Electronic surveys or electronic consent forms, or other material delivered electronically to subjects must have the IRB approval number inserted into the survey or documents before they are used.

Please keep in mind these additional IRB requirements:
- This approval is for one year from the date of the IRB approval.
- Request for continuing review must be completed for projects extending past one year. Use the **IRB Continuation/Completion form.**
- Changes in protocol procedures must be approved by the IRB prior to implementation except when necessary to eliminate apparent immediate hazards to the subjects. Use the **Protocol Revision and Amendment form.**
- Any unanticipated problems involving risks to subjects or others must be reported immediately.

Approved protocols are filed by their number. Please refer to this number when communicating about this protocol.

Approval may be suspended or terminated if there is evidence of a) noncompliance with federal regulations or university policy or b) any aberration from the current, approved protocol.

Congratulations and best wishes for successful completion of your research. If you need any assistance, please contact the UIW IRB representative for your college/school or the Office of Research Development.

Sincerely,

Rebecca Ohnemus

Rebecca Ohnemus, MAA, CRA
Research Officer
University of the Incarnate Word IRB

Appendix B

Institutional Review Board Approval Form Northwest Vista College

Northwest Vista College
Institutional Review Board

Review of Proposed Research Involving Human Subjects

Project Title: Examining Student's Course Outcome in First Year Anatomy and Physiology Using E-Books Versus Traditional Textbooks

Principle Investigator Information:
Name: Howard Marquise
Phone: 210-486-4355 or 210-846-4011
Fax: 210-486-9097
Email: hmarquise@alamo.edu
NVC affiliation: Program Coordinator & Instructor – Advanced Water Treatment

Other persons to contact (Provide relevant information below)

Project Funding Source:

_____

To be completed by NVC IRB:

Date submitted to NVC-IRB Chair: RECEIVED APR 1 5 2015

Date of review by NVC-IRB: MAY 2 5 2015

NVC-IRB Proposal Determination:
[X] Exempt Research
[ ] Expedited Review
[ ] Full IRB Review

IRB approval: APPROVED MAY 2 6 2015

Starting Date: June 1, 2015

Estimated Completion Date: December 31, 2015

Information on file with NVC-IRB:

See addendum

Appendix C

Code Book

Variable	Data type	Description
Age	Scale	Student's age
Age Groups	Nominal	Student's ages grouped (under 25=1, 26-35=2, 36-45=3, 46 and over=4)
Booktype	Nominal	Type of textbook student used (textbooks (Sp14)=1, e-book (Fall 14)=2)
Ethnicity	Nominal	Description of student's race (White=1, Hispanic=2, Black_Afr_Amer=3, Other=4)
Gender	Nominal	Student's sex (Male or Female) (Male =1, Female=2)
Outcome	Nominal	Student's course outcome (Successful Outcome=1, Unsuccessful Outcome=2)