THE DYNAMIC ELECTRONIC TEXTBOOK:
ENHANCING THE STUDENT’S LEARNING EXPERIENCE

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CHAPTER I: THESIS INTRODUCTION AND RATIONALE

FOREWORD

The origins for the concept of this thesis came from two distinct, though strangely linked personal experiences. First, in early 2010 I became the proud owner of an Apple iPhone. This was the first “smart phone” that I had ever owned, with a touch screen interface and capabilities of internet, email, video, and apps. As I explored my new device, I came upon the iBooks App, a free application that allows you to download and read electronic books (e-books) directly on your iPhone. This application comes with one free e-book, *Winnie the Pooh*, which was already loaded in the iBooks Library. I was immediately fascinated by this new found technology as I examined the functionality of this simple book in its new digital format. The overall experience was pleasing, though my mind questioned how well the user interface would handle a larger volume of text, or a topic of much greater complexity.

Later that year, I came upon an article on the website AIGA.org entitled *Stand Back for the Exploded View!* In this article, Patton (2009) discussed how the exploded diagram has been physically manifested in a variety of museums across the country. Environmental graphic designers have employed the technique to help educate their audience in an interesting way, especially in cases where the technology would be difficult to understand otherwise. One example mentioned in the article was a display of an exploded view of a racing engine, with all of the parts pulled out and suspended manually. This striking design approach grabs the audience’s attention and engages them in dynamic ways. There was one simple phrase from the article that caught my attention and seemed to summarize the whole idea perfectly: “A mechanical drawing brought to life.”

In my mind there existed a strong association of an exploded diagram with that of an instruction manual or school textbook. “A mechanical drawing brought to life.” As I read this quote, my thoughts jumped to my freshman chemistry textbook. I remembered struggling through the confusing subject matter of atoms, molecule structures, compounds, and various reactions. I also recalled the puzzling technical illustrations and formulae structures. I thought about how these archaic models and the information that they contained could be “brought to life” in such engaging ways as that of the above described engine display. Thinking back on my iPhone e-book experience, I pondered the vast opportunities in which e-book technology (and the devices associated with such) could be coupled with the technical information found in that of a college textbook (not just *Winnie the Pooh*) to elevate a student’s understanding of a subject matter.
STATEMENT OF THESIS

How contemporary education theory could support and justify the design of a dynamic and interactive electronic textbook created for a tablet PC, enhancing the student’s learning experience and fostering educational growth.

New technologies and recent advances have caused many publishers to rethink their approach to the traditionally print-based industry of newspapers, magazines, and books. In the past few years, electronic reading devices (e-readers) have flourished in the leisure-reading market. This shift from the traditional physical book to the read-only format electronic book (e-book) has been a much slower process, however, in the education market. For decades now, academic book publishers have been safeguarded from any considerable change that would cause them rethink their lucrative business model and disproportionate market power. However, with increasingly aggressive demands for digital content, electronic textbooks (e-textbooks) will play a major role in changing what was once one of the most conventional of industries.

“The digital age has spawned an e-publishing revolution and cultivated the growing prevalence of e-books” (Carreiro, 2010, p. 232). Breakthroughs in technology allow e-books to be downloaded, customized, printed, or sent instantly anywhere. A rapidly evolving culture of information-seeking students have embraced these new technologies as they increasingly expect the immediacy and familiarity of digital content. The academic publishing industry must respond to this growing demand. “How individuals access digital content will depend largely on how academic publishers adapt to the new digital environment” (Janke, 2011, p. 153).

Currently, the visual presentation of the e-textbook is little more than an a glorified PDF replica of its printed counterpart. This translation, while seemingly practical in terms of storage and portability, does nothing to improve the overall learning experience of the student. However, with the recent release of a practical and affordable tablet PC that utilizes advanced hardware and software capabilities (e.g. the Apple iPad), new possibilities of interactive information design empower visual communicators to reimagine textbook design and layout. Even relatively minor enhancements to e-textbook design have “the potential to alter our reading habits, affect the organization of our intellectual life, and change the venues of our reading experiences” (qtd. in Carreiro, 2010, p. 232).

This thesis will explore how the educational content of a traditional textbook, when realized in an interactive, multimedia, and multimodal e-textbook format, could improve the overall education of
a given subject matter to the modern-day student. Taking advantage of the advanced hardware and software capabilities of the Apple iPad, an enriched e-textbook could accomplish this by employing overall design decisions rooted in sound education theory that is supportive of today’s digital youth.

This thesis examines how contemporary education theory could support certain e-textbook design features, enhancing the student’s learning and fostering educational growth. Recent advancements in technology have allowed the e-textbook to become a viable tool for 21st century education. In order to understand the present context, one must first consider, among other things, the impact that technology has had on society, art and graphic design, and education in-general.
CHAPTER II: BACKGROUND AND CONTEXT

TECHNOLOGY AND SOCIETY

Stephen Hawking (2004), a celebrated theoretical physicist and cosmologist, writes that:

Computers obey Moore’s Law put forward by Gordon Moore of Intel. This says that their speed and complexity double every 18 months. Clearly this cannot continue indefinitely. However, it will probably continue until computers have a similar complexity to the human brain. (p.15)

Technology is omnipresent. It encompasses our world and the people in it. Satellites orbit our planet, cameras envelop our streets, and wireless internet signals abound our homes and businesses. We rely on technology for information, ease of living, and entertainment. At an accelerating rate, it grows amazingly more complex by the day (with no indication of slowing).

Currently, the most significant technology that consumes our daily lives is the Internet. The Internet, the World Wide Web, and associative products have penetrated society at, as alluded to above, exponential rates. As Rosen (2010) indicates (see Table 1.0), it took many years for older technologies (e.g. radio and telephone) to penetrate society, while newer technologies (e.g. Facebook and YouTube) took substantially less time.

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<tr>
<th>Technology</th>
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<td>Blogs</td>
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Number of years between introduction and purchase or use by 50 million consumers. This is the number consumer psychologists say indicates that a product has penetrated society. (Rosen, 2010, p. 9)
The numbers shown in Table 1.0 are eye-opening. Some might argue, however, that these figures are subservient due to the varied nature of the technologies (i.e. hardware versus software). This is probably correct to some extent. Regardless, recent sales reports from Apple seem only to support Rosen’s observation of society’s increasing appetite for all things technological. In May of 2010, Apple announced that it had “sold one million iPads in 28 days—which was less than half of the 74 days it took the iPhone to achieve this mark” (Buskirk, 2010). Also, nearly ten months later, Apple declared that it had shipped over 100 million iPhones since 2007 and over 15 million iPads since January of 2010 (Mills, 2011). These overwhelming statistics indicate that “Those children born in the 1990s and the new millennium are turning out to be even more enmeshed with technology than their older brothers and sisters” (Rosen, 2010, p. 13). This constant, deepening immersion in digital technologies has caused a fundamental shift in the way today’s children think and process information (Prensky, 2001). This phenomenon affects many aspects of the modern-day world, especially in how best to educate its youth (as will be discussed later in this thesis).

TECHNOLOGY IN ART AND GRAPHIC DESIGN

As technology continues to gain increasing significance in our daily lives, the deep immersion of today’s society in media rich technologies grows ever more apparent. Because of this, many new opportunities and responsibilities are developing for artists and graphic designers alike. But what is the role of technology in art and graphic design?

The integration of technology and art is not a recent notion of a computerized society. This concept has a strong foundation in the ideals of the 20th century school of the Bauhaus. Founded by Walter Gropius in 1919 in post-war Germany, the Bauhaus was a school of design noted for its synthesis of technology, craftsmanship, and design aesthetics. “Recognizing the common roots of both fine and applied visual arts, Gropius sought a new unity of art and technology as he enlisted a generation of artists in a struggle to solve problems of visual design created by industrialism” (Meggs, 1998, p. 278).

Laszlo Moholy-Nagy, a key figure of the Bauhaus and Gropius’ right-hand man, greatly influenced graphic design as we know it today. “Moholy-Nagy’s passion for typography and photography inspired a Bauhaus interest in visual communications and led to important experiments in the unification of these two arts” (Meggs, 1998, p. 281). In a lecture given in Chicago in 1937, Laszlo Moholy-Nagy outlines his vision of an educational program steeped in art and technology:

We don’t want to add to the art-proletariat that already exists. We don’t teach what is called “pure-
art,” but we train what you might call the art engineer. It is a remodeling of art—meaning we are undertaking. If our students become artists—this is their own job. We know that after they have learned to use materials, to understand space, to see color, they’ll be better artists no matter how far removed they think they are from practical life. But to you—the industrialist—we offer our services for research. We shall work on your problems. In our workshops we shall provide research possibilities for synthetic fibers, fashion, dying, printing on textiles, wallpaper design, mural painting, the use of varnishes, lacquers, sprays, and color combinations in decorating; we shall explore for microphotography, motion pictures in color and black-and-white, commercial art in posters and packages. We shall design stage display, window and shop display, exposition architecture, and all other architectural structures from a prefabricated bungalow to a factory; and we shall work with stone, glass, metal, wood, clay, and all plastics in the product design and sculpture classes... (qtd. in Stein, 1979, p. 193)

In today’s world, graphic design and technology seem more connected than ever before. In one way or another, computers play a key role in the creation of modern-day graphics and visual communication solutions. New technologies are continuously being employed by graphic designers to help them engage their audience, to better communicate an idea or context, or to make an experience more immersive or accessible. Also, today’s consumer is subject to an increasingly more diverse collection of technological devices that require thoughtful design for interface, interaction, advertising, and the like.

TECHNOLOGY, EDUCATION AND KNOWLEDGE

Merriam-Webster (2011) defines education as “the act or process of imparting knowledge or skills to another.” Likewise, learning is defined as “the act or process of gaining knowledge.” These definitions illustrate how new technologies make education and learning an everyday habit of 21st century society. How? The World Wide Web.

Education and learning is happening all of the time. They are a driving force behind every wiki, blog, product review, social network, download, video, tweet, email, message, or link. Contemporary mobile technologies allow people to access, contribute to, and interact with information on the World Wide Web whenever and wherever they desire.

In the classroom, new technologies have always been embraced and integrated into the educational
process. Enhancements in instructional technologies have changed over the years: from the chalkboard to the overhead projector, to the photo-copy machine, to the TV/VCR, to powerpoint on the computer. These technologies, which may slightly increase the efficiency of the teacher's time, are simply about the presentation of information and don't help the student—nothing is gained pedagogically. However, recent advancements revolutionize technology's role from a mere presenter of information to a powerful distributor. The role of technology in the classroom is now concerned with the access and interaction of information. Students have an improved ability to share ideas, collaborate with other students and faculty, and access supplementary resources.

Because of this, there are many people and organizations who are trying to get the best of what people have to offer within the reach of those around us (especially our students). The mantra of this movement is that 'universal access to all knowledge is within our grasp' (Kahle, 2007). This means digitizing all books, music, movies, software, etc. and making them readily available and accessible (for free) via the World Wide Web. An analogy is often made to the ancient Library of Alexandria and its collection of “all the world's knowledge.” This library is famously known for its fiery death and the destruction of its collection. Modern-day advocates seek to recreate a digitized version of this library, striving to preserve and share as much of human knowledge as possible, before it can be lost. Education activists point to initiatives of this sort as a step in the right direction in their pursuit of reliable educational resources and improved pedagogies for our youth.
CHAPTER III: COMMUNICATION IN THE CLASSROOM

The great triumph of Western intellectual history from the Enlightenment until the beginning of the 20th century rested on its ability to organize the knowledge of the world in a rational way independent of the learner, determined by some structure of the subject. Disciplines were developed, taxonomic schemes established, and all these categories were viewed as components of a vast mechanical machine in which the parts could be explained in terms of their relationship to each other, and each part contributed to making the whole function smoothly. Nowhere in this description does the learner appear. The task of the teacher was to make clear to the learner the working of this machine and any accommodation to the learner was only to account for different appropriate entry points for different learners. (Hein, 1991)

THE TRADITIONAL CLASSROOM

Davidson and Goldberg (2010) write that “the fundamental aspects of learning institutions remain remarkably familiar and have been for around two hundred years or more” (p. 2). Traditional teaching practices are commonly characterized by lecture style presentations and textbook methodologies. This traditional classroom setting, which has existed for so long, is structured primarily on the tenets of behaviorist learning theory. Behaviorism is grounded in objectivism, which assumes that there is a single reality external to individuals (Bichelmeyer & Hsu, 1999). Based on this objectivist worldview, the behaviorist learning theory argues that learning happens when knowledge is transmitted to the learner (Forcier, 1996).

The traditional behaviorist model is a teacher-centered environment where learners undergo some form of conditioning. The goal of the conditioning is to produce a behavioral result. The success of the conditioning is measured by verbal behavior (e.g. responding appropriately to a question). The behaviorist would interpret a student’s correct answer to a question as a sign of successful conditioning, and would reinforce this behavior by assigning good grades. Often, this form of conditioning (one designed to achieve desirable verbal behavior) exists as a lecture-based pedagogy (Boghossian, 2006).

Behaviorism thus views the student as a passive recipient and unreflective responder. A pedagogy of this sort has many disadvantages. Lectures fail to provide instructors with sufficient feedback about student learning and rest on the presumption that all students learn at the same pace. Often,
students’ attention spans diminish quickly during lectures and information can be quickly lost when students are passive. Also, lectures emphasize learning by listening, which is a disadvantage for students who prefer other learning styles.

This transmissive pedagogy creates a passive role for the student that consists of simply mirroring or reproducing knowledge that is provided by the instructor. “There is no subjective element to learning—either in determining what to study or in how information is interpreted, used, or understood” (Boghossian, 2006, p. 716).

**PROGRESSION TO THE MODERN CLASSROOM**

“The principle goal of education is to create men and women who are capable of doing new things, not simply repeating what other generations have done...” —Jean Piaget (qtd. in Golubchick, 1991, p. 97).

In recent years there has been a shift from the teacher-centered traditional classroom (as discussed previously) to a more student-oriented, problem-solving environment that espouses a constructivist based approach to learning. Constructivism is not a single theory, but a number of related theories and perspectives emphasizing the active role of the learner in building understanding and making sense of information. Although there are many different types of constructivism, they all share the same core idea that learners ‘construct their own knowledge.’ “Constructing knowledge means that the students are active participants in a learning process by seeking to find meaning in their experiences” (Boghossian, 2006, p. 714). Learners find meaning in their unique subjective experiences, and this result becomes knowledge. In a literal sense, knowledge is produced by the individual learner rather than processed from information received from an external source (Forcier, 1996).

A constructivist approach to teaching holds that the learner, through interaction, discovery, and experience with an object or process, creates knowledge. Instruction based upon constructivist theory places the student at the center of the learning environment. This approach emphasizes critical thinking skills such as conceptualization, analysis, synthesis, evaluation, and ultimately application of the information. Wilson (1996) defines a constructivist learning environment as “a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem solving activities” (p. 5).
BEHAVIORISM VERSUS CONSTRUCTIVISM

The essence of behaviorism completely opposes that of constructivism. Bichelmeyer and Hsu (1999) write that:

Where behaviorism views knowledge as resulting from a finding process, constructivism views knowledge as the natural consequence of a constructive process. Where behaviorism views learning as an active process of acquiring knowledge, constructivism views learning as an active process of constructing knowledge. Finally, where behaviorism views instruction as the process of providing knowledge, constructivism views instruction as the process of supporting construction of knowledge. (p. 3)

Which pedagogy is more appropriate to the modern-day student? Behaviorism and constructivism are broad teaching/learning philosophies that encompass a wide-range of models each. Exclusively using one approach over the other is not the answer. The saturation of new information technologies in teaching and learning (and in society in-general) support the more “active” principles of discovery and experience that constructivism advocates. However, there is much to be said about the overtly “passive” instruction techniques of behaviorist drills, tutorials, and rote learning.

CONSTRUCTIVISM AS ULTIMATE BENEFICIARY OF TECHNOLOGY

Technology services both behaviorism and constructivism pedagogies. However, the ultimate beneficiary is constructivism.

In the direct behaviorist model, technology does not radically change the way a lesson is taught; instead, most technology mirrors traditional instructional pedagogy (e.g. instead of using flashcards, a computer is used for the same rote drills). “Such exercises relegate technology to a secondary, supplemental role that fails to capitalize on its most potent strengths” (Stromen & Lincoln, 1992, p. 468). This model assumes that technology is neutral and fails to recognize technology’s ability to reconstruct existing methodologies.

In contrast, the constructivism model uses technology to facilitate learning, understanding, and exploration. Since constructivism emphasizes careful study of the processes by which ideas are created and developed, the advantages of technology lie in creating curricula that engages the student, challenges understanding, and encourages discovery—ultimately fostering growth and development of the mind (Stromen & Lincoln, 1992). Technology offers vast potentials of play,
experimentation, and collaboration. Because of these things, among others, technology has the ability to influence the fundamental principles of constructivist learning. Means and Olson (1997) suggest that the presence of technology facilitates a transition to greater emphasis on constructivist and project-based learning, which is not possible to achieve simply through lecture. Therefore, it is the constructivism pedagogy that truly makes significant gains by incorporating technology.
CHAPTER IV: ENHANCING THE LEARNING EXPERIENCE

Despite the revolutions wrought by technology in medicine, engineering, communication, and many other fields, the classrooms, textbooks, and lectures of today are little different than those of our parents. Yet today’s students use computers, mobile telephones, and other portable technical devices regularly for almost every form of communication except learning. (National Science Foundation Task Force on Cyberlearning, 2008, p. 12)

PROJECT INTRODUCTION

There is much room for improvement in the modern-day classroom, especially when the integration of technology is considered. A context for this thesis has been established and an evaluation of overarching classroom communication theory has been performed. Possibilities for enhancing the classroom experience will be now be explored. The subsequent chapters will investigate the background, market, target audience, existing competition, and strategy involved in designing for an improved e-textbook. The primary goal is to examine how contemporary education theory could support and justify theoretic e-textbook design features. The following research will ultimately address how the student’s learning experience can be enhanced with proposed new technology and design.

THE E-TEXTBOOK MARKET

For a few years now, people have been expecting electronic textbooks to take off in a big way: They’re cheaper than traditional textbooks, easier to carry around in a backpack, and seem like a natural progression for students who have grown up playing and working with digital devices. (Neary, 2010)

ORIGINS OF THE E-BOOK

The idea of searchable, digitized information first came from Vannevar Bush, Science Advisor to President Franklin Delano Roosevelt. In his seminal article in 1945, Bush wrote of a “memex” as a “device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility” (p. 43). This is an astounding description since it was written nearly three decades before the first electronic books
began to appear. In about 1968 Alan Kay developed the concept for the Dynabook. The original sketch of the Dynabook has an uncanny resemblance to the Amazon Kindle device of today (see Figure 1.0). Kay (2005) writes that:

Just as the book was an extension of the oral medium, so is the computer an extension of the print medium. There are many things that books can do, but computers have an extra dimension that seemed to me incredibly important, and this is key to the Dynabook idea.

Nevertheless, a few years later in 1971, the first internet e-book was born as a digitized copy of the U.S. Declaration of Independence, created by then University of Illinois student Michael Hart. Hart began with the Declaration and then added the Bill of Rights, and the whole U.S. Constitution. The Bible was added, and then Shakespeare (one play at a time). Hart went on to found Project Gutenberg, a non-profit organization set up to digitize public domain books and distribute them for free over the Internet. Project Gutenberg continues today with the same good-natured philosophy: encouragement for the creation, easy distribution, and use of e-books. Project Gutenberg (2011) is “the place where anyone can download over 33,000 free e-books to read on one’s PC, iPad, Sony Reader, iPhone, Android, or other portable device.”

Several other similar text archives were developed after Project Gutenberg. For example, the Oxford Text Archive in 1976 and the Etext Center at the University of Virginia Library in 1992. Many e-books (although this term was not used at the time) found their way onto CD-ROM in the 1980’s. The 1990’s
saw a rise in electronic publishing, as well as the emergence of aggregators such as netLibrary, Questia, ebrary, Credo Reference, and Knovel. These companies acquired the rights to titles from many publishers and brought them together in subject collections which could be directly licensed from the aggregator (Vassiliou & Rowley, 2008). From about the mid-90’s onward, commercial publishers (Penguin, Routledge, Cambridge University Press, etc.) began making titles available electronically, and large numbers of e-books began to appear on the web.

**THE E-BOOK MARKET**

In May of 2007, the Association of American Publishers (2007) noted a significant rise in e-book sales—a “24.1% increase in 2006 at $54 million, with a compound growth rate of 65% since 2002.” By comparison, four years later in February of 2011, the Association (2011) reported that “E-books once again increased significantly on an annual basis, up 164.4% for 2010 vs 2009 ($441.3M vs $166.9M). E-book sales represented 8.32 percent of the trade book market in 2010 vs 3.20 percent the previous year.” These quick comparisons clearly indicate a growing trend toward the e-book format. But why such a recent surge in demand? The answer is the creation of a more advanced and portable electronic reading device (e-reader).

The release of the Amazon Kindle in late 2007 was an eye-opening event for future e-book interest. On its release date, the $399 device sold out in a mere 5.5 hours (Patel, 2007). The device remained out of stock for five months until April 2008. This Kindle sported a 6 inch (diagonal) 4-level grayscale display, with 250 MB of internal memory—holding approximately 200 non-illustrated titles. E-books could be downloaded and copied onto the book-sized portable device to be accessed at one’s convenience. Amazon dominated the e-reader market for the next couple of years until the release of the Apple iPad in early 2010.

**KINDLE E-READER PILOT PROGRAM**

In May of 2009 Amazon introduced a larger Kindle, the Kindle DX (see Figure 2.0), with the aim of three primary markets: textbooks, newspapers, and magazines. Upon this release, Amazon selected seven universities to participate in a 2009 Fall Semester Pilot Study. The seven universities selected were: Arizona State University, Case Western Reserve University, Pace University, Princeton University, The University of Washington, and Darden School of Business at The University of Virginia. For each of the participating universities, Kindle DXs were provided to the students for
a select number of classes. The goal of the study was to evaluate the effectiveness and overall prospects of the new e-reader technology from the perspective of higher education.

The result was complete failure. While students still appreciated the idea of lighter bookbags, cheaper books, and the consolidation of texts in a singular place, the overall functionality of the device (as well as the e-textbook software) simply did not measure up. These black-and-white PDF-style versions of textbooks were awkward and unimpressive to say the least. As one student stated in Princeton University’s *Daily Princetonian*, “Much of my learning comes from a physical interaction with the text: bookmarks, highlights, page-tearing... not to mention margin notes... all these things have been lost” (Lee, 2009).

The consensus was clear: while the Amazon Kindle is an excellent device for leisure reading, it does not satisfy the demands of a classroom environment. Though improvements have been made to the Kindle since the 2009 study, the attention of school administrators was quickly consumed by the release of the sleek and powerful Apple iPad (see Figure 3.0).

**ENTER THE APPLE iPAD**

In April of 2010 the Apple iPad entered the tablet computer marketplace in notable fashion. In the
next six months, Apple would go on to sell 14.8 million iPads worldwide, representing 75% of all tablet PC sales by the end of the year (Cellan-Jones, 2011). These sales were dominated by the 18-34 year old age group, an ideal range when considering educational implications (Nielsen, 2010). Unlike the Kindle, the iPad is a tablet computer, not simply an e-reader device (nor is it marketed as such). It has all of the hardware and software capabilities of a regular desktop or laptop computer, wrapped up in a book-sized, multi-touch-screen package. The iPad’s sleek color screen, quick WiFi or cellular internet capability, and robust processing power (easily handling a multitude of applications and video) fueled its wide-ranging appeal and popularity. These striking new features lead many forecasters to predict that the Apple iPad would be hailed as the next candidate for “revolutionary educational technology.” In Spring of 2011, many universities began classroom experimentation with the iPad in much the same manner as was done two years prior with the Amazon Kindle.

THE E-TEXTBOOK MARKET PROGNOSIS

Next year, e-textbook sales are expected to more than double to $308 million from about $138 million this year, found social-learning company MBS Service Co.’s Xplana, which predicts that by 2014, the U.S. digital textbook market will surpass 18 percent of new textbook sales for the higher education and career education markets combined. (Novellino, 2011).

As tablet computers increasingly become more mainstream, the outlook for the e-textbook market is encouraging. Schools are continuing to incorporate the new devices into the classroom, leading publishers to collaborate with interactive textbook designers in an effort to expand their e-textbook offerings. McGraw-Hill and Pearson, the world’s two largest educational publishers, are both in advanced contract discussions with Inking, a San Francisco company founded by a former Apple manager to build interactive textbooks for the iPad (Roush, 2011). McGraw-Hill said that its top 100 undergraduate titles and its medical-school curriculum would be converted to a digital form with interactive features over the next year (Novellino, 2011). Vineet Madan, vice president of McGraw-Hill’s higher education division, called the move “just a first phase” in its plan to create more engaging learning experiences (Kane, 2011).

Proponents of tablet technology say that a broader use of tablets in the classroom is just a matter of time (Kane, 2011). Regardless, the recent endorsement of e-textbooks by leading academic publishers underscores the opportunity for enhanced e-textbook design.
CHAPTER V: THE TARGET AUDIENCE

THE TARGET AUDIENCE: WHO ARE THEY?

It is amazing to me how, in all the hoo-ha and debate these days about the decline of education in the USA, we ignore the most fundamental of its causes. Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach. (Prensky, 2001a)

DEMOGRAPHICS OVERVIEW

This project is directed toward a more mature student age group. In general, the target is that of students with considerable experience in a tiered educational system. This includes upperclassman high school students and all traditional college students. In terms of sex, race, ethnicity, origin, religious affiliation, sexual orientation, lifestyle, and income, among others, the diversity of the target audience is equal to that of a typical United States university campus.

DIGITAL NATIVES

An emerging idea over recent years describes a technologically absorbed and fundamentally evolved modern-day student, or “digital native” (Prensky, 2001a). This specific label is derived from a series of articles written by U.S. technologist Marc Prensky. Prensky (2001a) argues that today’s “arrival and rapid dissemination of digital technology” is “an event that changes things so fundamentally that there is absolutely no going back” (p. 1). Today’s student has spent their entire lives surrounded by and using new technologies (see Table 2.0) such as the internet, video games, digital music players, video cams, cell phones, “and all the other toys and tools of the digital age” (Prensky, 2001a, p. 1). Rather than being just a mere part of their everyday lives, Prensky asserts that using these digital technologies is essential to young people’s existence. This constant exposure and interaction has caused our youth to “think and process information fundamentally differently from their predecessors” (Prensky, 2001a, p. 1). Prensky (2008) has recently contended that this permanent state of technological immersion and dependence is encapsulated in the lifestyles of upcoming generations of “iKids,” who remain “plugged into” portable, personalized devices such as mobile phones, mp3 players, and handheld game consoles.
These claims are seen to be grounded in an emerging body of scientific evidence in the field of neuroscience. Prensky (2001b) explains that the human brain was once thought to be unreceptive or “fixed” after the critical period of infancy (i.e. that the brain cannot change or develop after the age of three for most humans). However, modern research has revealed that this is not true. The brain is now known to be malleable or “plastic” throughout one’s life. This idea that the brain is constantly creating and re-creating new thinking patterns, constantly reorganizing itself throughout our child and adult lives, is a phenomenon technically known as “neuroplasticity” (Prensky, 2001b, p. 3).

Prensky’s writings represent a flourishing body of commentary that seeks to document the same core idea. Other dominant labels for this tech-savvy youth include Generation Y (Perillo, 2007), Net Generation (Tapscott, 1997; Oblinger & Oblinger, 2005), and Millennial (Howe & Strauss, 2000). Many of these writings stress the digital native’s improved capabilities for learning and processing information, suggesting that vast technology usage has enhanced their working memory and adeptness at perceptual learning. Digital natives enjoy certain cognitive and neurological advantages that are reflected by the ease with which they learn at high speeds, make random connections, process visual and dynamic information, and learn through digitally based play and interactions (Prensky, 2001a). As well as these neurological and cognitive benefits, young people are also seen to be able to access vast digital networks of information, resources, and people, thus learning in ways that are increasingly situated within authentic contexts and webs of knowledge (Prensky, 2008).

This seems to suggest that what and how young people learn is continuously redefined by digital

### Table 2.0

**2010 Media Usage of Kids Under Age 18**

<table>
<thead>
<tr>
<th>Media</th>
<th>Time Spent in a Typical Day (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td>4:29</td>
</tr>
<tr>
<td>Music</td>
<td>2:31</td>
</tr>
<tr>
<td>Computers</td>
<td>1:29</td>
</tr>
<tr>
<td>Video Games</td>
<td>1:13</td>
</tr>
<tr>
<td>Print</td>
<td>0:38</td>
</tr>
<tr>
<td>Movies</td>
<td>0:25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10:45</strong> of total media exposure per day</td>
</tr>
</tbody>
</table>

Among all 8 to 18-year-olds, amount of time spent with each medium in a typical day. (Kaiser Family Foundation, 2010)
technology, often in ways and places far removed from the formal settings of the school or library. From his various studies and investigations of young people, Dr. Rosen (2010) observes “They hate school. Why? Education has not caught up with this new generation of tech-savvy children and teens. It is not that they don’t want to learn. They just learn differently” (p. 3).

**DIGITAL IMMIGRANTS: A LEFT-BRAIN BARRIER**

We are moving from an economy and society built on the logical, linear, computerlike capabilities of the Information Age to an economy and a society built on the inventive, empathic, big-picture capabilities of what’s rising in its place, the Conceptual Age. (Pink, 2006, p. 2)

Prensky (2001a) describes those people not born and raised in this digital age as “digital immigrants.” As Prensky (2001a) puts it “Today’s older folk were “socialized” differently from their kids, and are now in the process of learning a new language” (p. 3). In fact, one of the most consequential problems facing education today is that our “digital immigrant instructors, who speak an outdated language (that of the pre-digital), are struggling to teach a population that speaks an entirely new language” (Prensky, 2001a, p. 3). This is a noteworthy dilemma considering that nearly all educational institutions are being directed by digital immigrants.

Correspondingly, in his 2006 book *A Whole New Mind*, Daniel Pink writes that we have been raised in a logical, linear, analytical “left-brain” society. This rigid left-brain society is and has long been the mind set behind education. Pink (2006) says that the role of the right side of the brain, which predominantly handles things like inventiveness, artistry, empathy, intuition, storytelling, and the like, have long been undervalued, underappreciated, and misunderstood in our predominantly left-brain communities. However, as Pink (2006) notes, almost anything that involves left-brain thinking is either going to be automated, turned into software or hardware, or outsourced. Consequently, if today’s children are going to have the abilities to thrive in the culture of the 21st century, then educators need to encourage students to effectively use both hemispheres of their brain.

At first glance, it seems that Pink argues against new “computerlike” technologies. This is not the case. Pink observes rigid structures deeply entrenched in our society and in the current educational systems. What needs to be done to prepare young thinkers for a “Conceptual Age” is a shift in classroom teaching and learning pedagogy. Technology can accommodate this necessary transformation. By incorporating new technologies customized for the digital native mind, a more
open, active, and engaged learning environment can be achieved.

THE TARGET AUDIENCE: HOW DO THEY LEARN?

“If we teach today as we taught yesterday, we rob our students of tomorrow.” —John Dewey (1938)

A PEDAGOGY FOR THE 21st CENTURY

The brains of the digital generation have changed fundamentally, both physically and chemically. As a result, these digital natives are neurologically wired differently than previous generations. Not only does this digital generation have sophisticated skills in using digital technologies, but through their exposure to these technologies they have developed radically new cognitive capacities and learning styles (Prensky, 2001a). The new learning styles are said to include:

- fluency in multiple media, valuing each for the types of communication, activities, experiences, and expressions it empowers; learning based on collectively seeking, sieving, and synthesizing experiences rather than individually locating and absorbing information from a single best source;
- active learning based on experience that includes frequent opportunities for reflection; expression through non-linear associational webs of representations rather than linear stories; and co-design of learning experiences personalized to individual needs and preferences. (Dede, 2005, p. 10).

LEARNING STYLES

Learning styles research has a long history that can be traced back over 100 years. Within that time, definitions have varied from author to author. However, most seem to stress learning styles as a multidimensional construct: “Learning styles are cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to learning environments” (qtd. in Sharp, Bowker, & Byrne, 2008, p. 293).

According to Keefe (1982), the cognitive component of learning styles involves information processing, “the learner’s typical mode of perceiving, thinking, problem solving and remembering” (p. 44); the affective component involves motivation, “viewed as the learner’s typical mode of arousing, directing and sustaining behavior” (p. 48); and the physiological component involves the characteristic learning behaviors of the human body, “modes of responses that are founded on sex-related differences, personal nutrition and health, and reaction to the physical environment” (p. 49).
Today, the essence of Keefe’s ideas are reflected in the fashionable term VAK. The visual, auditory and kinesthetic (VAK) learning styles inventory was initially developed by Rose in 1985 and extended by Smith in 1996 (Lisle, 2007). VAK claims that: visual learners learn by seeing (e.g. diagrams, mind mapping, flashcards); auditory learners learn by hearing (e.g. lectures, verbal explanations, discussions with other students); and kinesthetic learners learn by doing (e.g. building models, interacting with texts, practicing lessons). The VAK concept is an extreme oversimplification of Keefe’s definitions and is most likely the reason for its popularity (Cassidy, 2007).

Because of VAK’s vast popularity, and a general lack in understanding of the more comprehensive underlying theories that serve as its foundation, educators must take care not to overemphasize learning styles or to pigeonhole students by preferences. This could have very negative consequences. Learning styles can be a recognizable and useful tool and must be considered, though a variety and combination of teaching mediums is often best.

**THE PRINCIPLE OF LEAST EFFORT**

In 1949, George Kingsley Zipf’s “Principle of Least Effort” stated that “Each individual will adopt a course of action that will involve the expenditure of the probably least average of his work” (qtd. in Chrzastowski, 1995, p. 639). In 1950, Calvin Mooers coined the term “information retrieval” and went on to propose Mooers Law: “An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him to not have it” (qtd. in Chu, 2007, p. 10). And in 1993, Thomas Mann was the first to apply The Principle of Least Effort to the context of information seeking. Mann (1993) observed that

> Most researchers (even “serious” scholars) will tend to choose easily available information sources, even when they are objectively of low quality, and, further, will tend to be satisfied with whatever can be found easily in preference to pursuing higher-quality sources whose use would require a greater expenditure of effort. (p. 91)

As Mann (1993) explained, “people tend to choose perceived ease of access over quality of content in selecting an information source...” (p. 93). Educational institutions must acknowledge this Principle when considering the adoption of any new technology in the classroom or campus setting.

A general intent of technology is to make life easier. For the digital native who has been raised in a culture of all things technological, this “ease” is a universal expectation. “Digital natives are used to receiving information really fast. They like to parallel process and multi-task ” (Prensky, 2001a, p. 3).
As seen by the Principle of Least Effort, how and what people learn will often be dictated by ease of accessibility. Though this behavior is not unique to the digital native, one can reason that it is more ingrained. This, in turn, has clear implications for visual communication design decisions in the digital age.

CAMBOURNE’S CONDITIONS OF LEARNING

Reflecting on our years of teaching, we have discovered that no matter what the age (pre-K or graduate students) or the content (whether it is a second graders studying the rain forest or in-service teachers studying the writing process) the same constructivist, brain-research principles, and Conditions of Learning when applied, help foster a creative learning environment for students to develop their knowledge and grow as independent problem-solvers. (Rushton, Eitelgeorge, & Zickafoose, 2003, p. 12)

Brian Cambourne (1988, 1995), an Australian educator and theorist, developed a constructivist perspective of learning as it applies to literacy, in what he refers to as Conditions of Learning (1988). Cambourne synthesized extensive observations of children to conclude that certain optimal interactions within the learning environment enhance students’ understanding of the learning process and their role within it. These Conditions of Learning suggest a concrete and viable means to enhance student development in literacy learning (Rushton, Eitelgeorge, & Zickafoose, 2003). The conditions that Cambourne found necessary for the acquisition of language also apply to learning anything else, from reading and writing to riding a bike (Cappellini, 2005). These eight interconnected and interdependent concepts are: 1) immersion; 2) demonstration; 3) engagement; 4) expectations; 5) responsibility; 6) employment; 7) approximation; and 8) response.

Cambourne’s eight Conditions of Learning (1988) are further described as follows:

1) Immersion: Learners need to be immersed into the culture, knowledge, and curriculum in order to make sense of their own learning styles, behavior, and content;

2) Demonstration: Learners need to receive many exciting and stimulating demonstrations to assist the learner in experiencing the desired outcome;

3) Engagement: Learner is a performer of demonstration, ideally without fear of being incorrect. While being immersed in the learning environment and viewing demonstrations, the learner must be engaged in the learning process;

4) Expectations: We achieve what we expect to achieve, we fail if we expect to fail. Educators must set
expectations high enough to challenge students, yet not too high to risk failure;

5) **Responsibility**: Learners need to make their own decisions about when, how, and what “bits” to learn in any learning task. Learners who lose the ability to make decisions are “de-powered.” In doing so, students can master the content and take responsibility for their learning in a manner that is appropriate for their best learning styles;

6) **Employment**: Learners need time and opportunity to use, employ, and practice their developing control in functional, realistic, non-artificial ways. Educator must provide ample experiences and opportunities for the learner to employ or use the learning both individually and in a social setting;

7) **Approximation**: Learners must be free to approximate the desired model, “mistakes are essential for learning to occur.” Providing opportunities for the learner to approximate the desired outcome without fear of criticism or punishment is an important component of the learning process;

8) **Response**: Learners must receive feedback “from exchanges with more knowledgeable others.” Response must be relevant, appropriate, timely, readily available, nonthreatening.

Cambourne implies that these eight principles create a dynamic and interactive experience between the learner and the content. “Each of these conditions supports both the student and the teacher in their discovery of learning and helps provide a context within which to learn” (Rushton, Eitelgeorge, & Zickafoose, 2003, p. 12).

With this in mind, a meaningful connection can be made between Cambourne’s synergistic Conditions of Learning and proposed e-textbook design features. Once an evaluation of the existing competition has been made in Chapter VI, the purpose of Chapter VII is to compare and link Cambourne’s Conditions of Learning to that of supportive e-textbook design features.
CHAPTER VI: EXISTING COMPETITION

AN EVALUATION OF THE COMPETITION

“If you’re the best in the world at uncovering your customers’ latent, unspoken needs, the strength of your insights might help you succeed in spite of shortcomings elsewhere” (Kelley, 2001, p. 6).

E-TEXTBOOKS CURRENTLY IN USE IN HIGHER EDUCATION

In order to evaluate the existing state of e-textbook design and to know what types of e-textbooks are currently being made available to our target audience, an assessment of prevalent e-textbooks must be made. Since the application of e-textbook technology is still relatively new, it is logical to look to present-day practices found in university campuses that are experimenting with and making use of e-textbooks in real classrooms this semester (Spring 2011). Therefore, based on this premise, four different e-textbooks have been evaluated.

Various universities across the country are experimenting with the Apple iPad and e-textbook technology as a part of their own individual studies. These studies are run much as the original Kindle Pilot Program had been, with a limited number of courses chosen for participation. Because of this, it was possible to discover certain professors who were willing to give feedback on their immediate e-textbook experiences. Interviews and/or surveys were obtained from professors at Arizona State University, Buena Vista University, Case Western Reserve University, Penn State University, Princeton University, Reed College, and the University of Notre Dame.

Four different e-textbooks currently being used in four different university classrooms have been documented. The courses and e-textbook titles are: Technical Writing with e-textbook Technical Communication (see Figure 4.0); Introduction to Digital Journalism with e-textbook Journalism 2.0 (see Figure 5.0); Fundamentals of Athletic Training with e-textbook Principles of Athletic Training (see Figure 6.0); and Project Management with e-textbook Project Management in Practice (see Figure 7.0). As a part of every evaluation, an interview and online survey (see Appendix 1.0) were conducted with the professor of each course. An effort is made to ascertain the opinions of the faculty and students based on information obtained from these interviews and surveys. In addition, each e-textbook has been purchased and downloaded to allow for a direct interaction with the text. This will ensure a proper context and permit feedback from a firsthand experience.
Figure 4.0  
*Technical Communication* (Markel, 2010).

Figure 5.0  
*Journalism 2.0* (Briggs, 2007).

Figure 6.0  

Figure 7.0  
*Project Management in Practice* (Mantel, 2010).
E-TEXTBOOK AS A FUNCTION OF ITS APP

Many commonalities and differences are noticeable by the interviews and surveys, but become even more apparent once these e-textbooks are actually engaged firsthand. Not all e-textbooks are created equal, this is certainly true. First and foremost is the matter of platform. Despite the fact that all of these e-textbooks can be easily accessed and viewed with the Apple iPad device, of this four-book sample, three different platforms, or apps, must be used. Technical Communications is of an iPad platform, requiring the native Apple iBooks app. Journalism 2.0 and Principles of Athletic Training are of a Kindle platform, requiring the Amazon Kindle iPad app. And Project Management in Practice is of a CourseSmart platform, requiring the CourseSmart iPad app. (CourseSmart is a group of some of the largest textbook publishers in the world. They came together in 2007 and formed an organization to offer digital versions of their textbooks. Members of CourseSmart include: Pearson Education, Cengage Learning, McGraw-Hill Education, and John Wiley & Sons.)

This initial distinction is an incredibly important one. Firstly, it means that the e-textbook will be limited by the capabilities of the app that it runs on. Secondly, it signifies that the design of an e-textbook and the development of an e-textbook reading app go hand-in-hand, and that one cannot be considered without the other. And thirdly, as visual communication designers move forward in improving e-textbook design, a close collaboration with each project’s app developer must be maintained. In fact, the integration of software development personnel in the design process will most certainly be a requirement for successful results. This initial discovery reveals that similarities and differences of the four e-textbooks sampled appear to be most easily distinguished by app platform.

E-BOOK FORMATS AND APPS

E-books are digital files designed to be read by specific computer software apps. In general, a single app is designed with the purpose to read many files of the same format. In the case of the Apple iPad (for which this thesis is directed), some of the most common examples include: 1) the iBooks app, which reads files in the ePub and PDF formats; 2) the Kindle app, which only reads e-book files in the Kindle format; 3) various PDF apps, which only read PDF files; 4) different ePub apps such as Stanza, which read ePub files; and 5) a mix of web browser apps such as Google eBooks, which read XHTML files. The specific differences between these file formats is beyond the scope of this project. However, it is important to understand that the file format of a given e-book dictates the app on which it can be read. These individual apps provide a digital bookshelf or “library” for one to keep his or her
own personal e-book files. These apps often include additional features such as a shopping interface to buy and download new e-book files, bookmarking and navigational aids, annotation tools (e.g., highlighting and notes), and layout and style options (e.g. choice of different font styles and sizes).

Another e-book format is the “book as stand-alone app.” Improvements in the tablet PC’s hardware and software capabilities have allowed multimedia to be embedded in new and creative ways. Because of this, a somewhat emerging trend for publishers and app developers is the creation of the book as stand-alone app. Creating this singular entity allows for customized navigation and styling without concern as to whether or not a particular e-book reader app will support it. Richmond (2011) reports that “Faber and Faber [an independent UK publishing house] has worked with app developers Touch Press to create an app-first book: Solar System For iPad. It uses the touchscreen and multimedia capabilities of the iPad to re-imagine the coffee table book.” This core idea is the driving force behind such upstarts as CourseSmart. In CourseSmart’s case, however, the company has simply developed a more singularly-purposed book-reading app (which will only read books developed by itself) in an attempt to better handle the needs of its primary users (students).

**iBOOKS, THE KINDLE iPAD APP, AND THE COURSESMArt iPAD APP**

The iBooks and Kindle app platforms are the two most prevalent and lucrative e-book apps in the electronic book business. Each platform was created for their own specific hardware device (the Apple iPad and the Amazon Kindle, respectively). Also, these applications were not designed specifically for academic use, rather they were simply meant to replace printed text for an easy reading experience. Millions of dollars have been and continue to be invested in each of these apps and their associative devices. This continual investment fuels their popularity and increases their practicality, especially when considering costs associated with the development of a new app and long-term maintenance (updates/firmware). For these reasons, amongst others, many higher education e-textbooks are purposely created for one or both of these platforms.

The CourseSmart app, on the other hand, is specifically designed for academic use. As mentioned before, this company is a venture supported by some of the leading higher education publishers in North America, and houses “the largest online catalog of eResources and digital course materials available for instant access” (CourseSmart, 2011). Also, according to the CourseSmart (2011) website, “CourseSmart’s comprehensive selection gives students, faculty, partners and institutions a new way to find and access exactly the course material they need in one place.”
iBOOKS AND THE KINDLE APP RESEARCH RESULTS

The iBooks app and Kindle app handle e-textbooks in much the same fashion and are nearly identical in terms of presentation and functionality. Figures 8.0 and 9.0 produce a truncated page of an e-textbook in each format. A quick scan of this side-by-side comparison reveals many characteristics that these two applications share.

Figure 8.0
iBooks display of the top and bottom of a page in Technical Communication (Markel, 2010).

![iBooks display of the top and bottom of a page in Technical Communication](image)

Figure 9.0
Kindle app's display of the top and bottom of a page in Journalism 2.0 (Briggs, 2007).

![Kindle app's display of the top and bottom of a page in Journalism 2.0](image)
Figure 8.0 shows the top and bottom of an e-textbook page in the iBooks app. The top of the page has “buttons” for (from left to right) ‘Library,’ ‘Table of Contents,’ [Title of Book in center], ‘Screen Brightness,’ ‘Text Size/Style,’ ‘Search,’ and ‘Bookmark.’ The bottom of the page has a horizontal scroll bar, with three lines of text below it: a ‘Back to page...’ link on the left, the page number in the center, and a ‘Last page...’ chapter location notification on the right.

Examining the e-textbook page in the Kindle app in Figure 9.0 exposes a very similar display. The top of the page has buttons for ‘Home’ on the left, [Title of Book in center], and ‘Bookmark’ on the right. While the bottom of the page has a horizontal scroll bar, with buttons above it for (from left to right) ‘Back,’ ‘Search,’ ‘Table of Contents,’ ‘Text Size/Screen Brightness,’ and ‘Sync.’ Below the scroll bar is text that indicates the percent completion of the book at its current location number.

Both the iBooks and Kindle platform present re-flowable (word wrap) and re-sizeable text. Inline raster and vector images move and flow with the adjustable text. When the iPad is rotated to a landscape orientation, both apps create an open book (two page) spread. Pages are turned by tapping or dragging the page horizontally, and words can be selected (by tapping) and searched throughout the book (or on the web). Also, both platforms have hyperlinks embedded in the text that allow the user to navigate to other places within the e-textbook, or to external websites on the World Wide Web. These apps have practically the same amount of touch buttons represented by similar icons that perform the same functions. Table 3.0 on the next page compares the functions and equivalent buttons of each app.

In terms of usability, functionality, and interface, there isn’t much that separates these two apps, though some differences do exist. The way that each app handles page numbering is probably the most obvious. Professor interviews reveal that this is one of the most frustrating aspects of the e-textbook experience. The iBooks app lists page numbers, while the Kindle app displays “location” numbers. Neither of these numbers relates to an actual page in a printed textbook. In iBooks, the page numbers don’t even relate to a common place within the text. When the text size or font is changed, the page numbers change and adjust accordingly, increasing or decreasing the total page count. Therefore, given the many options of text size and font, the ability to communicate the e-textbook page number (let alone print page number) to another person is extremely difficult. Instead of pages, the Kindle app measures files in “locations,” which are fixed positions in the text. One screen can contain more than one location, but the same location always refers to the same spot in the text no matter what the text size is (font choice is not an option in Kindle). While this is useful and logical, it can still be somewhat
confusing (and does not enable a comparative location to a printed text).

Other minor differences include the following observations. When an embedded hyperlink (one that links to an external website) is tapped, iBooks takes the user out of the e-textbook app and places them into the Safari web-browsing app. Kindle, on the other hand, loads the web page within the app.

<table>
<thead>
<tr>
<th>Function</th>
<th>iBooks Button</th>
<th>Kindle Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection/Store</td>
<td><img src="Image" alt="Library" /></td>
<td><img src="Image" alt="Home" /></td>
<td>Takes you out of e-book and into app’s main page where personal book collection is preserved; Options to sample, buy, and download new e-books exist here.</td>
</tr>
<tr>
<td>Table of Contents</td>
<td><img src="Image" alt="Table" /></td>
<td><img src="Image" alt="Table" /></td>
<td>Access e-book’s Table of Contents and a Table of Bookmarks, Highlights, &amp; Notes.</td>
</tr>
<tr>
<td>Screen Brightness</td>
<td><img src="Image" alt="Sun" /></td>
<td><img src="Image" alt="Aa" /></td>
<td>Adjusts iPad’s screen brightness;</td>
</tr>
<tr>
<td>Text Size</td>
<td><img src="Image" alt="Aa" /></td>
<td><img src="Image" alt="Aa" /></td>
<td>Adjusts the size of the re-flowable (word wrap) text.</td>
</tr>
<tr>
<td>Search</td>
<td><img src="Image" alt="Search" /></td>
<td><img src="Image" alt="Search" /></td>
<td>Search for any word or phrase in text; Can Google or Wikipedia directly from app.</td>
</tr>
<tr>
<td>Bookmark</td>
<td><img src="Image" alt="Bookmark" /></td>
<td><img src="Image" alt="Bookmark" /></td>
<td>Bookmark any page; Bookmarks are archived in the Table of Bookmarks.</td>
</tr>
<tr>
<td>Back</td>
<td><img src="Image" alt="Back" /></td>
<td><img src="Image" alt="Back" /></td>
<td>Allows user to go back to page they were at prior to clicking on a link that took them to another page in the book.</td>
</tr>
<tr>
<td>Page Color</td>
<td><img src="Image" alt="Aa" /></td>
<td><img src="Image" alt="Aa" /></td>
<td>Allows user to switch the color of page from stark white to sepia.</td>
</tr>
<tr>
<td>Page Scroll</td>
<td><img src="Image" alt="Horizontal Scroll" /></td>
<td><img src="Image" alt="Horizontal Scroll" /></td>
<td>Use horizontal scroll bar to quickly scroll to a new page; Page/Location numbers are displayed while scrolling.</td>
</tr>
<tr>
<td>Highlight, Annotate, &amp; Dictionary</td>
<td><img src="Image" alt="Highlight" /></td>
<td><img src="Image" alt="Highlight" /></td>
<td>Press &amp; release on a word to highlight, add notes, or to look up a word in the dictionary; Selection area can be adjusted by dragging the two blue nodes; Annotations will be archived in the Table of Bookmarks, Highlights, &amp; Notes.</td>
</tr>
</tbody>
</table>
This allows the user to quickly exit the web page by simply tapping “Done” at the top right of the screen, and eliminates the hassle of having to maneuver to and from different applications. Also, the Kindle app has a night-time reading page display option that places white text on a black background, while iBooks does not. However, while using the page scroll bar, iBooks displays the section heads and page numbers, while Kindle only shows the location numbers.

Professor surveys and interviews uncover several insights. Page numbers, as mentioned before, are of a primary concern. Another common complaint is formatting problems that result from changing text size or font. These problems are disruptive to the overall reading process and have strange effects on text-based tables and charts. When charts or other examples are in the form of a raster image, it was indicated that they were often even more difficult to read. Images can only be enlarged when viewed in isolation (by a double-tap or pinch-to-zoom motion), though this function is essentially useless due to the illegibility of the low resolution images. Annotation features are described as being useful and relatively easy to use, though slower than what can be accomplished manually. And most interviewed feel that improved navigation controls are a must.

Despite the many shortfalls, all interviewed felt that they had achieved a very high skill level in using their e-textbook. They agree that their e-textbook is useful and that there is a very high potential for e-textbook technology in the classroom. Also, all answered that they are very likely to purchase an e-textbook for another class in the future.

THE COURSESMArt APP RESEARCH RESULTS

The CourseSmart app, in contrast to the iBooks and Kindle platforms, was designed specifically for academic use. CourseSmart e-textbooks have similar features to that of the iBooks and Kindle apps, though the platform is of an entirely different format.

The pages of a CourseSmart e-textbook are fundamentally image files of the printed text. These pages include intensive graphics and require large files. For this reason, at least in part, CourseSmart operates more as an online service, rather than a distributor of downloadable e-textbook files. And in fact, this is how their business is structured. E-textbooks through CourseSmart are purchased on a subscriptional basis. The e-textbook is accessible for a predetermined amount of time (180 days in the case of my purchase of Project Management in Practice), and the book file is never actually downloaded or owned by the user. This means that every time an e-textbook in the CourseSmart
app is accessed, the user must go through a brief, though necessary “Signing In” procedure that logs the user into the online CourseSmart network. Although this online subscriptional service may be a profitable business model, it does lend itself to negative feedback. Professor interviews expose this fact as being one of the major pitfalls of this application: the fact that one must have available internet access in order to make use of their e-textbook.

Another consequence of the image file format is that the text is not re-flowable or re-sizeable, and one cannot select an individual word simply by touching it. This layout, thus, does not make use of embedded hyperlinks that could link the user to other locations within the textbook or to outside website resources. However, since the whole page is essentially an image, quick enlargement of the page can be accomplished by making use of the standard pinch-to-zoom motion (which cannot be done in the iBooks or Kindle app). These page image files are of much greater quality than the images of the iBooks and Kindle platform, and therefore enlarging charts or tables is not problematic. This also lends itself to a more consistent page numbering system. Each page of the CourseSmart e-textbook is the exact same as its printed counterpart. And since text size and font cannot be manipulated, the e-textbook page numbers will never change.

Figure 10.0 shows the top and bottom of a truncated e-textbook page in the CourseSmart app. The very top of the page has buttons for (from left to right) ‘Table of Contents,’ ‘eTextbooks library,’ ‘Highlight/
Annotate,' [Title of Book in center with page number], 'Goto page number,' 'Search,' and 'Add Note.' The bottom of the page has only a ‘Pages’ tab, which, upon touching expands across the screen horizontally, presenting a scroll bar and page thumbnails (see Figure 11.0). The green scroll bar (at the very bottom of the figure) can be moved from left to right to quickly get to another page, or the thumbnails themselves can be dragged and selected. Also shown in Figure 11.0 is the ‘Ruler’ function. This expandable mechanism can be moved up and down to help keep one’s place on the page while reading.

Figure 11.0
CourseSmart app display of the page scroll bar and ruler in Project Management (Mantel, 2010).

The commonalities of the CourseSmart app to that of the iBooks and Kindle app are basic. All three have functions of library/home, table of contents, highlight, annotate, search, and page scroll. However, differences quickly emerge from this point on. The considerable matters of access, page format, and page numbering have already been discussed above. Although the whole text is still searchable, the highlight/annotate function operates in a slightly different manner, and one cannot simply select a word and look it up immediately in the dictionary (there is no dictionary feature). The Table of Contents in the CourseSmart app thus has a Table of Notes, but no Table of Highlights or Bookmarks as in the others. And the page scrolling feature is of obvious difference.

Feedback from surveyed and interviewed professors implies that CourseSmart’s page numbering structure is a huge plus. In addition, professors appreciate having the capabilities to perform not
only keyword-based searches (as all three apps allow), but also to be able to perform graphic-based searches (i.e. “flipping” through the thumbnail pages to find something that is familiar looking). This was noted by all professors using the CourseSmart app as a very useful benefit. Noted negatives were: the highlight/annotate features were not quite there yet; lack of dictionary; lack of bookmarks; necessary online connection for access (as previously mentioned); and page refresh time was greater than other apps (probably due to a combination of the online connection and image page format). However, as with the iBooks and Kindle app, all interviewed agreed that they easily became skilled at using their e-textbook, they feel that it is useful and has a high potential for learning, and that they are very likely to purchase another e-textbook for a different class in the future.

**SUMMARY OF THE EXISTING E-TEXTBOOK SITUATION**

Current e-textbooks of the iBooks and Kindle app platform are clearly not tailored to the functional demands of higher education. The CourseSmart app, while better suited for the classroom environment, lacks in other basic function areas. Regardless of the app, the fact of the matter is that existing e-textbooks are merely digital formats of printed textbooks. And that is all that they are. Digital formats of printed texts, that are still intended to be used for the same old purposes in the same serial manner. Although this is a good place to start, it is a limited model that will not lead to educational improvement.

Currently, most teachers are not even thinking about how they can make use of e-reader and e-textbook technology to change or improve how they instruct their students. Many teachers simply transfer their existing methodologies to the computer screen. Modern-day technologies should encourage teachers to reconsider taken-for-granted assumptions, goals, and practices. But, for most faculty, it satisfies their student’s requirement for a textbook, and they could care less if it’s silicon chips or ink on paper.

The design and development of a truly digital textbook has yet to be fully embraced. A digital textbook, in my mind, is one in which the author does not determine the path used through the material, the user does. Here, the textbook becomes a repository of information with a series of learning objects that ultimately are linked together in a multitude of ways that allows the user to construct his or her own path of discovery at his or her own pace. Think more along the lines of a well-planned Wikipedia, where interaction, engagement, discovery, and learning are happening all at once, where reader becomes author. A truly digital textbook is dynamic rather than static, non-linear rather than linear, and electronically networked rather than materially unconnected. This is
a major change in the way a book is currently viewed and one that has yet to truly exist. Conceiving such a book would veritably stress the writing talents of the author, but the hardware and software capabilities to create such a thing do exist. Furthermore, contemporary education theory supports this idea. Brian Cambourne’s theory of learning is a major example of this. Cambourne’s Conditions of Learning need to be present in research-based best-practices instruction and seem a natural fit for the use of e-textbooks.
CHAPTER VII: LINKING EDUCATION TO DESIGN

LINKING CAMBOURNE’S MODEL TO DYNAMIC E-TEXTBOOK DESIGN

By coming to understand the complex facets of learning, the importance of engagement, and the power of learning communities, it is possible for teachers to transform their instructional practices within the confines of educational mandates. A shift in thinking about what it means to learn and a measure of trust in both teachers and students will achieve what all the mandates in the world cannot. It is possible for secondary classes to be intensely academic and also to deeply engage adolescent learners. Students can score well on standardized tests as a natural by-product of meaningful learning, and teachers can freely engage in curriculum topics beyond the confines of the test. (Lent, 2006, p. xv)

As described in Chapter IV, Australian educator Brian Cambourne (1988, 1995) developed eight Conditions of Learning that he found necessary for the acquisition of language. Cambourne (1995) describes this model as “being a set of indispensable circumstances that co-occur and are synergistic in the sense that they both affect and are affected by each other” (p. 184). These principles are embraced by education specialists in all fields as essential components of meaningful learning. As Rushton, Juola-Rushton, and Larkin (2010) put it: “We believe that the new insights from the neurosciences extend these conditions of literacy learning as universal conditions of learning that, when applied, will greatly enhance all learning, from early childhood through graduate school” (p. 355). A recap of Cambourne’s eight Conditions of Learning (1988) are as follows:

1) **Immersion**: Learners need to be immersed and constantly saturated in that which is to be learned;
2) **Demonstration**: Learners need to receive many stimulating demonstrations of desired outcomes;
3) **Engagement**: While being immersed in the learning environment and viewing demonstrations, the learner must be engaged in the learning process;
4) **Expectations**: Learners are influenced by expectations, which are powerful shapers of behavior;
5) **Responsibility**: Learners need to make their own decisions about when, how, and what “bits” to learn;
6) **Employment**: Learners need time and opportunity to use and practice new learning in realistic ways;
7) **Approximation**: Learners must be free to approximate desired study, as mistakes are essential for learning to occur;
8) **Response**: Learners must receive relevant, appropriate, timely, nonthreatening feedback.
These eight principles support and justify the design and development of a dynamic, interactive e-textbook created for a tablet PC. In the sections that follow, each of Cambourne’s Conditions of Learning is linked with proposed e-textbook design features. Although these Conditions have been numbered above for clarity, keep in mind that they are interconnected principles that involve, share, and affect each other. Cambourne’s (1988, 1995) model makes clear that students must perceive a need or purpose for learning, must actively participate in learning, and must have a safe environment in which to try out or “approximate” learning.

CONDITION OF LEARNING: IMMERSION
E-Textbook Design Features: Embedded Video, Embedded Audio, Class Blog, Hyperlinked Refs, etc.

Cambourne’s (1988, 1995) first condition of learning is about getting students fully immersed in the subject matter being taught. As Cambourne (1995) puts it, students need to be “saturated by, enveloped in, flooded by, steeped in, or constantly bathed in that which is to be learned” (p. 185). It is necessary to have intellectual (reading, writing, analyzing) and sensory (seeing, smelling, touching, listening) stimuli that provokes the student to care, capturing his or her attention and imagination. All too often students find themselves sitting for long periods of time listening to a teacher lecture. These tiresome lectures are then followed by rote drills or textbook handouts. This traditional approach to learning is uninviting and does not engage or motivate the student.

An e-textbook could be structured to aid teachers in creating an immersive environment. E-textbooks can be developed with a full integration of various multimedia, as this will continue to become a desired component. Caine et al. (2005) observes that “Student’s brains are indeed changing and gravitate to multimedia stimulus to engage them in learning” (p. 20). Embedded audio and video could grab students’ interests, while an integrated class blog (specific to the class and thus integrated into the e-textbook) could keep student’s engrossed and “saturated” in a subject matter as they share individual thoughts, photos, or videos that pertain to the task at hand. Also, an e-textbook laced with hyperlinked reference materials would provide vast amounts of related information for the student to access.

CONDITION OF LEARNING: DEMONSTRATION
E-Textbook Design Features: Video Demo, Audio Demo, Shared Q&A, Teacher Customizations, etc.

Another of Cambourne’s conditions for learning is demonstration, where students “observe (see, hear, witness, experience, feel, study, explore) actions and artifacts” (Cambourne, 1995, p. 185). The concept
of demonstration can be applied to all tasks, such as tying one’s shoelaces or riding a bike, because all learning begins with a meaningful and relevant demonstration (Smith, 1981).

The e-textbook is an ideal vehicle of demonstration, as it supports features that help to work against our inherent human deficits of attention, judgement, and memory. For example, a series of short video animations could present the steps of a process in appealing, intellectually digestible portions. “Having stimulating ‘mini-lessons’ or ‘teaching points’ modeled in a manner that is non-threatening will focus the student’s attention” (Rushton, Juola-Rushton, & Larkin, 2010, p. 355). Students’ would be able to replay video or audio demonstration as many times as they like, giving them the opportunity to take their own personal notes. In addition, a student could post anonymous questions about a certain process directly onto the e-textbook page. These “shared questions” could be a class-specific feature that is easily toggled on (viewable) or off (hidden) by any individual student. This would allow some students to see that they are not alone in being confused about a certain concept, and give other students the opportunity to help clarify the answer by posting explanatory text, links to supportive references, or video/audio clips. The teacher could serve as mediator, correcting, adding, and/or answering when necessary (though the teacher’s primary function in this case is facilitator, not subject expert). Collaborative components like this would provide the student with a chance to understand lessons from a different perspective, exploring new avenues of thought as they try to create meaning for themselves.

A flexible e-textbook could also enable teachers to customize certain aspects of the book itself. Depending on the particular course, there will always be specific sections of a textbook that the teacher will want to focus on and bring attention to (as a single textbook will often be used for different kinds of classes, but that each class will stress different aspects depending on specific objectives). Giving teachers the ability to personalize an e-textbook can be a useful advantage. “Content personalization is a very important aspect in the field of e-learning” (Rey-Lopez et al., 2006, p. 1). A teacher could, for example, insert personal video or audio demonstrations at predetermined locations, stressing importance and engaging the learner at crucial teaching points. Students could simply upload these materials from the teacher’s device, as the e-textbook would be designed to automatically insert these components seamlessly into the text.
CONDITION OF LEARNING: ENGAGEMENT

E-Textbook Design Features: Shared Q&A, Virtual Worlds, Shared Class Highlights/Notes, 360s, etc.

Cambourne (1995) places engagement at the heart of all learning (see Figure 12.0). Immersion and demonstration are important aspects of the learning process, however, learning is increased only when the student becomes actively engaged in the demonstration itself (Rushton, Eitelgeorge, & Zickafoose, 2003). “Learning is unlikely if learners do not attend to demonstrations in which they are immersed” (Cambourne, 1995, p. 185).

The example of the “shared Q&A” e-textbook feature described previously shows how a classroom could become actively engaged in the demonstration itself. Such an activity could engage the learner on multiple levels: cognitive (critically thinking about the topic, problem, and/or answer at hand); social (interacting with classmates by posting questions, answers, and/or additional resources); and emotional (students feel comforted knowing they can ask questions and attempt to answer questions in a nonthreatening forum; in addition, self-esteem and positive reinforcements are gained when students help each other and share knowledge). Engaging students on multiple levels helps motivate them to set goals and take responsibility for their learning. “Motivation is a key aspect of real world learning” and is often found lacking in traditional classroom environments (Jameson, 2009, p. 3). Motivation is generated by the need to feel competent, autonomous and well thought of by others (Deci & Ryan, 1985).

Figure 12.0
Cambourne’s model of classroom literacy learning (Cambourne, 1995, p. 189).
E-textbooks could also engage and motivate students with educational games, videos, animations, or virtual worlds. Virtual worlds “intrinsically have elements such as goals, outcomes, challenges or competition” (Whitton, 2010, p. 29). For example, a classroom/topic specific virtual world could be a component of an e-textbook, serving as a more entertaining and engaging way for the student to test ideas, learn new processes, socialize, and experience “flow.” Flow theory (Csikszentmihalyi, 2002) describes a state of “optimal experience” where one is completely focused and steadfastly intent on a task. Flow has important implications for motivating learning and complements constructivist principles. “Conditions that encourage flow include clear goals, a sense of control, a balance between ability level and challenge, opportunity for deep thought and concentration, and direct feedback” (Jameson, 2009, p. 3).

An e-textbook design feature that could provide engagement in a different way would be “shared class highlights” and/or “shared class notes.” This could be a class-specific feature that is easily toggled on (viewable) or off (hidden) by any individual student. When “on,” the student’s e-textbook would display highlights and notes that any other student in the class has made. This could be an engaging tool when students seek to discover why classmates have highlighted or noted certain items. Also, they can compare and contrast what they have done to others, stimulating ideas of expectation or approximation (as will be discussed subsequently).

Another engaging e-textbook feature that would support exploration and discovery is an embedded 360 (pronounced “three-sixty”). What is meant by a “360” is an interactive type of flash or video object that can be rotated three-hundred-and-sixty degrees around in all directions by the user. This type of embedded interface could allow the user to rotate, explore, zoom in to endless details, and discover (from every angle) new aspects of any infinite amount of objects, structures, or processes. 360s would enable the student to interact with learning objects in whole new ways, challenging a student’s preconceptions and creating new opportunities for knowledge growth.

**CONDITION OF LEARNING: EXPECTATIONS**

E-Textbook Design Features: Shared Teacher Highlights/Notes, Portfolio Hub, etc.

Cambourne (1995) writes that expectations are “messages that significant others communicate to learners,” which are “subtle and powerful coercers of behavior” (p. 185). He notes that most parents expect their children to learn to talk and encourage their child’s early attempts with much praise. Similarly, teachers who set high expectations believe that their students can and will learn, and thus
provide those students with ample opportunities to engage and practice skills daily in a low-risk supportive environment (Desjean-Perrotta, 1996).

A dynamic e-textbook could have design features that help communicate teacher expectations. One way this could be accomplished is by “shared teacher highlights” and/or “shared teacher notes.” This could be another class-specific feature that is easily toggled “on” (viewable) or “off” (hidden) by any individual student. When “on,” the student’s e-textbook would display highlights and notes that the teacher has placed in his/her own e-textbook. When handled with restraint and purpose, this could be an effective way to guide the student’s focus, while still allowing them to contemplate significance and meaning. “Teachers of all ages will want to foster a learning context that builds trust, promotes self-direction, and encourages students to freely exchange their feelings and ideas” (Rushton & Larkin, 2001, p. 29).

In addition, a fully-featured e-textbook could help facilitate students’ expectations of themselves. The e-textbook could act as a central hub that contains one’s portfolio of work throughout the duration of a course (e.g. graded tests, papers, and assignments). Performance metrics and/or teacher feedback logs could be integrated. This would allow the student to periodically assess his or her progress, permitting expectations to be managed, goals to be refocused, and responsibilities to be prioritized.

CONDITION OF LEARNING: RESPONSIBILITY
E-Textbook Design Features: Planning Functions, Student Personalizations, Class Wiki, etc.

Students need to make their own decisions about when, how, and what “bits” to assimilate in any learning task. If teachers make all of the decisions for their students (e.g. what they read, what they write, or what questions to answer) they deny them opportunities to learn how to handle responsibility (Lent, 2010). When students are allowed to have choices and make decisions, learning is often increased. Cambourne (1995) writes that:

The significant others in young learners’ environments communicate very strong expectations that the learning task will ultimately be completed successfully, while simultaneously providing deep immersion with meaningful demonstrations. But the learners themselves decide the nature of the engagement that will occur. (p. 185)

“Students will need to act, reflect, plan and personalize their learning, adapting it to their needs and aspirations” (Kumar, 2008, p. 31). An e-textbook could promote student responsibility by
having integrated functions that allow for planning, keeping of goal records, setting reminders, or programming calendar alerts. How responsible a student becomes, however, is heavily contingent on engagement, motivation, and expectations.

The significance of knowledge construction for instructional technologies lies in the building of environments that make it easy for learners to formulate their own understandings of the world (Winn, 2004). Students who take responsibility for their learning can do so in a manner that is appropriate for their best learning styles. A flexible e-textbook could promote this aspect of responsibility by allowing for student customization. Students could personalize an e-textbook by having the ability to insert their own images, text blocks, or video/audio recordings. Or, perhaps more practically, they could create any number of hyperlinks to additional video, audio, text, or interactive resources. If, for example, a student was particularly inclined to visual learning, he or she may discover instructional or informational videos on the World Wide Web that are very useful and that help clarify particular ideas. That student would then be able to easily create their own links to these resources at any desired location within the e-textbook itself. The Theory of Multiple Intelligences (Gardner, 1983) supports this personalization feature. It proposes that people learn in a variety of ways and have diverse strengths and abilities which, if recognized, can be developed to enable learners to reach their potential. Gardner (1995) writes that if “a more personalized education is the outcome, I feel that the heart of MI theory has been embodied” (p. 209). Students could employ e-textbooks as useful instruments of personal expression and choice, as they build their own environments and construct their own understandings of the subject matter.

An integrated “class wiki” is another possibility for the interactive e-textbook. This wiki could simply be another page or tab built directly into the e-textbook. It would allow for collaborative authorship of any relevant topic by students from the same class (where any individual could contribute, expand on, or make changes to the information). Similar to Wikipedia, students would be responsible for deciding what types of content are appropriate, discovering said content, and citing references. When students are actively engaged and take responsibility for their learning, a sense of empowerment often follows (Rushton et al., 2003).

**CONDITION OF LEARNING: EMPLOYMENT**

E-Textbook Design Features: **E-Textbook/Class Social Network, Simulations, Group Blog, etc.**

Students need time and opportunity to use, employ, and practice their developing knowledge and
responsibilities in functional and realistic ways. Teachers must provide ample experiences and opportunities for the student to employ the learning both individually and in a social setting. Cambourne (1995) writes that students “seem to need two kinds of opportunity, namely those that require social interaction... and those that are done alone” (p. 186). Cambourne (1988) suggests that as a consequence of discussion and personal reflection, children will construct new knowledge. Both Vygotsky (1979) and Caine et al. (2005) indicate that humans need to socialize and relate to others in order to enhance learning.

Constructivist learning principles, of which employment is steeped, are based on the premise that learning is an active process in which students construct new knowledge based on their existing knowledge. An interactive e-textbook could enable social interaction and active learning through a collaborative class network. This class specific social network could be integrated straight into the e-textbook itself, allowing any student making use of the e-textbook at any given time to know how many fellow classmates are also accessing the book at that very moment. A live “class chat room” could be a component of the network, where questions or thoughts could be offered out and answered in real time. Another component could be a “posting area,” where questions could be posted or new ideas could be offered out for feedback. This network would allow those who were connected (using the e-textbook at that time) to view or reply to any given post or chat.

An e-textbook could also have embedded digital simulations. These simulations could give the student an immediate opportunity to employ skills learned on real-world problems. “Authentic learning refers to teaching and learning processes that encompass real-world problems and simulations closely resembling the field of study” (qtd. in Jameson, 2009, p. 3). Gee (2003) argues that learning needs to be “active” and that simulations permit the user to “learn to experience (see, feel, and operate on) the world in new ways” and “gain resources that prepare us for future learning and problem solving” (p. 23).

In addition, the interactive e-textbook has the power to facilitate brainstorming, an important aspect of employment. Remote team brainstorming efforts could be possible through the above described class social network. They could also exist in the form of a class blog, conceptual twittering, or a topic specific blog created within the e-textbook construct. Social interaction components of this sort can be convenient due to their abilities to operate on synchronous and asynchronous levels.
CONDITION OF LEARNING: APPROXIMATION

E-Textbook Design Features: Educational Games, Quizzes, Shared Q&A, etc.

Students must be free to approximate the desired model, as mistakes are essential for learning to occur. Cambourne (1988) suggests that students need to take risks, to test out hypotheses, and make approximations as they discover the overall content. Providing opportunities for the learner to approximate the desired outcome without fear of criticism or punishment is an important component of the learning process.

Approximation involves the teacher providing feedback systems to guide, scaffold, and challenge a student’s attainment of the skill at hand. An interactive e-textbook could provide ample opportunity for students to approximate desired outcomes. Educational games integrated into the e-textbook software could serve as a functional source of problem-based learning. “Researchers have highlighted that computer games have the facility to create real-life problem-solving experiences. Kili (2005) argues that games provide a meaningful framework for offering problems to students” (Whitton, 2010, p. 50). Self-assessments, that ultimately provide response, could include quizzes, puzzles, strategy games, etc.

The previously described “shared Q&A” e-textbook function could also give students an excellent opportunity for approximation. Here, approximation comes when the student attempts to answer another student’s question. Risk is taken by attempting an answer, however, it is a good place for the student to approximate and to receive nonthreatening feedback (response).

CONDITION OF LEARNING: RESPONSE

E-Textbook Design Features: Shared Q&A, Games, Quizzes, Text-to-Speech, Video Lectures, etc.

Students need to receive feedback on their approximations from exchanges with more knowledgeable others. It is important that the teacher create a trusting environment and that the response be “relevant, appropriate, timely, readily available, with no strings attached” (Cambourne, 1988, p. 33).

Most of the previously discussed e-textbook features inherently facilitate response in several different forms. Feedback can arise from educational games, self-assessments, quizzes, or shared Q&A. In a class social network, collaborative argumentation could allow learners to articulate and negotiate alternative perspectives regarding a particular topic. Repetition drills and study activities could be integrated into any e-textbook to allow for quick, repeated response. Also, text-to-speech functionality
is another e-textbook feature that could be useful for particular subject areas (e.g. student makes approximation of how to say a sentence in a foreign language, e-textbook gives correct response).

In addition, an e-textbook could provide unique opportunities for more in-class response time. For example, a teacher could have all of his lectures video-recorded prior to the beginning of the semester. He could quickly and easily distribute them, one at a time, through a user-friendly e-textbook interface. This would allow for most of the traditional classroom lecture time to be moved outside of class (i.e. assigning students to watch and take notes of video lectures for homework). And this, in turn, would make it possible for most of the “active learning” (i.e. completing out-of-class homework assignments) to be done in the classroom with the teacher present. The important active learning processes would now occur when the teacher is “readily available” to coach, support, or challenge particular students (or groups of students) when appropriate.

**SUMMARY OF CONDITIONS AND E-TEXTBOOK FEATURES**

There are vast possibilities for enhanced e-textbook design features that would bring value to today’s classrooms. Fully-featured e-textbooks will blur the line between courseware (educational software) and e-books. Not all proposed features will be viable solutions, however, significant rationale has been provided for the consideration of each. Nevertheless, under the umbrella of Cambourne’s Conditions of Learning, one can clearly see how contemporary education theory supports and justifies the design of a dynamic and interactive e-textbook.
CHAPTER VIII: CONCLUSION

FUTURE DEVELOPMENT OPPORTUNITIES

As e-books and tablet PCs continue to grow in popularity, the role of the e-textbook in education will become ever more important. Academic publishers are slowly adapting to the nontraditional digital environment with new research and development efforts currently underway. Opportunities exist for visual communicators to reimagine and redefine the textbook as we know it today. However, meaningful advances in e-textbook design can only be achieved when the educational needs of the student are fully understood and considered.

The objective of this thesis has been to explore how contemporary education theory could support the design of a dynamic and interactive e-textbook. The research presented herein demonstrates why advanced e-textbook design features would enhance the student’s learning experience and foster educational growth. Thus, further e-textbook development efforts, well-grounded in education theory, are ultimately justified.
REFERENCES


