Redefining the Textbook:
A user-centered approach to the creation, management and delivery of digital course content in higher education

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Abstract

Our everyday experiences are quickly moving into digital platforms. Nowhere is this more true than in higher education. As technology advances and students evolve, the industries around education rush to provide new digital tools to augment the course experience. One example of these new tools is the digital textbook. In an attempt to meet the needs of digitally native students, publishers have made a concentrated effort to provide a digital equivalent to the traditional textbook. However, the current offerings lack a consideration for the real needs of student users, and therefore tend to detract, rather than enhance the course experience.

This study aims to define a better solution for the digital college textbook. To do this, attention must is paid to all of the many aspects that contribute to the experience of using a textbook. Primarily, there are three areas that make up this experience: the historical context of the textbook, recent advancements of technology in the space, and the needs of real student users. After these aspects are better understood, insights from all three areas can be combined into a more useful solution for a textbook in the digital environment.
This exploration will take the form of multi-faceted methodological approach. To start, a contextual analysis is conducted to better understand the historical implications of a textbook, the capabilities of cutting-edge digital tools, and the generational preferences of digitally native students. The insights gained from this secondary research will be leveraged later and combined with insights from a set of qualitative methods. Surveys, interviews, participatory methodologies and evaluative sessions are all be utilized to gain a deeper understanding of student user needs when using educational tools.

The outcome of this study will be a set of required attributes for the digital textbook of the future. These attributes are a translation of user insights gained throughout the research process. Additionally, a tested design prototype will be proposed as a solution for the management, delivery, and use of digital college course materials. This study presents a novel approach to the gathering and implementation of user insights into new digital experiences. Insights gained in this study can be applied to other educational tools or any digital tool that aims to translate a physical experience in to a digital format.
Dedication

For Beth.

Without your steadfast support, patience and love, this work would not have been possible. You will always be my inspiration to do good work.
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Last, but certainly not least, thanks to my family. I am very fortunate to have been raised in an environment that placed an importance on education. I have always been lucky to be surrounded by smart and hardworking people. Most importantly, thanks to my wife, Beth, for encouraging me take the time to explore graduate studies. I literally could not have done this without your help.
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Technology is changing the way we experience life. Anyone who has interacted with a website or mobile application in the last few years knows the power of recent digital technology. On a whole, our lives are systematically being transitioned into digital experiences. Over time, this transition has gained momentum to incorporate an ever-increasing proportion of our everyday lives. As this happens, the digital experiences we have are becoming increasingly complex. At the turn of the 21st Century, we began using digital tools to do basic tasks. We started reading static material on the Internet and became familiar with navigation systems in our cars. But over time, digital tools have become much more powerful, connecting us to new experiences and information.

More recently, digital tools have advanced to help us supplement much of our daily lives. Computers have become the center of our everyday activities. The phones in our pockets have matured into powerful computers, instantly connecting us to a world of knowledge and ability. This phenomenon has impacted our society in a number of ways. Most importantly, we have come
to expect rich and useful digital experiences. Many industries have raced to provide these experiences by building new tools that take advantage of emerging technology. However, we have only begun to see what is possible.

As these digital interactions have advanced, they have begun to amass an increasing amount data and content. As our physical interactions have moved online, the data that we used to transfer between each other has now become digital. There is a lot of potential that can come from huge amounts of digitized content. As more information becomes available online, we all gain access to a deeper network of data. However, one of the major obstacles that will need to be overcome lies in the management of this content.

We have seen glimpses of how companies and industries are starting to deal with the management of this data. In many instances their solution revolves around centralizing the content. Companies like Apple, Inc. have uncovered the power of creating a centralized, unified interface to distribute and manage content in their application iTunes. In Apple’s case they are dealing with music, movies, applications and other forms of entertainment. Users have access to amassed content on the iTunes service and can in turn distribute that content to their devices for use. This is important because it takes the emphasis off of the hardware being used and gives the content more importance through longevity.
Media industries have worked hard to design these new digitally centralized experiences. Seeing the benefits of a connected society, industries all over the world are racing to move into new digital landscapes. One area that has recently made strides into the digital world is education, specifically in higher education. The industries surrounding higher education have led the charge to meet the needs of technology enabled students and instructors. However, as we are just entering the era of widely available digital course material, there are still major growing pains that are prevalent. There is still much work to be done in the area of digital educational tools.

Education will benefit greatly from a more connected society. This is an obvious statement, but why then have education-centric industries not harnessed these new environments to their full capability? In industries that have led successful digital transitions, an important aspect of their solution can be directly tied to Design. In new digital experiences, Interaction Designers, User Experience Designers, Visual Communication Designers and Usability experts play a crucial role in the development and success of these tools. Design’s involvement in this area puts an emphasis on the user’s needs.

It is my hypothesis that educational tools have not fully embraced user-centered design. One specific tool that is severely lacking in the digital space is the textbook. Textbooks have made the transition to a digital environment, but it is
my observation that they have done so without much consideration of their users. In this case the stakeholders fall into three distinct groups: instructors, students and content publishers. Of these the two groups that are actual users, instructors and students, have changed dramatically with the proliferation of the Internet. Publishers on the other hand have resisted change, which has resulted in an inferior product.

New generations of digitally native students and their instructors have come to expect a high level of usefulness in their digital tools. After examining the current offerings of digital textbooks, I believe that their needs are not being met. I hypothesize that the shortcomings of these digital textbooks are a direct result of a lack of user understanding on behalf of the publishers. With this in mind, I developed the enclosed research plan to began taking a serious look at the needs in this area. With more understanding of how students and instructors would like to interact with their digital course materials, a better tool can be constructed.

1.1 Research Process

Starting with Chapter 2, the process of understanding the student needs begins with a thorough contextual analysis. We must first place ourselves in the timeline of technological advancements. Part of this contextual analysis involves a historical overview of the Information Age, an investigation of digitally native student preferences, an understanding of our current obstacles to progress and
an overview of more recent technological advancements. The knowledge gained in Chapter 2 will lay the foundation for the rest of the document.

Next, in Chapter 3 an extensive look at existing digital educational tools will give insight into what solutions have already been tried. By doing this, we can get a better grasp of what has worked or failed in the area. Several digital tools will be evaluated and broken down into distinct categories including online distance learning institutions, digital textbooks, online content aggregators, audiovisual content aggregators, online marketplaces, course management tools and search engines.

With insights from the earlier contextual analysis, I will move into an initial proposed solution in Chapter 4. Stemming from the observations of successful experiences from other industries, I will propose a systemic solution for the digital textbook. This solution takes the needs of its users into account and incorporates many of the positive attributes seen in other digital tools.

My solution is built with the intention of evaluating it with real users. In Chapter 5 I begin the process of involving users in the research process. The primary objective of the first round of user research is to better understand how students use digital materials in their courses. This involves understanding the students’ comfort levels and personal experience with technology in the classroom.
Additionally, I incorporate a portion of the study that allows students to define their ideal experiences when using digital materials in their courses. To gather this information, I utilize surveys, interviews and generative methodologies.

In Chapter 6 I take the insights learned in user testing and incorporate them into my solution. Also, at this stage, I formalize my proposal into a prototype. This chapter outlines how to take user derived insights and translate them into concrete design elements.

Chapter 7 then describes the process of evaluating my proposed solution with more users. In this round of research, I develop a customized methodology that combines elements of both usability analysis and focus groups. This method proved very effective in identifying successes and weaknesses in the solution.

1.2 Expected outcomes

The outcome of this work will take the form of a set of characteristics that will define the textbook of the future. In addition, there will be a proposed prototype that starts to incorporate those characteristics into a real solution. Recommendations will be made abound future work that can be done to continue this investigation. Working in these proposed areas will help advance a truly useful solution for the delivery and management of digital course material in higher education.
This work also outlines several important aspects of converting traditional, physical experiences into digital experiences. The enclosed process can be used to better understand the users of any digital experience. Subsequently, a useful process will be outlined for the implementation of the derived insights into concrete design attributes. Anyone working on the design of a new digital experience or tool will find useful insights in this work.
CHAPTER 2

Higher Education in the Information Age

2.1 The rise of the Information Age

For the past few decades, we have been living in a time of enormous technological development known as the Information Age. The Collins Dictionary identifies the Information Age as “a time when large amounts of information are widely available to many people, largely through computer technology” (2011). The Information Age has been slowly gaining momentum since the late 1970s with the inception of the Internet and the popularization of the personal computer. Through a rapid and steady progression over the last few decades, the Internet is now nearly ubiquitous, especially amongst teenagers and young adults. According to a recent Pew study, 93% of those ages 12–29 go online with a still-high 74% of those over 29 utilizing the Internet (Lenhard, 2009). As a result of this era, our society is becoming digitally aware at an alarming pace.

One of major benefits of this rapid growth is the democratization of information. Alberts stresses that the advancements during this time have allowed us “to overcome the barriers imposed on communications by time, distance, and
location and the limits and constraints inherent in human capacities to process
information and make decisions” (2004). As a global society, we are no longer
constrained by older methods of communication and information gathering. New
information is being delivered through constantly evolving media to people all
over the world. In the realm of higher education, the Internet has become a very
powerful tool. As we will see, it has changed the way students work and learn in
educational settings.

2.2 A new generation of students

Society’s digital evolution is most apparent in higher education in its students.
As society evolves, technology becomes a deeply ingrained part of our lives, and
higher education struggles to stay relevant with its students. While students
are rapidly becoming digital beings, their educational system is lagging behind
their expectations for a learning environment. Students that are entering higher
education now, along with anyone born between 1982 and the early 2000s, are
members of the ‘Net Generation.’ These students are “digitally native” meaning
that they have grown up with technology and are very comfortable using it in
many circumstances (Tapscott, 2009).

The Net Generation, sometimes labeled as ‘Generation Y,’ is often categorized as
having a much more personal relationship with technology than its predecessors.
Tapscott was one of the first to identify and study this generation’s students and
has classified many of their distinguishing characteristics: “They prize freedom and freedom of choice. They want to customize things, make them their own, They’re natural collaborators, who enjoy a conversation not a lecture...Speed is normal. [And] Innovation is part of life” (2009).

The Net Generation’s early exposure to technology and the Internet has impacted many aspects of their lives. It has been speculated that individuals in this generation have been impacted in ways ranging from shorter attention spans to a higher propensity for violence (Green and Hannon, 2007). Along the same lines, their attitudes towards education have changed as well. Barnes points out that “Net Geners’ use of the Internet for immediate access to information has taught them to expect immediate answers” (Barnes, 2005). This attitude easily crosses over into their academic lives. Barnes goes on to report on Carlson’s work in this area: “Net Geners tend toward independence and autonomy in their learning styles, which impacts a broad range of educational choices and behaviors, from ‘what kind of education they buy’ to ‘what, where, and how they learn’” (2005).

One of the predominant themes seen in research about the Net Generation in higher education is that they rely on choice. These students are used to solving problems with technology on a daily basis. The Internet has always been available to provide entertainment, connect them socially, and even help them engage in civic causes. One needs to look no further than Barack Obama’s 2008 presidential
campaign to get a glimpse of the power of electronic communication (Tapscott, 2009). Unconsciously, these students understand the potential that a connected society provides. However, they do these things on their own terms. They find digital solutions to the problems they are presented with, often in unique ways. They no longer see the boundaries that the physical world and traditional media entail. For these reasons, it is important that their educational environment provide them with a similar experience.

2.3 Obstacles to progress

In looking at the studies about this new generation of students, it appears that the world is primed for a sea change in the education system. However, we should not jump to conclusions about the abandonment of our old system for a new digital approach. Ideally, a course that truly takes its students’ needs into account must fully understand their hesitations and restrictions when working in digital spaces. A better system can be established to deliver course content to this generation of students, but we must first look at the obstacles that we currently face.

2.3.1 Student Hesitation

While the new generation of students appears to be changing rapidly and holistically, there are certainly exceptions to the rule. In fact, recent studies provide evidence that there is less digital adoption than previously expected.
We’re starting to see more student hesitation around the use of digital tools, with Kennedy pointing out: “These studies reveal that the relationship between Net Generation students, technologies and education may be more complex than commonly believed” (2010). Kennedy even goes as far as to say “The clear implication of these findings is that large-scale changes in curriculum or teaching approach based on assumptions about the technology experience of this generation of students as suggested, for example, by Prensky (2001) and by Oblinger (2008) cannot be justified” (2010). I disagree with Kennedy’s provocative observation. In order to move our educational system forward, we must push the boundaries of what already exists. I hypothesize that this disconnect between the Net Generation and educational technology is simply caused by two factors: cost and instructor apathy. In addressing these barriers, I believe that we will see much higher adoption of technology in the classroom.

2.3.2 Cost restrictions
The high cost of technology has historically hindered the growth of its use in education. Students, who already have limited funds, are not able to afford the latest ‘gadget’ just because their professor suggests its use. However, the cost of computers has dramatically decreased over time. For example, in 2010 the cost of an average personal computer fell to an average of $615 (Worthen, 2010). In comparison, in 2006 the same technology cost over $800 on average. Decreasing personal computer costs are an indication that computer use will be
nearly universal in the near future. This newfound affordability in technology will cause an increase in the amount of people that can access its use. Additionally, programs like One Laptop Per Child (OLPC) have worked to both reduce the cost of personal computers and expand their use to poor communities around the world (Pischetola, 2011). With the rapidly changing economics of personal computing and continued innovation in the field, it is fair to say that cost will no longer be an issue in the future.

There is a second way to approach the issue of cost. After the initial investment from institutions, it has been shown that overall technology costs can actually be reduced over time while simultaneously improving the learning experience. The work of classroom technology pioneers, like Carol A. Twigg, has proven this well (Smith, 2007). Twigg has been successful in this area through an emphasis on redesigning courses to implement technology in a more efficient and useful way (Twigg, 2003). In a 2007 interview, she reports on this success saying “All 30 courses [that were] redesigned in [her] Program in Course Redesign...reduced costs from 15 to 77 percent, with an average reduction of 37 percent. At the same time, 25 of the 30 projects showed significant increases in student learning. (Smith, 2007). In addition to the striking data about success, this work also points out the importance of instructor investment in utilizing these tools.
2.3.3 Instructor Apathy

While Kennedy has reported that “only a small subset of students use more advanced or newer tools and technologies,” there is a proportional lack of investment in the utilization of digital tools on the part of instructors (2010). A recent study of new digital tools clearly showed that the “biggest challenge is getting professors to use the new features of the digital texts” (Wieder, 2011). Similarly, Barnes looks to the work of Seymour Papert for perspective on this long term issue by reporting that “computers and technology can be powerful teaching tools, but their potential is not fully exploited by educators who use them as isolated tools, disconnected from the processes of student life and learning” (Papert 1993 via Barnes, 2007).

This last point highlights a key issue regarding instructor apathy towards technology. Frequently, instructors in higher education do not have exposure to the true potential that a digitally connected classroom can provide. This is the classic case of they don’t know what they don’t know. We cannot expect instructors to invest in a system that has not been vetted and is often cumbersome to learn. I will show in the next chapter that the current offerings in educational technology ask professors to abandon their trusted way of teaching to mold to the technology. We have reached a point technologically where we can begin to structure the technology around the course. If we take this approach to
technology in the classroom, instructors will be much more willing to use better tools to improve the learning experience for their students.

2.4 Technological advancements

Technology has improved rapidly over the lifetime of the Net Generation. Not only were they exposed to technology from a young age, they also expect rapid innovation and improvement. For the simplest explanation of how rapidly technology improves, one needs to look no further than one of the earliest evaluations, Moore’s Law. Gordon Moore, working at the Intel Corporation in the mid-Twentieth Century determined that “processor transistor densities will double every two years” (Kuniavsky, 2010). This law is a technical way of saying that computing devices, like personal computers, double in speed and power every other year. Because of this exponential growth in the ability of technology, it is understandable the Net Generation students have come to expect innovation.

2.4.1 Ubiquitous Computing

One of the major byproducts of the rapid technological advancement described by Moore’s Law is ubiquitous computing. The combination of rapid iteration and an increase in the mass production in the technological industries has led to a consistent decrease in the cost of component parts and devices. This newfound affordability has allowed for the proliferation of ubiquitous computing. Kuniavsky describes ubiquitous computing with a metaphor: “Computation is a
cloud that surrounds us.” He continues, “This metaphor compares the permanent availability of information and information processing to a vapor enveloping... every person and object (2010).”

This idea can be seen in many of our everyday products. It is outstanding how much of our life is influenced by computing power. Everything from our automobiles to our kitchens to our bodies, with objects like prosthetic limbs or pacemakers, now has powerful computing power (Kuniavsky, 2010). While this perceived superintendence may seem overwhelming to previous generations, it is important to note that the Net Generation has grown up in this environment. This generation is comfortable in world that is automated, indexed and digitized. Their educational environment must follow suit.

2.4.2 Mobile Computing

There is no doubt that mobile computing has been on the rise in recent years. This growth has a symbiotic relationship with ubiquitous computing. Garter reports that “Mobile data traffic will increase significantly as more people will have access to mobile data networks, there is a migration toward smartphones and an increase in sales of media tablets” (2011). In fact, Fortune Magazine reported that sales of smartphones, like Apple’s iPhone or Research In Motion’s Blackberry, passed the sales of personal computers for the first time in Forth Quarter of 2010 (Weintraub, 2011).
It should be no surprise that members of the Net Generation are comfortable in this space. Members of this generation are at the leading edge of the growth of mobile computing with total cell phone ownership in the demographic growing from 45% in 2004 to 71% in 2009 (Lenhart, 2009). Smartphones and now tablet computers like Apple’s iPad have allowed users to work in new ways. We are just now on the brink of understanding how to best use these tools in educational settings, but it is very clear that a great number of students desire to use them.

2.5 Historical context of course materials

Traditionally, courses have revolved around the textbook. The textbook either served as a cornerstone, where lectures and in-class activities were driven by its contents, or as the primary supplement for the course, where readings from the text were used to reinforce in-class activities. With that in mind, it is important to understand the historical context of textbooks and what they provide. Wakefield has done a historical analysis of textbooks and points out that they had their start at “the end of the eighteenth century, when such books were commonly in the hands of students as well as teachers” (2000). Their roots are grounded in religious readings and originally had a strong emphasis on memorization. These books were highly customized collections that contained short texts for students to learn lessons and memorize facts. Each instructor had a customized book was crafted by either themselves or their school for their specific class.
However, as time went on, the use of the textbook evolved further and further away from its originally intended use. The transition was the result of “...a change in educational theory, the rise of teacher education, and the commercialization of textbooks” (Wakefield, 2000). The standardization of educational theory and subsequent mass production of textbooks produced a system that lasted for the next 150 years.

Books were quickly revised to work for as many classrooms as possible. This was a major detriment to the textbook as a resource. Textbooks no longer applied to every course and slowly became a cumbersome, expensive item that was not very useful to most people (2000). In addition, mass production added extra time to the process. Textbooks now had to go through a laborious process of vetting and approval before they could be printed. This dramatically increased the amount of time between releases and often rendered the book obsolete towards the end of its life.

Now, with recent advancements in technology, we can return to an idealized system that makes the textbook a customized, focused resource for a course. Wakefield reports that “An increasing number of teachers...are perceiving the textbook not as the sole information sources, but as the hub of several information resources” (2000). We now have the capability to make a new textbook, almost instantaneously. In addition we can craft them, as Wakefield
describes, as a central hub of information. The textbook no longer has to be the definitive and often outdated source that is used by thousands of courses around the world.

**2.6 Area of opportunity**

After looking at this research, it is clear that there is a new area of opportunity. The intersection of Net Generation student needs, new technological advancement and a struggling textbook industry provides an interesting convergence that is propitious for discovery. However, before a solution can be developed, a thorough understanding of the resources currently available to both students and instructors is necessary.
CHAPTER 3

Contextual Analysis of Existing Industry Products

Based on the findings in the previous chapters, the importance of a digital transition in the educational system is very apparent. However, this is not an entirely new concept. Professors and institutions have long been exploring the power of digitizing material and connecting to the Internet. Those investigations have proven successful in many cases and have failed in others. In this chapter you will find a detailed analysis of several educational products currently on the market. They all attempt to satisfy a specific market within higher education. In analyzing different categories of available technology, a determination can be made around what can and should be integrated into a successful content delivery system. Special focus is paid to sources and materials that enhance the traditional model of course reading material.

3.1 Online Distance Learning Institutions

It is important to note upfront that this analysis will not include fully digital institutions. The ultimate manifestation of a digital education environment is an institution that functions completely online. These are often private institutions,
like the University of Phoenix, that cater to professionals or students who cannot commit to full-time schoolwork. There is much to be said about the value of these institutions for that demographic. They provide a much-needed educational outlet for people who otherwise would not pursue higher education (Ng, 2006). While this forum has its place in the landscape of higher education, it is not a solution for all students. The aim of this analysis is to understand what aspects of digital materials and delivery systems are successful or weak, so they can be better integrated into more traditional course settings. The goal of the developed solution is not to replace the classroom but rather to supplement the experience.

3.2 Digital Textbooks

With the rapid growth of mobile technology, notably tablet computing, there has been equal growth with digital textbooks. Textbooks made an quick transition to the digital format. However, their early transition has led to a slow evolution of their potential. As textbooks made their transition to electronic media, they often became simply static, digital representations of their physical counterparts. No special considerations were given to the changing needs of students. Being in a digital format added no value to the books. Other than the basic ability to search or annotate, there was no conceivable difference from the physical book.

With that being said, there has been a recent movement to bring more functionality and use into the format for students. The software company Inkling
Systems, Inc. has been doing some interesting things in the area of digital textbooks with their iPad application Inkling (Figure 1). In an attempt to make digital texts more useful for their Net Generation users, Inkling has focused on updating the overall experience. Their digital texts offer interactive asides, interlaced assessment tools and varied content media (Figure 2).
Inkling’s approach to the digital textbook is refreshing in that it is really striving to meet the educational needs of Net Gen Students. Providing them with multiple media avenues to understand a concept is in line with the research
about these students’ preferences. This is a great example of a company utilizing new technology to make the educational experience better. Inkling also has implemented a new economic system that will resonate with Net Gen students. This idea will be explored later in this chapter.

Similar to Inkling, Kno is another digital offering in textbook space. Kno is also innovating in the format, but in different ways than Inkling. Kno offers the ability to add course supplements in the form of PDFs to its system. The software then gives the students the ability to group course reading material purchased through their storefront with extra documents that are related to the course. For me, this is a breakthrough in the medium. Students are now given the ability to keep all of their course materials in one digital grouping. However, there are still some negatives associated with the system. Interaction with the material itself is still quite basic, giving the feel of a static representation of a physical book.

In both of these examples, the systems are still very restrictive in the sense that they only allow the student to use their authorized material. Students and perhaps more importantly their instructors are regulated to a narrow selection of materials. Often the books are still very expensive and are not completely useful for the course. Nonetheless, there are exciting things happening in the digital textbook space. There are many examples here that point to a promising future for a digitally enhanced classroom.
3.3 Online content

As seen in the advancements of digital textbooks, specifically within Kno, students clearly desire the ability to supplement their provided course materials. Because of this, delivering additional content to students in a digital format has been one of the most utilized pieces of technology in education. Delivering various materials or readings in a PDF form is widely used in courses around the world. In recent years there have been huge advancements in how content can be delivered to students while simultaneously fostering serendipitous discovery of supplemental materials. Additionally, students have rapidly become comfortable using these resources to supplement course material. Instructors can utilize these digital materials by distributing them to their students to help them better understand the course material.

3.3.1 Course repositories

Websites like the Massachusetts Institute of Technology’s MIT OpenCourseWare (OCW) are a prime example of delivering content digitally. OCW is “a web-based publication of virtually all MIT course content” featuring content for over two thousand MIT courses (2011). Instructors are responsible for posting content to the site for students or the general public to use in relation to a course. This means that they can publish anything that may be useful for the students. Videos, PDF readings, blogs and virtually anything else that is available online can be added to the course repository.
There are a few key characteristics that should be noted with this system. First, the course material is completely open. As long as the instructor publishes the information to the site, it can be accessed universally. This is an intriguing concept because it allows students from other institutions to reference this material as a supplement to their own coursework. Because it comes from a reputable source, MIT, it is a safe place where anyone can come to utilize the materials and know that they are credible and useful. Second, this system builds an element of choice into the course material. Frequently, each instructor presents the students with video lectures and transcripts of lectures as well as reading and supplements (Figure 3). Based on the profile of Net Generation students, this feature will strongly resonate with the demographic.
While looking at OCW, there are a few other features that add to the overall experience. First, there is wide integration of social networking. In addition to the ability to connect to traditional networks like Facebook or Twitter, students are also able to create smaller networks or ‘study groups’ (figure 3). Secondly, the instructor has the ability to build in self-assessment guide points for the students to use. Similar to Inklinkg’s built-in assessment, this feature gives students a chance to test their knowledge as they read the material.

Another service similar to OCW is Connexions, which describes itself as a “dynamic digital educational ecosystem consisting of an educational content
repository and a content management system optimized for the delivery of educational content” (2011). Simply put, Connexions is an open-source community where anyone can search or browse for course content by identifiers like subject, title, author and more. Functionally, this service appears to be very useful as a place to publish course notes, lessons and resources in one place.

However, from a user experience standpoint, the service struggles. Interacting with the site feels cumbersome and generally lacks readability (figure 4). This is a big downfall when working with the Net Generation. If the system seems hard to use, student users will leave almost immediately. However, there are several redeeming features in the system. Students have the ability to browse for similar content by a multitude of filters. This is highly desirable because of the Net Generation students’ desire to solve problems in unique ways. Other useful characteristics include social networking integration, ability to save the course materials in multiple formats, and the ability to integrate multiple modes of media into the course collection.
3.3.2 Audiovisual content

There are several services that offer an online hub of audio or video material that can relate to the course. These services offer video presentations, lectures or other supplementary material, usually in the form of podcasts. Parsons describes podcast services as “the subscription to and subsequent automatic downloading of either an audio or video file to be played on a computer or iPod/MP3 player” (2009). This allows the students to download visual material at their own pace.

The distinguishing characteristic of this delivery mechanism is that it allows for freedom of use, allowing students to use these materials in different ways and on
their own schedule. Parsons describes the added benefit of these supplements by saying “Vodcasts are considered a useful addition for increased understanding of the material, while podcasts are considered to help understanding during the course and for revision purposes” (2009). Use of this kind of supplementary material is ideal for the Net Generation because it gives them an opportunity to gain further understanding in a space that is comfortable for them.

One popular example of this education podcasting is iTunes U (Figure 5), a special section of Apple Inc.’s iTunes software. This section, which is housed in a familiar setting for students, is a place for instructors or institutions to post educational podcasts. Students can access free content from their course, or even institutions around the world, and transfer it to mobile devices for convenient use. This interface also allows the student to browse supplementary content by topic. For instance, a student who is struggling with the concept of supply and demand can find and watch video lectures from several universities to get a better grasp on the concept.
Another outlet for online audiovisual material is through content providers and organizations like Technology, Entertainment and Design (TED). TED organizes annual conferences that bring together the best minds in a variety of fields. At TED Conferences, presenters discuss a wide variety of topics, often about cutting-edge work in their field. TED’s accompanying website, http://www.TED.com (Figure 6), posts videos of all these presentations for free use. This is an excellent example of a way to implement Net Generation type resources in higher education. TED videos, which are already widely popular, can be a useful addition to course supplements.
TED.com also has several features that cater to tech savvy users. The site gives users the ability to share the videos on social networks, comment on the videos with other users, and even utilize interactive transcripts. This feature allows users to read the transcript of the video, click on any word and be shown that exact place in the video. This type of multimodal learning environment is highly desirable amongst Net Generation students. Parsons describes the importance of these video-centric resources by saying “In this environment, students can learn at their own pace and in a variety of modalities…” (2009). The propagation of tools like TED.com in course supplements is just another piece to helping students learn in an ideal way.
Content Marketplaces

While there are a host of free resources available for students to access free supplementary materials, like TED.com, there are also services that allow for the purchase of material. The general feeling amongst Net Generation students is that anything can be found online at any time (Green, 2007). However, there are instances where the needed information cannot be found in a freely online. While library systems, with the help of services like Google Books and
Safaribooks Online, are constantly updating their roster of digital offerings, students must sometimes purchase materials.

As previously mentioned, Inkling has introduced an intriguing economic system to their purchasing options. Each textbook, which is specifically formatted for the Inkling software, is available for purchase in its entirety or by the chapter at a subsidized price (Figure 7). We know that the cost of higher education has risen dramatically over the last few decades, partly due to the cost of textbooks. A recent study found that “[70% of] college students said they had not purchased a textbook at least once because they had found the price too high” (Redden, 2011). Offering students the ability to purchase individual sections, as opposed to the entire book could potentially save the student money. At the very least, giving students this option ensures that they will get the most usable sources for their money.
Figure 7. Inkling’s storefront allows for the purchase of individual chapters.

Some of the leaders in the textbook industry are adopting these pricing models. Wieder reports in The Chronicle of Higher Education that publishers including McGraw Hill, Pearson Education and Cengage Learning are all beginning to
implement this type of pricing structure (2011). In addition, they are providing instructors with the tools to build custom textbooks. For example, McGraw Hill offers a product called Create that allows instructors to “Customize [their] own high quality, well-designed, full-color textbooks in print or ebook format” (2011). Chapters from many McGraw-Hill texts can be combined into one collection (Figure 8). There are even options about how to publish the newly created book. Students can access them in electronic or printed form. This is just one example of how improvements in the area of content purchasing allow for smarter course content.

Figure 8. McGraw-Hill Create’s custom book building interface
3.4 Course Management

The field with the most variety in this new digital space is within Course Management tools. Course management can be classified in many different ways, but for the purpose of this study, I am grouping together tools that allow students to interact with their course. This can include anything from learning management, to assignment or tasks organizers, to future course discovery. Because of the potential these tools hold, It is understandable that Industry has raced to meet the needs of this generation in these areas.

Companies like Desire2Learn have been providing eLearning solutions to academic organizations since 1999 (Desire2Learn, 2011). This system, which is used by The Ohio State University, allows institutions to make customized online spaces for students and instructors to hold conversations, access course material and assess their knowledge with quizzes or tests. These are fairly successful applications that offer a lot of course functionality in a centralized location. However, their interfaces are often cumbersome, lacking intuitive interaction and usefulness. These types of interactions are negative from both the student and instructor perspective.

Looking at The Ohio State University’s Desire2Learn system, called Carmen, you can quickly find several areas for improvement. One is the basic organization of course material. There is no universal way to organize material, allowing each
instructor to organize information by date, topic, or any other method. Looking at Figure 9, it can be seen that one instructor has chosen to organize the material by date. However, Figure 10 shows course material that has been organized by topic section. Small inconsistencies like this build up to a poor experience for the students.

Another negative about this system is that courses do not interface very well together. Courses are separated from one another, perpetuating the feeling of a disconnected collection of materials. Speaking from experience with this system, instructors have difficulty transferring information from one course to another, and students have to follow a cumbersome path to work with multiple courses in one session.
Figure 9. Collected course content on Carmen organized by date
Browsing available courses is another troublesome area. This type of forum seems like an ideal place to explore new course options. The ability to compare other course offerings by looking at descriptors like reading lists, covered topics and assignment examples would give students valuable insight into the usefulness of the course. The environment appears to be primed for this type of exploration. Because of all the pertinent information for the course is housed in the system, the next logical step would be to make that information public. This ties perfectly back to Barnes’ observation about Net Gener’s desire to have choices available to them (2007). With a simple Google search, anyone can find
basic course information from a multitude of institutions. Provisions should be made to allow students to explore course information in a better way.

There are a few services that are starting to allow students to explore courses in useful ways. Courserank (Figure 11) is a service that is dedicated to giving students information about courses and previous student experiences. Its goal is to connect students to the best course for their needs or preferences. While this service does not go into detail about specific subjects or topics that will be covered, it does provide valuable insight from students who previously took the class. This type of openness about an experience is important to the Net Generation. It’s also an introduction to another indispensable tool for Net Generation students: search.
While discussing the concept of searching, it is important to note offerings in the academic search field. Students are not only searching for future courses to take; they are looking for almost everything online. Barnes points out that “Net Geners’ use of the Internet for immediate access to information has taught them to expect immediate answers” (2007). Part of being ‘digitally native’ means that everything is accessible instantly through the Internet. Green and Hannon further describe this observation further when describing the students’ search habits in regards to education: “Trawling search engines and websites ... is not seen as cheating
by these ‘information gatherers’ but the primary method of locating the answer” (2007). Students within this generation do not have a problem asking for the answer to a question by quickly searching the Internet. This should not be seen as a bad habit but rather an evolution of information gathering.

These students are the first generation to have this type of tool accessible to them, so it makes sense that there is apprehension about their use of these technologies. There must be a conscious effort on the part of search engines to instill a sense of credibility. Similarly, attention needs to be paid to teaching students good practices when it comes to searching. Green and Hannon point out that “many are not capable of critically evaluating sources. Although search engines and web 2.0 sites are this generation’s reference point, they are being employed with varying levels of sophistication” (2007).

Students who are looking to supplement lecture or readings often turn to search engines to get a better grasp of a concept. In the academic setting, search engines generally fall into three categories. However, each category of search has strong positive and negative aspects. First, mass-market, high-traffic engines like Google or Microsoft’s Bing are by far the most popular. Based on proprietary algorithms that filter results by factors like keywords and popularity, a search could yield nearly anything, which often renders results useless.
Second, wiki-based engines like Wikipedia are a popular choice for students. The positives of a wiki-based system revolve around the power of publicly generated content. Because sites like Wikipedia rely on the generation of content by their users, they are able to index massive amounts of data about countless topics. Search results here are generally more appropriate, but because of the open nature of the site, accuracy can become a concern. Green and Hannon report that students are generally trusting of crowd-sourced information but are aware of the negatives, which causes some doubt about the legitimacy of the source (2007).

Last, academic-centric search engine like library websites are tools that can be used with a fair amount of confidence about their legitimacy. Searching for a topic within a library website or broader service like WorldCat.org will yield vetted sources. However, these services are often hard to use, relying on librarian-centric taxonomy and search techniques. Because the other two categories of search tools are very popular and comfortable for the Net Generation, students can have difficulty working within these systems.

To illustrate the differences within these tools, I have entered the query ‘supply and demand’ into each one. The results of this search query varied widely, as seen in Figures 12, 13 and 14. However, even though the results are so different, students will always use the engine that is easiest for them. With that in mind, it
is important to think about how to combine and maximize the strengths of each system to make a better experience for students.

Figure 12. Varied, unpredictable Google search results
Figure 13. Topic overview-based Wikipedia search results
Figure 14. Accurate but hard-to-find WorldCat search results
CHAPTER 4
Proposing a Systemic Solution

4.1 Observation of the issue

In an attempt to reach the needs of Net Generation students, the industries that surround academia have rushed to release digital products. As a result, they have flooded the market, developing many useful options for students. However, digital tools are often disjointed from each other, making it cumbersome to work across platforms in order to compete similar tasks. In Chapter 3 of this document, we looked at educational tools that are presently available on the market. While all of these tools are extraordinary in their own right, they have to interface together to create a unified course content experience. This means that students and instructors are required to use multiple tools within one experience.

It could be possible for some of the aforementioned tools to create a unified experience. However, because there are so many tools available, none of them can gain enough momentum individually to reach their full potential. Due to strong competition in the market, there are often several product options that complete the same task. While this seems like an ideal scenario for the Net
Generation because of their predilection for choice, I actually see it as a real deterrent. Instructors see educational tools come and go, leaving them skeptical to try new solutions. As a result, students follow suit and choose not to use tools they know will not be compatible with their course. Similarly, students cannot afford to invest too much time or money into tools that are not guaranteed to be compatible. We must also compensate for the Net Generation student predispositions. As we have seen, students spend a large amount of time online, giving them a feeling of connectedness and immediacy. Because of this, they have brought use patterns, good and bad, with them to the educational environment.

With this in mind, the pieces are in place to inform better course content delivery systems. We now have the ability to harness the affordances of the Information Age in order to create a comfortable, useful experience for both students and instructors. In thinking about crafting this new experience, we have to look at existing systems that work in similar ways. Overall, a more unified solution will allow all stakeholders to work comfortably while simultaneously allowing for better, more effective experiences.

4.2 Successful Digital Transitions

Before proposing a new system, it is important to examine successful instances of content delivery systems. As previously stated, education has been notoriously slow to accommodate the needs of an evolving student population. Meanwhile,
other industries have met the challenge with innovation. It is important to look at these examples and define what was successful about them. Industries like music and non-academic publishing have embraced their new demographic and developed a near ideal experience for all stakeholders.

Apple Inc.’s iTunes is one of the best examples of transitioning an industry to a digital format. In 2003, Apple launched its music delivery service and changed how the music industry has delivered content to its customers. Through iTunes Apple allows users to purchase content like music, movies, books, podcasts and more. Dating back to 2005, iTunes’ dominance of the industry has been well documented (Borland, 2005). In fact, it has been estimated that from 2004-2009, digital sales of music rose 940% with the bulk of that success attributed to iTunes and its effect on the digital music landscape (IFPI, 2010).

Similar to iTunes, Amazon.com Inc. (Amazon) has advanced the publishing industry to a digital delivery model with its Kindle system. Amazon is a web-based storefront that sells a multitude of items but has long been known as a leading provider of books and other published material. For the past few years, Amazon has begun selling electronic versions of their books alongside traditional formats like hardcover and paperback. Customers are able to purchase these books and subsequently read them in several formats including online, on mobile devices like the iPhone, or primarily on Amazon’s Kindle e-Reader device.
Amazon has been selling an increasing number of digital editions, crossing the threshold of selling more digital books than hardcover editions on 2010 and eventually selling more digital versions than any other format in 2011 (Tweney, 2010; Miller, 2011). This highlights the popularity of digital content but also speaks to Amazon’s own success. In 2010 it is estimated that Amazon had 70 to 80% of the market share of digital book sales (Carnoy, 2010). This means that Amazon has been a driving factor in the success in this industry.

In looking at these two companies and their content delivery strategies, there are some striking similarities. Identifying their successful traits can lead to an integration of these strengths into a solution for higher education. Upon closer inspection, there are four areas that Apple and Amazon do well in their systemic solutions: seamless integration with mobile devices, a consolidated user interface, reduced or subsidized pricing, and connections to social networks.

To begin, both systems take great pains to be compatible with a variety of mobile devices. Because we know Net Generation students like variety, this is suited perfectly for them. In Apple’s case anything purchased or rented in iTunes can be viewed on a PC or sent to an iPod music player, iPad tablet or iPhone smartphone device. Similarly, digital books purchased on Amazon can be sent to a much wider variety of devices including Amazon’s own Kindle e-Reader, Apple’s suite of devices, Google’s Android phones, PCs and more. This ability gives users the
freedom to use their content in any setting they like. Someone who has purchased an electronic copy of a novel through Amazon’s storerfront can start reading it on the computer, push it to their iPhone to read on the bus, and later finish the book with a Kindle while sitting on the couch. Because the content is centralized within the system, users can always access their materials easily and use them in a variety of ways.

Secondly, these systems offer a consolidated interface to search or browse for content. Searching in these types of systems yields a variety of content. Users are then allowed to browse by format, media or relevancy to pick the item that is best suited to their needs. Amazon does this through their well-stocked online storefront, but it is iTunes that best exemplifies the usefulness of this feature. If a user searches for the term ‘jazz’ in the global search field, they instantly receive an extensive list of options (Figure 15). From there, the user can find exactly what they are looking for in the format they are most comfortable using. Songs, entire albums, TV shows, iPhone applications, university lectures, eBooks, and movies are just a few of the options that are available. Because of these systems, Net Generation students have become accustomed to getting these types of inclusive search results. Everything is useful, but they are allowed to pick their content based on what is most usable for them according to their criteria.
Next, the choices are extended to the payment structure of the system. This means that users are allowed to pick an item based on not only the usefulness of the content but also the price point. In iTunes this is best exemplified by the ability to purchase music at subsidized prices. Each album is available for purchase in its entirety, usually $9.99 USD, or at a subsidized $0.99 USD per-song price point. This is yet another measure to ensure that users can buy exactly what they need. Our current technological state allows users to buy exactly what they need at an affordable price. Amazon has a similar pricing structure but to a lesser extent. Unfortunately, they have not reached a level of sophistication.
like the previously mentioned Inkling, which would allow the user to purchase individual chapters of content material. However, they do have some nice economic features that would resonate in an educational setting. Regarding textbooks, Amazon offers the ability to preview a book and subsequently purchase the traditional or digital editions. They also offer an outlet for the user to easily sell the book back to them at the end of the term or even rent a book for a short period of time. It is starting to become clear why the Net Generation is so comfortable with choice and freedom on the Internet. They are given so many more options than students that came even five years before them, let alone previous generations. This preference must be accounted for in their digital academic environment at an increasing level of sophistication.

Finally, there is an element of social networking that is prevalent in both of these systems. There are the basic sharing features that are commonly found in many contemporary websites, but there is also a much more powerful feature at work. User reviews or comments are highly prevalent in these systems. Net Generation users gravitate towards the sense of community that is fostered by these comments. When purchasing music or books, it is important for users to have validation that they are making the right choice. User generated comments are just another way to help filter results and make more informed decisions.
4.3 Systemically redefining the ‘textbook’

After looking at systemic solutions in other industries, it quickly becomes apparent that digital educational tools need a similar approach. The case studies of iTunes and Amazon are perfect examples of how to craft a system around an experience. These systems are very successful at providing a service that is easy to use and delivers exactly what the user needs. This usability directly impacts the experience. By creating an environment that enables complex digital interactions and yields useful output, users are enabled to walk away feeling content and empowered. Imagine if an educational content delivery system could deliver a similar experience. An equally powerful experience can absolutely be crafted for academia. Instead of consumers feeling content with their purchases, now students can equip themselves to learn in ideal ways.

I am proposing that a new systemic solution can foster a much-needed refresh to the concept of a ‘textbook.’ Static, prescribed content offered by traditional media has quickly become a thing of the past. As has been shown, there are a myriad of content options available to students now. The delivery of course materials and supplements can now return to its early form, a custom collection that caters to a specific demographic. With new technology at our disposal, a system can be crafted to allow for a textbook to be customized for each student. However, this type of experience is much more complex than current offerings.
In order to create a better content delivery system, I am proposing a new system of interaction (Figure 16).

**Figure 16. Proposed systemic solution**

1. Instructor tool: Manage and format (design) course materials
2. Existing materials: Ability to upload course documents/media
3. Publish to students: Send collected materials directly to students
4. Student interface: The ‘textbook’ the students see and interact with
5. Learning object aggregator/Store: Instructors or students can add professional materials or other supplements to the course packet
6. Social network: Connect students and instructors together
Each part of this new system has been thought out and is vital to its overall success. After thoroughly examining the available tools, I now have the ability to combine aspects of all of them to create an ideal interaction. The interactions are housed within the system and equip it to meet the needs of all of the stakeholders within a course. Instructors are able to generate or collect course materials, students can consume materials in familiar ways, and publishers have an ideal outlet to sell content. Not only can this new solution meet the current needs of these users, but the integration of all of these pieces will enhance the experience greatly. Open access within this system will allow for new information to easily be discovered and will also help foster course dialogue. With this in mind, each portion of the system will be outlined in the following sections.

4.3.1 Instructor Tool

The system begins with an Instructor facing component. In this system instructors will now have the ability to create, organize and publish course material to their students. It is crucial that the interaction is comfortable and useful for instructors. As described in Chapter 2, if instructors are not comfortable using a system or are unsure of its potential for their students, they will often disregard the tool.

The goal with this portion of the system is to allow instructors to build a textbook that is exactly what they are trying to convey in their course. Similar to the
existing tools offered by textbook publishers, the instructor will be able to choose specific chapters or available articles. However, now the instructor will be able to include relevant material regardless of medium. Anything that is available in a digital format, including anything that instructors upload themselves, can be collected into this system. Self-recorded videos, unpublished papers, previous student work examples, and even websites or blogs are now possibilities for instructors to share with their students. Because all of this content is being collected in one centralized place, it will be easier for the students to make connections across content, relieving them of having to jump around to find various parts of the material.

These collections will act as a guide for the course, just like traditional textbooks. As instructors build these collections, they should be able to easily organize topic sections and associate content with each section. This helps the student get a broader view of what types of materials are being used to cover current or upcoming course topics. This interaction will work organizationally in a similar way to the example of Carmen and functionally in a similar way to OpenCourseWare in that the collections will be visible to all students. As a result, each published collection will now become an index-able entity unto itself. There will be more explanation about indexing collections in the description of the Marketplace. The instructor tools lay the foundation for the rest of the system interactions.
4.3.2 Student interface

Once the instructor has collected the course materials, the collection will be released to students. Once in their viewport, students will have a host of options for what they can do with the collection. Each student will want to consume the material in his or her own way. This system now allows for that freedom. Similar to Amazon’s system, the student can read content online, push it a mobile device, or print the documents at their discretion.

The instructor has put together a collection that is ideal for the specific course. However, we know that each student learns differently. Delivering the content in this way can now allow for a better alignment of materials and student need. Students will be able to do add materials through the marketplace or in social interaction with their peers. In general, the student interface will feel familiar to the student because of an emphasis on contemporary design and interaction standards. Their college course textbook book will now feel as familiar as their use of Facebook or Google.

4.3.3 Marketplace

As previously mentioned, the instructors will be able to build their collection of materials from a variety of sources. They should be given the opportunity to find and include valuable sources from all different types of media. iTunes provides a good example of offering a multitude of formats on a topic. This new system will
work in a similar fashion. We now have the capability to collect any consumable piece of information into individual modules. These modules may consist of a chapter of a book, an online video or blog entry. By indexing all of these modules into one system and allowing access to them through a unified interface, both instructors and students can find the most useful items available on the Internet. Content similar to that outlined in Chapter 3 including popular video depositories, podcasts, or websites can now be included in the same interface with traditional academic sources. We know that students are using these types of materials already, so it makes sense to try and present them with the best content possible.

However, this amount of information in one place could be overwhelming for any user, so the system must compensate in order to present it in a usable way. Search filters and recommendation algorithms are necessary to allow for simple discovery and browsing. Students who are having difficulty with a topic in a course can now come to the system and find more information that will help them learn in their preferred way. Each module within the marketplace can be added to a student’s collection, either by the instructor or the student themself. Each item will be available at a subsidized cost or in some cases free. For materials that are available freely online, it will be beneficial for the student to now have the ability to add this to their collection instead of accessing it separately online.
4.3.4 Community network

One of the more important attributes of this type of system is that it allows for a network of communication. This network’s primary function is not intended to be a social outlet like other available tools such as Twitter or Facebook. Instead, this academically focused network would allow students and instructors to create a system of critique. Because the system is so dynamic, new content will be added or indexed every day. It is important to build in an outlet for students to comment on these ever changing materials. Students can talk to each other about the course, useful materials they have found, or simply inform the global community about a piece of information. Similarly, instructors can comment on the validity of a material or recommend alternate resources to their students. This network will add a much-needed vibrancy to the system, making it an ever-evolving database of experience and insight. It will also help the Net Generation students feel as though they are part of a larger community, a noted preference among member of their demographic.

4.4 Known or perceived obstacles

In this proposed ideal solution, there are some clear obstacles that must be overcome before it can become successful. While it is important to note these obstacles, it is not the objective of this research to solve them in the near term.
4.4.1 Integration with institution

Many institutions already have some form of digital course management system already integrated with their school. For example, the Desire2Learn web application Carmen at The Ohio State University already offers a place to organize digital course content. While it would be necessary to integrate this new system with those already in place, that topic will not be a focus of this research. With that being said, the ability to connect directly to the full institution would allow for a richer experience. Courses would already be catalogued in the institution’s system, allowing for discovery of potential courses. Integration with the institution would also add an element of credibility that cannot be achieved using third party software.

4.4.2 Economic roadblocks

The traditional economic system of publishing is well established. There is no doubt that a system like this will put a strain on the industry and invoke anxiety. Much work will need to be done in order to balance providing these materials in an ideal way and keeping the content providers fiscally healthy. However, it is my hope that the arguments made in this research point to a clear shift in the economy of academia.
4.4.3 Assessment

It makes sense that instructors would be able to assess the progression of their students’ knowledge within a system like this. Additionally, students could potentially have the opportunity to self-assess as they progress through the materials. This could be yet another powerful tool that accompanies the experience. However, the area of assessment requires in-depth research that is not feasible within the constraints of this project. In order to be done right, we must thoroughly understand the goals around knowledge assessment within the system for both students and instructors. Meanwhile, assessment is an important factor in the overall success of this experience that needs more attention.

4.5 Hardware independence

An important attribute of note in this solution is that it allows for complete independence of hardware technology. As specified earlier, the hardware that is used to deliver content in a system like this changes very rapidly. Because of Moore’s Law and other economic factors, the technical ability of hardware improves at an astonishing rate. The system I’ve proposed takes this into account by centralizing the content. Organizing and storing the content in one networked place allows for it to be distributed to any device. As a result, the content will stay relevant and compatible on all future hardware.
CHAPTER 5

Understanding student needs

5.1 Narrowing of scope

The system that I have proposed is based primarily on the analysis of current student preferences and trends amongst existing product offerings. I believe the solution is thoughtful and well-researched. However, it is useless if it is not what the stakeholders are actually looking for in a content delivery system. In order to gain a better understanding of user needs and validate my proposal, I conducted an initial round of research.

Through both a survey and interviews, I attempted to uncover thoughts on course content delivery from the people who might actually utilize the services. There is equal value in getting this type of firsthand information from both students and instructors. However, with the constraints of time and resources, I decided to focus primarily on the student perspective. Student preferences have changed dramatically in recent years while instructors have remained relatively flexible, evolving to meet their student’s needs. Because of this dynamic, I felt there was sufficient validation to move forward with an observation of students.
In understanding student desires, we can more accurately build an instructor interface that helps deliver useful materials.

Additionally, this proposed system is very large. With my constraints in mind, I chose to focus on one specific area within the larger whole: the marketplace. I felt that this area had the most potential for innovation. This section also lends itself well to a unique user experience and interface design solution. One of the clear benefits of the marketplace is that it allows students to explore supplementary materials with the goal of better understanding their course content. This can be a very powerful tool if done well. With all of this in mind, I set out to gather insights from students about how they prefer to supplement their course material.

5.2 Demographics

For the initial round of research, I chose to solicit participation from students in the Department of Computer Science and Engineering at The Ohio State University. Computer Science (CSE) is more advanced in terms of digital text offerings than other academic areas (Li, 2011), which increases the chance that these students will have had some exposure to digital educational environments. Additionally, I partnered with a group of students in the CSE department’s CERCS for Enterprise Transformation and Innovation (CETI) who were working in a similar area and had exposure to a large number of students.
Both undergraduate and graduate (Master’s and PhD) students were included in the study. No special considerations were taken to differentiate between gender, ethnicity, socioeconomic status or any other distinguishing characteristic. The primary goal of this first round of research was to get an overall idea of trends and desires in the general student population.

5.3 Methodology

During OSU’s Spring 2011 academic quarter, a survey was drafted to better understand students’ use and preferences surrounding their course materials. Special emphasis was placed on understanding where students go to supplement their prescribed course materials. The survey was administered in both physical and digital formats. Participants were asked questions in three categories: General preferences in course materials, library use, and a comparison between digital and traditional materials. Thirty-eight total students participated in the survey with a breakdown of 11 undergraduates, 20 Master’s, and 11 doctoral students.

Based on the responses to the survey, nine students were selected to be interviewed in greater detail. Each interview lasted approximately 30 minutes, and participants were compensated with a $10 restaurant gift card. These interviews were conversational in nature but were moderated based on a specific set of questions and a generative canvas. The canvas (Figure 17) served as an
assistive tool that allowed the participants to think about their everyday lives and reflect on their use of educational technology more thoroughly.

Figure 17. Generative canvas used during interviews.

Each canvas contained a frequency scale on which the participants were asked to describe information gathering that they do throughout their day according
to frequency of searches. The participants then marked down instances of information gathering throughout their day. It was important to allow them to document non-academic information gathering as well as academic. This information will give insight into the differences between the results they get when looking for more academic information versus recreational data, such as movie show times.

The goal of asking students to document their habits in this way was to allow the participants to think about things they liked or disliked about their current state of researching. In doing this, they were eventually able to define an ideal tool that would allow them to find information or supplementary materials. After talking through elements that they liked or disliked about traditional and digital media, they were able to describe an ideal scenario. They were also asked to document the attributes of their ideal solution and rank these attributes according to importance.

5.4 Results and Insights

The results of both the survey and interviews easily validated my assumptions. After hearing what students had to say, some clear themes about their needs in this area emerged. The sections below outline those themes and how they might impact the proposed system.
5.4.1 Multiple Modalities

To begin with, there was a resounding call to have digital materials available within their courses. In fact, 92% of the respondents reported that they prefer digital materials to physical versions when given the choice. Additionally, the participants frequently mentioned the desire to have freedom when choosing the format of their materials. The desire to transfer their reading material from one device to another or to print it at their discretion was common amongst the participants. This finding aligns perfectly to the research pointing to the Net Generation’s desire to have options.

5.4.2 Validity

The second major theme was the importance of validity when searching for course-related information. The best example of this idea is captured in the analysis of words that were used to describe the participants’ ideal solutions. Words like “comprehensive, relevant, legitimate and accurate” were among those used most frequently. Each participant phrased this concept in a slightly different way, but it was very clear that students are concerned about the validity of information they find online. This is a refreshing finding, proving that students are savvy about their academic lives online.

In the survey the students were asked to define what method they use to start an initial search for information. The answer to that question is that they
overwhelmingly use a popular search engine, like Google or Microsoft’s Bing, instead of library websites or other services. Next, they were asked to identify why they chose this method. The most popular response was ‘legitimacy’ (42%) followed by ‘time’ (31%). Interestingly, when they were asked to determine which outlet would yield the most legitimate information, they identified their library’s website as the most legitimate source. Why is there a disconnect between what students perceive to be a legitimate source and what they actually use? I would argue that the popular search engines have put a lot more effort into crafting a good experience than the local library. This will be an important piece of information to have in the future development of a solution.

When probed for a solution to the problem of validity online, the students had several interesting ideas. The following solutions were the most common or had the most applicability to the present issue:

**Crowd-sourced validation**

Students frequently brought up the importance of knowing what other users have encountered when using a piece of information or resource. Comment threads and forums were frequently mentioned as good ways to get validation.
**Legitimacy meter**

One of the more intriguing concepts was the idea of a meter that would identify the legitimacy of the source. The student expressed a desire to have some way to know that the information is useful or accurate. This ranking could come from a variety of sources such as content experts or through user validation.

**Triangulation**

Another interesting concept is the idea of triangulation. The student who described this brought up the fact that they don’t know if they have found all the sources available on the topic. Students wanted some way to know that they had triangulated information from varied and accurate perspectives.

**Location based preferences**

The students were more likely to use a source if they knew it was from a familiar place. Students reported that reviews about an item are not as useful if they all come from another country.

**5.4.3 Content based searching**

I mentioned earlier that I divided in participants’ canvas into personal and academic sections. This was done in an attempt to understand if there was an overlap in the way students search for information in their personal and academic lives. There was one intriguing concept that came out of this
investigation. Net Generation students are very comfortable searching for things in their everyday lives. They look for song lyrics, friends’ addresses, acting resumes and a multitude of other items every day. However, when they do this, they focus on content rather than keyword. Academic searches tend to have more specificity and therefore require different search techniques. This is important to note when designing a new system. Students want to search for information in a conversational way. This relates back to their personal relationship with Internet and also points to their lackluster use of keyword dependent services like the library. In moving forward there should be an emphasis on allowing students to search in comfortable ways while still yielding useful results.

**5.4.4 Preferences when purchasing materials**

Because my proposed solution is an actual marketplace in addition to a discovery tool, I wanted to get a better idea of student opinion about purchasing supplementary material. While there was a lot of hesitation to the idea, there was indication that students would be willing to purchase extra materials on certain conditions. Professor recommendations, confirmation of legitimacy and usefulness, and perceived longevity of use were all factors that could lead to the student purchasing information. However, the predominant preference was to find free resources when available.
CHAPTER 6
Prototype development

As previously described, my solution for a new landscape in digital course materials revolves around the idea of a collection of materials from various media or formats. This collection will provide a more ideal experience for Net Generation students and give them a digital outlet to interact with their courses. Empowered with insights from students, I began to develop a prototype that would solve for both their obstacles and needs. By building aspects like choice of format, a sense of validity, content-based searching and better purchasing options into my proposed solution, I felt that I could make a real attempt at improving the state of digital course material offerings. In order to accurately portray my idea for this new experience, I determined that a working prototype would be necessary for further evaluation.

6.1 User Story Development
To begin, I started building stories about how users would work within the proposed system. This process helped inform the prototype at an early stage. I worked through several iterations, always pulling from the firsthand accounts
that were gathered during the student interviews. I determined that two stories would best showcase the new solution. Both involve students that are currently enrolled in a course using one of these new digital course collections. The stories highlight the tasks of researching supplementary materials for an existing course topic, sharing found materials, researching a new topic that is not covered within their current course and finally browsing collections from other courses (See Appendix E and F for more detail). These tasks best exemplify the needs that students described during the interviews. I felt that these stories allowed me to begin accommodating for the interactions that students felt were lacking from their existing experience.

6.1.1 Story One: Researching supplementary materials and sharing

The first story aims to capture the experience of using the system’s search engine to find additional materials to supplement knowledge on a topic. The story starts with an undergraduate student user reading an assignment from a course. After the student has read the chapter, he or she does still do not understand the concept that the teacher wanted them to grasp. Within the system, they are now able to do a related search for materials that will provide similar content but in different ways. The student can filter additional materials by instructor recommendations, classmate recommendations, usefulness, relevancy, media format and other relevant information. Because they are able to get access to
materials they know are useful and accurate, the student can now learn about the topic in a more comfortable and efficient way.

After selecting the supplementary material, in this case a book, the student notices that it is possible to purchase each chapter of the book individually. The system provides an easy-to-use interface that gives a prominent usefulness ranking alongside each chapter. After looking through the chapter options, the student decides to buy only one chapter of the book because it is labeled as the most useful for the topic he or she is investigating.

After the student purchases the chapter at a subsidized price, he or she decides to share what they have found. The system allows the student to share his or her materials in a number of ways, on the course message board, through email, or via many popular social networking sites. The student decides to share the chapter with his or her friends so that they might be able to use it for a similar course.

**6.1.1 Story Two: Researching a new topic and using other collections**

The second story was built to highlight the system’s powerful content database. During my initial research it became very apparent that students do an introductory search for new information through a search engine or resource
like Wikipedia. While this search is meant to be cursory and yield only a brief overview of the topic, students still are not able to consume that information with complete trust. Because of the vast amount of information available and the open, public nature of the Internet, students are cautious about information available online. I am proposing that the new system should allow students to do these cursory searches within the system, get the information they need and then be immediately connected to usable information sources on that topic.

This story starts with a student searching for a topic that was brought up in class but not covered by the instructor. After searching for the topic in the system’s content-centric search engine, the student is provided a list of relevant topics that relate to the search query. These results closely resemble those found on Google or Wikipedia. After selecting one of the results, the student is delivered a high level overview of topic from reliable sources. Because the system evaluates relevancy and accuracy, the student can be sure that the information is useable.

The student is then presented with a list of filtered materials that can give more information on that topic. One of the provided filters allows users to look at other course collections from classes around the world. Each course’s collected materials are cataloged alongside the other materials in the system. This means that students or instructors can see what other courses are using to cover similar topics. The student notices that there are other courses that cover this topic, and
he or she decides to look at the collection from another institution. After looking through the collected materials, the student decides to purchase one of the items that was ranked as very useful.

6.2 Workflow Diagram

With stories developed, the next step was to diagram the workflow of the tasks. This diagram would ensure that the appropriate number and types of pages were developed in order to tell the stories with the prototype. Because I knew what stories I was trying to convey with the prototype, I was able to narrow down the exact tasks that were needed to complete the users’ goals. This allowed me to organize pages or interactions that would assist in the completion of those tasks. I was then able to turn that information into a logical workflow, connecting pages and tasks to complete the stories (Figure 18).
As previously outlined, I am only focusing on one portion of the larger system, the student-facing interface. With this in mind and my workflow in place, I was able to identify the exact pages that I needed to accurately describe the user stories. They include:

1. Initial landing page

2. Student user dashboard/landing page
6.3 Wireframe prototype design and development

With the stories defined and workflow in place, I began constructing a simply designed version of the application, otherwise known as a wireframe (Figure 19). This form of development allowed for a more fundamental evaluation of my proposed solution. By not applying aesthetics to the design at this early stage, I was able to focus my full attention on the interactions and functionality of the system.

The application Axure RP Pro 6 (Axure) was used to build a working wireframe prototype. Axure was chosen because of its ability to rapidly generate a useful and clickable prototype. Building the prototype in this way allowed me to evaluate it much more effectively. In future testing students would be able to actually
click through the pages and get a sense of what it would be like to actually interact with the system.

Figure 19. Wireframe view of the application’s landing page

6.3.1 Branding considerations

Even though I wanted this initial prototype to be completely devoid of aesthetics, I still saw value in branding the application early in the process. I chose the name ‘Txtbook’ for the application and branded it throughout. The termTxtbook was
chosen because it combines the concept of a collection of academic materials, a traditional textbook, with Internet jargon used by Net Generation students. The phrase ‘Txt’ is a common substitution for the phrase text messaging.

In addition to naming the application, I also branded certain features within the system. The term TopicSearch was used throughout in conjunction with the content-centric search feature. This term was chosen to imply that you search by topic, which was desirable according to my interviews. I felt that branding certain elements within the system allowed for the application to feel more approachable. The sense of approachability or familiarity was important to project to early viewers of the application. I felt that this aspect would let the students relate more to the application by presenting it in a similar way to existing web interfaces.

For the purposes of evaluating the application with real users, I also designed one screen with a high fidelity visual design. This design was built to give the students a very brief idea of the tone and atmosphere that would be established through aesthetics (Figure 20). These branding related measures were put in place for the sole purpose of accurately portraying my solution to the users for evaluative testing.
6.4 Prototype user need considerations

Because the prototype had now taken on a visual form, it was possible to formalize many of the user accommodations in the design. Following through on these user considerations with real design decisions will help make the project a success in the end. I carefully integrated each of the four main categories of important features into the application: digital preferences, validity, content-based searching and smarter payment options.
6.4.1 Implementation of Digital preferences

The primary way I integrated the student’s desire for digital materials was by bringing the primary interaction of reading and researching course material online. My research has shown that students are already doing a majority of their work digitally, so I have now moved their primary collection of course materials to a web-based interface. Anything that the student receives from a class will now be handled electronically. Instructors will deliver all of their materials through the online interface, meaning that there will no longer be in-class handouts. The primary mode of information transfer is through a variety of electronic media, including PDF’s, eBook publication files, web pages and movie files. When the student looks at their textbook collection, they will see a variety of digital file formats (Figure 21).
This complete digital conversion doesn’t mean that physical materials are obsolete. Students should still have the ability to export these files in numerous ways. At this point in development, it was not clear what types of output would be necessary, but simply that the functionality should be there. This implementation is a realization of the student’s desire to control their materials to a high degree. I believe that the new ability to collect, group, distribute, share and consume all of their materials, instead of just some, in one digital interface will resonate strongly with students.
6.4.2 Implementation of Validity

Next, my first research participants frequently discussed the idea of validity when using digital course materials. They had several smart ideas on how this could be implemented; some of which can be found in this prototype. First, the idea of crowd-sourced validity rankings was one that tied closely to the Net Generation’s tendency to value community input. Because of that, I felt that this was an important feature to include in the application. This idea can be seen in the results that are delivered after a ‘related search.’

As outlined in the first user story, Txtbook allows students to search for related materials that may give them a deeper understanding of a topic. When they search for a related item, they are presented with a host of options that are filtered many ways (Figure 22). One of these filters indicates a Class Recommendations selection. This is a place where students can recommend resources for each other to use when approaching a given topic. Students may already share this information elsewhere, but centralizing the interaction in the system allows it to be catalogued and used by other students, courses or institutions. Filtering can become a very powerful tool where students can access materials that they knew their peers have found useful.

Some student will not trust their peers’ choices but will still desire a valid recommendation. For them there is also a filter that displays their instructor’s
recommendations. In the initial round of research, it was revealed that a professor's recommendation was one of the most valued sources of material. Additionally, students should be given the opportunity to directly ask their instructor about the validity of a resource. The application should be set up in a way that allows students to do this without being intrusive to their instructor (Figure 24). With Txtbook students now have the ability to look through and filter materials any way that they desire. This infrastructure should be in place to allow them to work in a way that is comfortable and familiar.
Another way to display validity is in the form of a graphic meter. Being highly attuned to visual stimulus, it is no surprise that the Net Generation students I talked to suggested a ‘validity meter.’ This concept provides an easy-to-use visual that identifies an item’s credibility or usefulness. These numbers would be aggregated from a variety of data points, but ultimately the credibility ranking would be tied to expert evaluation while usefulness would be tied to user feedback (Figure 23). For example, an item may be ranked as highly credible because of a
combination of the number of times it has been cited, the number of courses that use the item, or expert rankings (Figure 24).

Figure 23. Item detail page displaying validity meters

These rankings should be provided for every item in the system. They empower the students to more quickly choose materials that deliver exactly what they need. The rankings build in an additional level of confidence that is seldom found in online research. Another benefit of housing all of this information in one centralized system is that it allows for the identification of validity at any scale. Because each item, whether it be a book or website, can be divided into smaller
sections, it is now possible to rank validity for each division (figure 6.6). As a practical use for this idea, each chapter of a book can be ranked for validity on any topic. Because many users are populating usefulness data into the system, it now becomes possible to identify the exact chapter of a book that will deliver accurate information on the topic in question. Both time and money are saved in the process. Validity rankings are a powerful tool that can be utilized throughout this application.

Figure 24. Dialogue box describing an item’s credibility.
6.4.3 Implementation of content based searching

One intriguing finding from my initial conversations with Net Generation students was the disconnect between their search methods and their desire for validity. When presented with an unfamiliar topic or concept, Net Generation students will most likely initiate a search using a popular search engine like Google or Wikipedia. While they described this as the norm, they simultaneously discussed their distrust of the results of this method. Uncertainty about facts delivered in publicly generated forums can lead to more work or the propagation of incorrect information.

When looking at this situation more closely, it became apparent that students want to search for their materials in a conversational or content-centric way. They want to get a high level overview of the topic in question and dive into more reputable sources for specifics later. For example, if a student has a question about the demographics of Iraq, he is more likely to do a Google search for the query “How many children are there in Iraq?” rather than sift through countless books or articles on the subject. While the information that they find may give them a rough estimate, the sources may be widely varied and lack credibility. I believe that this interaction should be integrated into their digital academic life.

A better solution will allow students to search in this way while simultaneously getting the most recent and credible information available on the Internet. This
interaction starts with a simple search box that the student would be used to using on a daily basis (Figure 25). They should be able to search with this tool in a content-centric way. Their search query will yield a high-level topic overview, which is very similar to Wikipedia.

Figure 25. Landing page with simple search experience

The student will be presented with thorough information that is ranked similarly to the rest of the items in the system. Now students will be able to see that the information they are reading is credible. Because the system can pull information from anywhere on the Internet, information is not limited to just overviews provided by Wikipedia can come from anyone with the most credible source.
In addition to a high-level description, students should also have easy access to a description in another form of media. On existing sites that provide similar information, there is often a static image of the topic or item. With a more comprehensive overview, there should also be an overview in video or audio format. Finally, filtered links to useful materials are located on the same page as the content overview. This would allow students to go directly to a citable source after they learn about the topic.

Figure 26. Topic page with multimodal overviews and direct links to materials
6.4.4 Implementation of Preferential purchasing options

The last major consideration that I have built into the prototype was an updated pricing structure. Often, students do not have a lot of money. This means that they have to get as much use as possible out of every material that they purchase for their courses. Because of their interactions with applications like iTunes, Net Generation students are used to being able to buy specifically what they need. Additionally, the Internet provides numerous outlets to purchase the same item, which has conditioned these students to constantly look for the lowest price.

With this in mind, I implemented a subsidized pricing structure for every item in the system. If the item is broken down into smaller divisions like chapters in a book, it should be possible to purchase each item individually. Of course, the student still has the option to buy the entire book or other collection at the full price. Moving to this payment structure allows decision making to revolve around usefulness instead of cost. Another model of payment that was approached but not implemented in this prototype is a subscription model. In this model, students could pay a flat rate per term and get access to all the materials contained in the system. While this model was not implemented, it is still valid to meet the needs of the students.
Figure 27. Payment options lowering cost and improving usefulness
CHAPTER 7

Prototype evaluation

The creation of the above prototype allowed me to incorporate all of the insights I’ve gathered thus far. However, the solution needed to be vetted with actual users to test its validity. With that in mind, I developed an evaluative session to allow student users to give feedback on the proposed prototype. The insights I found in these sessions will directly inform the final proposed application.

7.1 Methodology

My goal in this portion of the study was to gain insight into whether or not my structural and visual solution met the requirements that I learned from earlier users. In order to get this information, I had to craft a customized methodology. Because the prototype was only developed at a wireframe level, it was not possible to do a full usability evaluation. Similarly, it was not useful to simply do another interview; I felt that I would hear similar insights as the first round of research. Meanwhile, I crafted a methodology that combined the two approaches. I refer to this method as an ‘evaluative session.’ Combining elements of usability
testing and focus groups, I believe that this methodology delivered the type of results I needed at this stage of the project.

Each evaluative session consisted of two to three student participants and myself and lasted 45 minutes. As the moderator I walked the students through a brief introduction the problem space and led a subsequent discussion to confirm my initial findings. After that brief discussion, I moved the conversation to my proposed solution. Because the prototype was clickable, simulating actual use, I walked the participants through the stories outlined in Chapter 6 of this document. At critical points in the interaction, I would elicit feedback from the students. After the walkthrough was complete, I ended the session with a brief discussion of the high-level effectiveness of the solution.

It was important to me that these sessions were administered in groups because I felt that they would lead to a more meaningful discussion about the proposed solution and problem space. This assumption was correct, and I found that the students were able to assist each other when discussing how they might use a system like Txtbook. An interview with one student would give me valuable feedback, but the conversation amongst students adds another level of insight that is unattainable with just a one-on-one conversation.
7.1.1 Demographics

Students were recruited through the OSU Undergraduate Student Government listserv, which encompasses a large majority of the undergraduate student population. I made the decision to recruit from this large group in order to involve students from a variety of academic backgrounds. The first round of research was aimed specifically at Computer Science students because of their frequent use of classroom technology. At that stage, it was important that the participants understood the digital landscape. However, now that I had a more approachable solution in place, I felt it was important to involve a wider group of participants. The students that responded and took part in the study came from backgrounds including Music, Biology, Economic, Criminology, Communication, Engineering, and Art. Additionally, the student participants represented a range of academic status from first term freshmen to seniors.

Three evaluative sessions were administered with a total of 6 students. Based on Nielsen’s observation that usability evaluations should involve only five participants (Nielsen, 2000), I felt that this was a good starting point. If the feedback I heard from these sessions was inconsistent, further sessions could be administered. However, the responses showed consistency, so further sessions were not necessary.
7.2 Results and insights

Overall, the evaluations proved to be successful. The majority of students were excited about the experience that my proposed solution would provide. The responses I received closely resembled those from my earlier research. There was still a clear need for a new solution. This was gratifying to hear because it validated my previous research and proved that students are open to the idea of an inclusive digital course collection.

Each of the evaluative sessions provided important insights on improvement to the solution. Interestingly, the participants’ thoughts ran parallel to each other across the sessions. The students wanted to see improvement in similar areas of the application. My student participants consistently mentioned the areas of instructor oversight, multimodal interactions, smarter payment options, and information organization. The students had strong opinions on these areas, and each session’s insights closely resembled the collective thought. In the following sections I will highlight specific insights in these areas and make recommendations to improve the experience.

7.2.1 Instructor oversight

One of the main areas of concern that I heard from students concerned the level of instructor involvement. Due to a perceived lack of instructor oversight, the students overwhelmingly reported concern around the discovery process included
in Txtbook. The core of Txtbook’s success lies in its ability to deliver accurate supplements for students to use in order to better understand a concept. It was my intention to provide this feature so that students could learn in a modality that is comfortable. However, the students expressed their anxiety about finding and using materials that were not approved by their instructor. When asked about related search filters they would use, the collective response was ‘Professor recommendation.’

The solution for this concern lies in a deeper involvement from instructors. Txtbook provides an outlet for instructors to recommend additional materials. These recommendations are then provided to students as a filter when conducting a related search. However, in my initial prototype, I gave equal prominence to all result filters making classmate recommendations equal to instructor. My participants voiced their desire for instructor recommendations to have higher importance in the application.

Additionally, in order for this experience to be successful, instructors must take an active role in recommending materials. This means that the instructor-facing portion of this system must be extremely easy to use. As was pointed out earlier in this document, one of the reasons new educational technology fails is due to a lack of instructor adoption. Much future research will be necessary to explore how instructors will be able to manage their tasks in a minimally invasive way.
7.2.2 Multimodal interaction with materials

One of the more surprising insights to come out of the evaluative session was the fact that students still desire the ability to print their materials. This became evident early in the evaluative process and was echoed throughout all sessions. Several students expressed the importance of being able to print their digital materials in order to read them in a physical form. They stated several reasons, mostly experiential concerns, for the desire to print. The most common response pointed to the fact that it is easier to annotate printed documents. Additionally, the students reported that they felt they learn best when they have a physical material in front of them. The desire to similarly export these materials in other digital formats, like a PDF or Amazon Kindle file, was mentioned but was not as predominant as the desire to print.

There are few things that can be incorporated into the system to accommodate for this need. Even with this insight, I still believe it is still important to provide all course materials in one central digital collection. With that in mind, I now believe that it is equally important to allow students the ability to export their materials. Printing the materials is the obvious feature that is needed. Anything that can be printed should have the option available. Similarly, almost all of the files in the system should be exportable to numerous formats. For example, the students should be able to export readings, audio files or videos to their tablet.
computer, iPod, or other compatible device. The ability to export the materials in this way will further allow the students to use their materials in an ideal way.

7.2.3 Desire for smarter payment options

By far, the most desired feature of the system was smarter payment options. A vast majority of the student participants expressed the desire to have subsidized pricing options. I repeatedly heard that the students were tired of paying for textbooks they don’t use. Most of the students were excited about the opportunities that a new pricing structure provided. The results of this study indicate that there is a clear need for more research into payment structures in higher education materials.

The students were asked if they would prefer the proposed subsidized pricing structure or one that was subscription based. The subscription model would allow students to pay a flat fee at the beginning of each term and have access to all materials in the Txtbook system. With this model, they would not have to pay for each item that they want to use. If they think a chapter might be useful, they can explore it freely with losing money. Other industries have successfully explored this model. Internet music service Rdio.com, amongst others have implemented a successful subscription model for the music industry. Similarly, and the movie industry has thrived with Netflix and its popular ‘Watch Instantly’ portal. The subscription seemed to intrigue the students, but they were a little
apprehensive of the usefulness. Preference for either model was fairly even amongst the participants. However, with the subscription model, I heard from several students that it would be important to have the optional ability to purchase the materials for future use.

7.2.4 Organization of interface

This research also provided a few areas of insight about the actual interface layout. When looking at the Txtbook collection for a course, students thought it was very important to have visual differentiation between materials that the instructor required versus those added by the student. They wanted to have the ability to quickly scan the page and see their additions. Secondly, a few students expressed concern that the related search results interface was overwhelming. In this interface, it will be important to present the search results in a usable way. The students should see only the materials that are relevant to their search. Any additional, less useful information should be collapsed or not as prominent.
CHAPTER 8

Conclusions and Recommendations

8.1 Project Summary and objectives

The goal of this project was to design a new solution for the delivery of digital college course materials, otherwise known as a digital textbook. Overall, I had observed that current offerings in the space tend to neglect user needs. By taking a user centered approach and making real considerations for their needs, I felt that a better solution could be developed.

To verify this hypothesis, I developed a research plan with the goal of getting useful data and implementing a new design. To begin, I did a thorough analysis of the existing landscape. During this early investigation, I evaluated the design of digital educational tools, Net Generation student preferences and industries that made a successful transition to a digital format. All of the information I gathered helped inform my design of a new solution.

After that investigation, I determined that my solution should be systemic and impact multiple sectors of the digital course experience. This new system will
help facilitate better use from all user groups involved. With the system in place, I identified the student-facing section as having the most importance. As a result, I continued with my research agenda but now with a special focus on student needs.

With students in mind, I developed a set of surveys and interviews to better understand their needs and desires in the space. The information I gathered in those sessions allowed me to develop a wireframe prototype of a new digital textbook experience. The prototype integrated needs that I heard specifically from student users, which included digital format preferences, validity rankings, content-based search and discovery and freedom in purchasing.

After evaluative testing on this prototype with undergraduate students, I determined that this solution is highly desirable. Students had thoughts about improving the system in many ways but collectively expressed interest in using it in their classes. While there is still work to be done in this area, it is a clear step in the right direction.

8.2 The Textbook of the Future

The textbook of the future is digital.

There is a definite shift towards proliferation of digital education materials. In fact, in South Korea, “...one of the world’s highest-rated education systems,”
there has been recent legislation that mandates all textbooks be offered in a digital format by 2015 (Eason, 2011). In the United States, there is similar legislation starting to pass. For example, California has implemented a similar mandate that all textbooks must have digital editions by 2020 (M. Miller, 2010). In addition to legislative mandates, this research has shown there is a clear desire amongst students for digital offerings.

**The textbook of the future is agile.**

It is an easy assumption to say that the textbook of the future will be digital. However, this study has shown that it cannot simply be an electronic replication of our existing books. The Internet and emerging technology allow us to integrate a host of new features that can be leveraged to improve educational experiences. In order to be successful in the marketplace, the textbook of the future must become an agile, living document. Students demand more and more from their digital tools, and educational experiences must follow suit. In the future, textbooks will need to be smarter, accommodate for student needs and even recommend supplementary reading. All of this is in place to improve the way that students obtain and learn information.

In addition, agility comes by creating a hardware independent interaction. As was found in this study, students want to use their materials in a variety of ways. This will be amplified as technology evolves and new hardware becomes available.
The centralized content available in future textbooks will have the capability to be delivered to any compatible device.

**The textbook of the future is systemic.**

By integrating a systemic solution, as outlined in this document, the textbook of the future can allow courses of any size or in any discipline to leverage the new technological ability. The real strength of this solution lies in the ability to collect all of the materials and digital interactions for a course in one consolidated place. By providing an outlet that allows students to use the materials easily, instructors’ lives are also impacted for the better. Because the materials are consolidated, instructors now only have to populate their materials in one place.

Centralizing in this way will allow for the creation of a more usable interface for instructors, which will benefit all stakeholders in the end. I believe that the system I have proposed is strong, and student feedback has validated that belief. With the textbook of the future, the days of juggling multiple books, papers, websites and online communications are over.

**8.3 Implications for future work**

**8.3.1 Investigation of Instructor preferences**

Upon starting this research, I knew that the instructor portion of the interface would be critical to the overall success. Due to constraints of time, I chose to
primarily focus on the student interaction. Because students are the users that will benefit the most from using a system like this, I focused on their needs first. I felt that with an understanding of student needs, we could later craft the instructor interface around the student needs while simultaneously focusing on the usability from the instructor standpoint.

After my final evaluative sessions, it became very clear that the instructor end of the system is more important than I originally postulated. There was actually a direct connection between student need and the instructor interface. One of the primary responses I heard from students was that they needed to feel like their instructor was fully invested in using the application. There are several features, including professor recommendations, which are dependent on instructor input. Because of this, it is critical that the instructor feels comfortable using the application. Measures should be taken to understand how instructors want to interact with their course in a digital way. With better understanding in this area, an interface can be constructed that allows them to work efficiently and in turn positively effect the student experience.

### 8.3.2 User Interface Development

As Visual Communication Designers have known for years, the visual design and layout of the interface that users interact with is very important. Visual design must work in tandem with the interaction and information architecture that is
established. From this study I have proposed the foundation of the interactions that should be included as well as early layout solutions. With that in mind, there needs to be much work done on the development of the actual user interface. We know that Net Generation students have certain preferences when it comes to the visual design language that is applied to digital interfaces. I have proposed an early solution to the graphical user interface, but that solution needs to be vetted in much more depth. A close examination of visual design trends in the market and input from student users in necessary to create a successful design solution. Through a focused effort in this area, the visual design can work to improve upon the system as a whole.

8.3.3 Collaborative Development

There are many aspects of my solution that need collaborative input. Areas that need focus from other fields include business and computer software engineering. First, the pricing structure in the system I have proposed is very complex and has rarely been implemented because of its scale. In an ideal solution, students will have the ability to purchase access to their materials in multiple ways. There will need to be significant input from our colleagues in Business to inform the best business model and pricing structure. From the results of the evaluative sessions, it was clear that some students desired a subscription model while others requested a subsidized pricing structure. More research needs to be done on the feasibility of these options given the scale and complexity of the offerings.
Secondly, this system must be technologically advanced. The types of interactions that are supported in this application are multifaceted and will require a high level of technical sophistication. During many of my discussions with students, I heard that the application will need to function efficiently and without interruption. Net Generation students have the ability to find a solution that works perfectly. They have access to numerous outlets on the Internet, which means that if the application isn’t working effectively they can easily find a replacement. These students recognize smart and productive digital tools and will readily adopt their use. In order to foster the use of the proposed application, Computer Scientists must have a predominant role in the development of the real product. With all of this in mind, it is vital that future work on this project be multidisciplinary in nature. A true solution cannot be achieved without collaboration.

8.3.4 Immersive Beta Testing

This system provides an interface that connects a complex network of users, all of whom are completing very different tasks. Students, Instructors, Administrators, and Publishers are just a few of the roles that will work within this system. As researchers, we can only plan one portion of the interface at a time and guess how the different sections will impact each other. I believe that the only true way to test the validity of this system is through the use of an immersive beta test. This test would involve a complete iteration of an application that is fully
active and populated. A selection of courses must then be chosen to test the application in use. Instructors should upload their materials, students should add supplements into the collection and publishers should grant access to materials at the agreed upon price. Everyone should be testing the system as if it was complete.

This immersive look at the interactions provided by the application will show a lot of small discrepancies that were missed in development. The complexity of the application is too overwhelming to focus on during development but should be embraced during late-stage testing. This approach will allow us to craft an excellent user experience. By investigating the minute details of the interactions and accommodating for their shortcomings, the end product will be truly user focused.

8.4 Broader Application of Findings

The above work and findings were a result of investigating the use of digital tools in a educational settings. A great deal of planning was done in order to use appropriate methodologies to better understand the needs of users in the educational arena, specifically students. When reflecting on the process that led to my final recommendations and design, I believe that it can be used in the design of future digital environments.
The Education community’s transition to a digital environment is very complex. It involves many traditional, physical interactions intersecting with newfound digital ability. This juxtaposition will become the norm as more experiences become digital. For the foreseeable future, we will need to interpret the essence of our everyday interactions and translate those into digital experiences.

The process that I went through in the study proved very effective in understanding this complex transition and led to the development of a better solution. By first understanding the history of the interaction and gathering firsthand insight about what the users truly want, I was able to propose a unique solution that took this complexity into account. Following the initial phase of the project with a thorough evaluative process ensured that my early findings or hypothesis were valid. This led to the creation of a well-planned, practical and approachable solution.

Moving forward, this process can easily be applied to the development of other, similar interactions. As society digitally evolves, we will be faced with obstacles similar to those seen in Higher Education in a myriad of other instances. There is no doubt that we will be impacted by the digital interactions we have in our everyday lives. With a process similar to the one outlined in this document, we can ensure that those digital interactions will be usable, productive and inspiring.
APPENDICES & BIBLIOGRAPHY

Appendix A. User preference survey
Research Resource Preference Survey

Your Preferences

Degree Level: Bachelor’s  Master’s  PhD

If Undergrad, Year in School: __________

Major: ________________________________

Please think about a recent academic situation (course, research etc.) where you have needed to search for some information. You may have needed to do some research for a paper or had to utilize outside resources to get more information on a topic. Briefly describe the course that you are thinking of. It can be a course that is part of your major/concentration, but is not required.

When you start searching for this information, what is the biggest factor that impacts your decision in where to start? (select one)
- Time (I want to find it fast)
- Ease (I know it will be easy to find)
- Legitimacy/Reliability (I want to know the information is correct)
- Consistency (I always find things in the same place or way)
- other ________

How confident are you that the information found with that resource is legitimate?

1  2  3  4  5
Least confident  Most confident

What gives you that confidence?

When you search for information, where do you usually start looking? (select one)
- Search engine (i.e. Google, Bing, etc)
- Wiki (i.e. Wikipedia)
- Library website
- Other website
- At the library (building)
- Ask a friend or colleague
- Consult a professor
- other ________

What type of resource would you give the most confidence in its legitimacy? (select one)
- Search engine (i.e. Google, Bing, etc)
- Wiki (i.e. Wikipedia)
- Social Network/Media (i.e Twitter, Facebook, etc)
- Library website
- Other website
- Resources at the library (building)
- Asking a friend or colleague
- Consulting a Professor
- other ________
Library Use

How often do you go to the library (the building) to find resource information?
- never
- once a day
- once a week
- once a month

What type of resources do you use or obtain while at the physical library? (select all that apply)
- books
- academic journals
- online resources (public computers, database search)
- multimedia (audiobooks, DVDs, etc)
- course reserves
- periodical (newspapers, magazines, etc)
- programming/events/lectures
- librarian advice or support
- other

On a scale of 1-10, how easy is it for you to find what you need at the actual library?

1 2 3 4 5

How often do you use online library resources?
- never
- once a day
- once a month
- once a week

What type of library resources do you use or obtain online? (select all that apply)
- reserve books
- access academic journals
- database search
- download multimedia (audiobooks, DVDs, etc)
- online programming/events/lectures streams
- librarian advice/support (email or chat)
- other

On a scale of 1-10, how easy is it for you to find what you need using online library resources?

1 2 3 4 5

Difficult

Easy

Digital vs. Traditional Resources

Are you more comfortable finding additional information digitally (websites, search queries, chat, etc.), or with traditional media (books, papers, face-to-face conversation, etc.)?
- traditional
- digital

For you, what are the benefits to finding and using course material with traditional media (course handouts, books, journals, handwritten assignments, etc.)? Please describe those benefits.

Conversely, what are the benefits to finding and using course material in a digital space (course sites or wikis, PDFs, eBooks, website, etc.)?
Do you use an eReader (Kindle, nook, etc.), or eReader application (Kindle app, iBooks, etc.) for course material?

- yes  - no

Please list the hardware or software you utilize.

Thank You

Thank you for completing this survey. We will need additional help from a few people in the second round of this research. If you would like to help us in the future, please submit your name and email below. If you are chosen to help in the second round, you will receive a $10 Chipotle Gift Card.

Would you like to assist us on further research?

- yes  - no

Email

How likely would you be to purchase additional materials to supplement your course?

- very unlikely
- probably not
- unsure/it depends on the situation
- probably would
- very likely

What circumstances (i.e. professor requires it, I know the information will be extremely useful, etc.), if any would lead you to purchase supplementary materials instead of finding free content somewhere else? This can be any type of material: books, journal subscriptions, web subscriptions, movies, etc.
Appendix B. User preference interview questions

Part One: Prime
First, I want you to think about the last 24 hours. Within that timeframe, think about a one thing that you have researched. This can be anything from something for a class to looking up a actor from a movie. Tell me about that thing that you looked for.

Where did you initially look for an answer? If you were online, what site was it?

Then, if you weren’t able to find the item using your initial tactic, where did you move next? What source brought you to a satisfactory answer?

Part Two: What are you searching for, and why?
Next, I’m going to ask you about some things that you’re typically researching as a student, and try to understand what is driving that search.
For this conversation, we’re going to use a canvas (see page 4) to help you organize your thoughts. At the end, we’ll look for connections between what you’ve researched and how you’re looking for answers.

First, I would like you to think about your classes and academic life. What type of information do you usually have to look for classes. This can be any class. Write some of those items on these post-it notes and place them on the left side of the canvas. If you look for some of them more than others, place them closer to top.

As you place each item down on the canvas, also write on the post-it the reason for the search. Is it just curiosity, a requirement, making sure you’re thorough?

Now do the same thing for items you’re researching in your personal life. What kinds of things are looking for? Recipes, movie showings, info about friends?

Again, as you place each item down on the canvas, also write on the post-it the reason for the search. Is it just curiosity, a requirement, a questions from a friend?

**Part Three: Experience around this process**

Now, looking at the diagram you’ve made, it looks like you usually search for __________.
What is the preferred way that you search for this information? (maybe give a list of methods)

Why do you choose this method?

What are the most important aspects of that research method that drove you to choose it over another one? (speed, accuracy, relevancy, popularity, cost, etc.)

What is usually the outcome of that search? Do you have exactly what you need or does it lead you to another search? Why?

What are the negative aspects of this method?

Now, moving on to another item on your diagram, I want you to talk about one of these things that you look for much less frequently.

How do you usually look for that information?

Why do you choose this method?
What are the most important aspects of that research method that drove you to choose it over another one? (speed, accuracy, relevancy, popularity, cost, etc.)

What is usually the outcome of that search? Do you have exactly what you need or does it lead you to another search? Why?

What are the negative aspects of this method?

With any of these searches, are there any circumstance that would lead you to pay for a search result?

This can be repeated with more types of information searches

**Part Four: Ideal System**

Now that you’ve thought about how you currently search for information, and the pluses and minuses around that those searches, you have the chance to reinvent the way you search for things.

Looking at your diagram of things that you search for, I want you to think about a research technique that will be best for you.
Before you start, I want you to think about whether or not it is important to you to have research in your academic and personal centralized to one method, or separate.

I have some words for you to use to describe your ideal search strategy. Please use any additional words that are not included.

**Provided Words:**

- easy
- conversation
- comparisons
- browse
- fast
- timely
- insight
- visual
- hypertext
- organize
- crowd-sourced
- easy to find
- social
- mobile
• physical book
• relevant
• full-text
• PDF
• popular
• professional
• open
• filter
• expensive
• partial
• accurate
• searchable
• reading
• free
• abstract
• legitimate
• links
• historical
• closed
• cost
• comprehensive
• library
To start, please describe the actual way that you will be doing the search. [online/website, online/app, in-person, social media, physical space]

What is most important to you in this method of research? Please choose words that represent this search and place them in the rows. Place words that are most important towards the top, and things that are less important towards the bottom.

**Part Five: Explanation**

Please tell me about what you’ve made.
Appendix C. Interview Canvas – Word cloud of ‘Most Important’ aspects of digital system

Figure 29. Most Important aspects word cloud
Appendix D. Interview Canvas – Word cloud of ‘Least Important’ aspects of digital system

Figure 30. Least Important aspects word cloud
Appendix E. First Round Interview—Participant insights

Participant 1: Female, Graduate Student (1st year)

- looks for information for a psychology course - propose a case study
  - Google to find the information idea of what papers you need
  - library site to get access to the full paper
- Do a quick Google search to get an idea and then move to library to get official work
- Often use wikipedia to get an understanding of what something is, will move on from there
- YouTube - use bookmarks in chrome to find things in personal life/entertainment
- Look for information about PhD and whether or not to go
  - will build a list and then browse the information
- Has a job a Nationwide, which is very technical
  - will Google tutorials for information on technical information
  - search for blogs
  - viewer comments are very useful b/c you know if its worked or not
- Shopping online at Amazon or Target
• if finds something at Target will go to the store
• Want personal and academic resources separate
  • likes wikipedia b/c it gives short burst of info that tells exactly what you want to know
  • Pay if your sure that you are getting the right information

Participant 2: Male, Undergrad (3rd Year)

• Search for work related purposes
  • works at a HR Help Desk, looking for computer drivers
  • most frequently will search forum posts, this will give him the best results, if people have commented and affirmed that it is correct he will use it.
• Class search: German literature class - have books(fiction) that are to be read and write personal responses to that
• Tutorials - iPhone development
  • Uses an eBook to learn (Safaribooks), has some technical issues with using the book on Safaribooks
• library website is often very slow
• wants to search for books and then have the physical one
  • likes to browse through many books buts wants to find them first via search
• interaction with the book is nice, likes the full text so he can skim

• Personal searching: looking for famous people and find information about entertainment
  
  • uses wikipedia often, really quick information if it looks usable, will check against other sources

• When searching for academic information, will filter search via advanced search to look for .gov/.org sites
  
  • They usually bring good results, facilitate finding better information

• Looking up syntax information - forum or tutorials
  
  • Google for them, highly ranked results on Google give the best results
  
  • More people visit sites that are ranked highly on Google

Ideal system:

• display legitimacy is most important (delivered via a vetting system by users)

• wants to be able to quickly bookmark within books

• maybe you can see who is validating the source

• search will compare multiple sources

• will not pay for monthly subscription

• Wants to see legitimacy as a percentage

• non-required supplements aren’t as useful to him
• won’t buy GET materials

• will buy supplements if sees as useful in future.

Your Ideal Method

• Electronic media that is cross checked for truth and correct information with easy navigation allowing to mark certain spots that are found important. Containing anything that would want to be known.

Participant 3: Male, Graduate (Masters, 2nd Year)

• recent search: class report for Jay’s 788, required class
  • for the paper, looking for models that already exist
  • Google - Description tells if it usable information

• Caligraphy is a hobby
  • videos are good here, but not for technical info

• For academic: search for course slides from other areas (universities)
  • look at what other people are doing
  • will look from a top list of universities and find what they are doing

• Use Google Scholar to search for academic purposes

• Pro account at IEEE through department

• Library comes into play when you are finding the actual source

• Organization in Google search helps
• insight into what’s in the text rather than Titles/Authors (search preferences)

• Will use forum to look for technical information

• Suggestion based results:
  • Give results that are somewhat related to the topic
  • likes the idea of hypertext learning where everything is clickable to learn more information
  • Horizontal information (breadth) is better than focused/detailed articles

• Will purchase materials only if they are going to to use frequently

• Wikipedia is comprehensive
  • uses for general curiosity

• Search on library should be more comprehensive in terms of searching body of content rather than title/author.
  • more leniency w/ how you are searching

Your Ideal Method

• Ideal search will be content based and not just author or name of book or article/paper (as in library systems [ddc?]) So if you can integrate google search (i.e. any content based) to library system. So you can look for all results in Google but your university system will tell you out of these results, these 5 are available in library.
Participant 4: Male, Graduate (PhD)

- Recent search: conference (FIE) paper
  - background research about capstone course history
  - given a head start of papers to look at
- General search habit is “Breadth first”
  - library website first when doesn’t know what he’s looking for
  - When doesn’t know what he’s going to find, will pull abstracts and get a few papers found detailed, specific information from papers (articles)
- Gets breadth first and then delves into depth when pretty comfortable that the information is appropriate.
- Searching for information about qualitative methods (dissertation research):
  - Trying to build rationale
  - Going back to source of the methodology (looking for specific books he knows are useful)
- KIndle use: won’t buy academic books there
  - more comfortable with physical books for academic purposes.
- Academic: primarily looking for resources with specific direction.
- searching/shopping for personal life: looks for product reviews
  - will thoroughly explore all products
  - prefers to search Google and consumer reports first
• not much confidence in user reviews

• will go to the authority to find best data (expert reviews)

• Wants data triangulation for all modes of research

• Idea of local crowd-sourcing: has more confidence around the results that come from a similar source (recommendation from someone in Columbus rather than India)

• Hypertext: will follow a link that helps triangulate a resource

• Looking for cooking advice
  • uses recipes as guidelines
  • finds them on blogs and personal sites
  • has a set of established sites he knows will provide good recipes
  • looks for recipes with photos, they help the most

On the ideal system:

• Multiple sources!

• wants a consensus about the information

• search will find sources and the results get validated

• want to be sure that your picking the right information

• second ‘yes’: making sure you’ve found everything

• the thing that scares him about search is “you don’t know what you don’t know”

  • not sure if he’s getting all the facts
• validation from experts!

Least important aspect: library

• the library doesn’t always have the definitive sources

• Not too concerned with mobility, will usually find a computer if doing research

Your Ideal Method:

• Find some info then get someone to validate the info is good (i.e. credible, exhaustive, etc.) Need to be a trustworthy sources (or 2 or 3). Local advice is always better (i.e. friend).

Participant 5: Female, Undergrad (1st year)

• Frequent searches (recent)
  • Finding information on Wikipedia
  • looking up works in the dictionary

• Wikipedia is first option, general information about something quickly

• Other recent search: videos for building a robot
  • easier to see something in a video

• Stats for engineers
  • look up calculations (wolfram alpha)
• know how to set up an equation and it shows you how it solved the problem
• common from high school, especially with technical info

• Resources need for classes
  • Psych 100: need a textbook
  • Yoga: carmen articles and diagrams
  • also looks up videos for yoga outside of class (youtube)
  • Econ: bought textbook, uses it as a reference
  • Physics: bought textbook, uses it as a reference

• will look at study help websites or comments under a youtube video.

• prefer to have a physical book
  • more control over what she’s looking at
  • headache from looking at screen too long

• Searching amazon
  • looks at seller reviews, may take it into account when purchasing if advice is overwhelmingly one way or the other.

• Had an option in one of her classes to get a digital PDF or print it off (with a pay service)
  • like that system
  • got the PDF and printed it herself

• If have to find information herself (not directed by an instructor)
  importance goes to speed.
• About purchasing:
  • If just needs it for a short time, will get it from the library
  • If can buy it cheaper from someone else, she will
  • will buy Exam style books to write in
• Ideal system: find book online (reviews and right edition)
  • don’t want to have to find it in the library
  • go to the library, pick it and take it home
• search is very important in the digital space.

Participant 6: Female, Graduate (Master’s, 1st year)
• Recent search:
  • research papers in the field
  • has used IEEE or ACM website
  • eventually got source from library because knew could search
    multiple sources from one site.
  • Past experience led to this decision
• Safaribooks very useful
  • it cannot be downloaded which is bad, want to be downloadable
    would put it on laptop via PDF
• Movie search, looking for when new movies are coming out
  • uses MSN site, just likes the site, uses it frequently
• when searching for journals
• searching on the libraries website
• likes that you can use the title or abstract
• likes that you can annotate on a PDF
• Wants to search for a topic in a conversational way
  • include format in search
  • wants the search results to filter out format so she can go directly to
    the one she wants
• free is very important, don’t want to input credit card information
• wants to put reading material on any device
• comparisons are important: different authors have different perspectives
  • results should show varying solutions about different authors
• Timeliness is important: current articles have more relevant info.

Your ideal Method
• I would like to input some topic and the format. Then it can return the
  results according to the format I enter.

Participant 7: Male, Undergrad (4th Year)
• Recent search: Cell phone or tablet device to buy
  • for work and home
  • search on frugel, amazon, google
• primary search is to search google to find forums to get info about how people are using the tablets

• will value user input over expert advice

• anthropology course: has a textbook, but didn’t ever use it
  • teacher would deliver notes, would use that to study

• Comparative studies course: research projects
  • Google search would deliver good info when searching for information about the history/stats of a golf course he was researching
  • Searching on sites for information: sometimes, if he knows that a topic has a definitive source/company that deals with it, he will go directly to their site

• Verify any found information against multiple sites
  • wants to look at a lot of site
  • Get a lot of sites and check against each other

• Use of Google Reader: manage feeds based on category.
  • RSS can be overwhelming, just tend to read less with all the feed visible

• looking for a new house to live in (buy or rent)
  • looking on Craigslist or rentals.com
  • not enough usable return with those searches
• Calculus course: supplementing lectures he has with Khan Academy or Patrick JMT
  • will use them mobile if necessary
• Evernote: puts everything there, gives him constant access to whatever he needs
  • notes from a meeting, etc.
  • uses it as one big notebook with everything he thinks about
• Popular/social aspect
  • Not as important that it’s popular, if it gets the job done, it’s good

Ideal method:
• simple search (text or voice)
• pull multiple sources, go through, tag credibility.
• show how many people/sources corroborate that the info is correct
• forums, expert analysis will weigh more heavily in search results

How this ideal system looks:
• paragraph that will answer the question
• I want to know why it validated it and what sources it checked against
• hover over the link for more information
• that will tell why the info is there, give links to additional sources and show opposition.
Your ideal Method

- Search result is paragraph summarizing information from multitude of sources with Color coded authority rankings of each sentence/thought with easy to see sources and credibility rankings.

Participant 8: Male, Undergrad (4th Year)

- Recent searches: Java libraries for a course
  - google Oracle Java (database website)
    - information is provided by experts
  - will also Google to find forum
    - Googling gave ideas on how to use different methods that wouldn’t have thought of
    - Likes this broad Google searching early because it gives him a broad base understanding and then moves into deeper methods from there.
- Looking for job listings
  - looks on LinkedIn and Monster
  - has found job fairs and professor recommendations to be better (physical contact)
- Accounting course: looking for accounting rule (tax rules)
  - has a hard copy book, it is wordy and hard to find things
  - searchability is important in course materials
• doesn’t mind having a hardcover book the first time he’s going through the information

• Sometimes looks for rules on the Fisher website, but have to have a biz student account to get them

• other .edu or .gov websites are the next choice.

• knows info is reliable when it comes from those domains than with .com

• can use the info found on .gov/.edu as a base and then can check other things he’s finding against that.

• Bus schedule
  • look for when the bus is coming
  • uses cota website/Google maps
    • pretty helpful, it gives a rough estimate, but know has to be flexible

• C++ pipe reference course:
  • looks for professional examples first and then jump into the forum.
  • The professional examples are more reliable, then will look at what other people are doing.

• Wikipedia
  • does use it, but not for classes
  • will look up words for scrabble
and general internets of things he hears on tv or radio

uses it to get a general idea of what it is.

Ideal method

- fast, professional, expert setting
- electronic would be easier
- result will be digital
- what tells him it’s expert:
  - pro website, official source of the information
- Doesn’t necessary to be mobile
- Organized: if the complex topic, parts of a whole are clearly divided

Your ideal Method

- From an expert source. Online, any format that is readable and easy to access.

Participant 9: Male, Graduate (PhD)

- Recent searches: Math class
  - looking for more information/explanation of a math theory
  - there is a textbook that is just notes printed as a textbook
    - notes aren’t really useful because of complexity of the topic
  - Other way to find better/usable info: Google search
• finds presentations and notes in other classes from other schools
• matched what he saw in his class so it was corroborated
• knew it was correct because it was coming from other trusted mathematics departments and professors

• Information about school work/research:
  • technical information about computer science
  • do a Google search
    • finds blogs, etc. that will show tested methods that other people have use.
    • if it looks simple will try the way other people did it
    • if it doesn’t, then will keep looking for more options

• Trivia
  • Fark - just browsing to see information
  • Wikipedia to find things that don’t really matter.
    • has a little bit of a negative connotation, but never really found bad information
    • defaults to things that are high in Google results, like Wiki entries

• Word working techniques
  • hobby
  • has a couple books that he will reference
  • uses online materials to find any supplementary info he needs
    • i.e. tools, other techniques people might use, tv shows
- Class/course info
  - uses Buckeyelink, Carmen
  - department/professor site is the best because it shows what he actually needs to take
  - buckeyelink is very large and hard to tell what can take, etc. in that large site
- Looking for academic papers
  - know that wants to find a specific paper
  - has a paper title and has to find it
  - uses google to find the full text
  - usually pulls up a IEEE or ACM result
  - can get a full text free when using the CSE network
  - Want full text sources for free when in a class, unless he’s going to fail without it
  - if needed the source to publish a paper himself, then he’s more likely to pay because it has more payoff
  - subsidized pricing: likes the options. if it was for a course, would default to free or library and then would pay for subsidized price as a last result.
- Library services
  - checks out textbooks and personal use public library items
• does an online search on the library site, reserves it and then goes
to the library to pick it up

• Most important aspect for him is low cost

• Openness is also very important

  • no DRM, want to use it in the way that is comfortable

Ideal system

• computer to index/searchable

• optional media to receive as a result of the search

• have adapted to Google and how it works. “I have worked around Google
  and adapted.”

• “It has made me work the way it works”

Your ideal Method

• Searchable index with options for multiple media formats such as
  websites, books, disc.

• He ranked his descriptive words:

  1. low cost
  2. fast
  3. easy to find
  4. relevant
5. quick
6. filter
7. free
8. full text
9. open (no DRM)
10. printable
Appendix F. User Story One: Researching supplementary materials and sharing

Getting Started

Jamie is a student in Professor Winthrop’s Economics 101 course at Ohio State this quarter. Professor Winthorp is using Txtbook to post the reading for the course, and has reminded the students that they have a reading to complete before the next session.

Jamie is in the third quarter of her Freshman year at OSU, so she has been getting pretty good at using the Txtbook interface. She logs in to her account to start reading her assignment. To get there, she finds the Econ Txtbook in her library and opens.

Reading and Searching Related

Once inside the Econ Txtbook, Jamie finds the reading that Prof. Winthrop told them about in class. This time the reading is an actual chapter from a book, but in the past he has given them a video to watch, or a blog entry to read. Jamie doesn’t
learn very well from reading dry textbook-style books, but she goes ahead and reads the assigned passage.

The topic they are covering this week in Econ is ‘supply and demand.’ After Jamie reads the assigned chapter, she has a very basic understanding of the concept, but doesn’t feel like she has a good enough grasp on it to discuss it in class.

Jamie knows that textbook has a really great search feature that allows you to find related material on a topic, so she decides to look for another item that might help her understand supply and demand better. To do this, she clicks on the ‘related’ link next to Prof. Winthrop’s assigned reading.

**Browsing related by filter**

Clicking on related actually did an advanced search in Textbook’s TopicSearch feature. It filtered out similar items to the reading based on a series of identifying tags. Then it displays items that Jamie might want to use to understand the topic better. It is displayed in way that Jamie can pick exactly what she needs to know she’s getting the right information.

On this screen she can see that there are items filtered by credibility, usefulness, other recommendations that Prof. Winthrop has made, and recommendation that her classmates found helpful. Additionally, she can see what similar courses from
around the world are using to cover the same topic, or she can filter by a format that is most helpful to here, like YouTube videos.

Jamie trusts her classmates because they have always given her the best info in the past, and decides to try one of their recommendations first. She sees that the first item on the list is “The Complete Idiot’s Guide to Economics.” This seems like it should be helpful, so she clicks on it to see more information.

**Getting more info on an item**

Now she can see more information about the specific book. Right off the bat, she notices that it has a pretty good credibility ranking. She wonders what defines the credibility ranking, so she clicks on ‘View expert rankings’ to get a better idea of why its so credible.

**Understanding the credibility of an item**

This opened a popup that shows specific information about this book’s credibility. Every item in Txtbook has a credibility ranking that is evaluated by several criteria including how many courses use the item in their Txtbook, how many publication cite the item, and rankings from professors. Instructors who are verified with Txtbook can rank an item as ‘credible’ or ‘not credible’ to help inform students about items that are good to use.
Jamie sees that a lot of courses use this book, and it has been cited a lot of times, so she is pretty sure it’s a good source. However, Prof. Winthrop has not ranked it. She wants to make sure that she’s not going to get contradictory information from what he will cover in class, so she requests that he rank the book.

Requesting his input pushes a notification to Prof. Winthrop’s computer and iPhone. He sees right away that she wants to know if it’s a good source, and responds that it is something she can use.

**Gauging usefulness**

With that information, she now goes back to the info page for the book and looks for a reading that will be most useful for her. This is an easy task on Txtbook because it gives her a usefulness ranking that is based on her earlier search query.

She immediately notices that Chapter 2 and 3 in this book should be the most useful for understanding ‘supply and demand.’ She really likes this feature because she wants to know that she’s getting the most reliable and useful information, especially if she’s purchasing content.

Because she can buy each chapter individually, she decides to purchase Chapter 3 and add it to herTxtbook list by clicking ‘Add’ next to the Chapter.
**Adding item to Txtbook and Sharing**

This brings up a dialog to purchase the chapter. Txtbook knows that she has been looking for items for her Econ class, so by default it adds the item to the Econ Txtbook. Jamie can change this in the dialog box if she wants to add the item to another Txtbook.

After she purchases the item, she has a few options. She can start reading immediately, continue looking for items, or share what’s she’s found in multiple ways. She decides to share the chapter incase anyone else wants to use it. She knows it will get in front of more people if she just tweets it, so she posts it to Twitter.

After she shares the chapter she found, it takes her back to the book info page.

**Browsing again by different filter**

Jamie decides she wants to get one more item that she can read to better understand supply and demand. She returns to the search results from earlier and notices that Prof. Winthrop recommended a blog. That caught her attention because she usually gets really good information from blogs. She’s always a little uneasy about reading only blogs though, because she doesn’t know how legitimate they are.
However, because she knows that this blog was recommended by her professor, she decides it might be pretty good. She clicks on the blog link to see more info about it.

Gauging credibility and usefulness; ending session

Jamie immediately sees that this item was recommended by her professor at the top of the page. She loves this feature because it's like a guarantee that the info will be accurate.

She sees that the information might not be the most credible based on the overall score, but that most people found it useful. Based on that, she decides to add it to her Txtbook for future reading. Even though she may not go back there very often, it's nice to know that it's cataloged in her book. Because it's free, she just has to click ‘Add to Txtbook’ and it's immediately there.

After a couple very successful minutes of searching and browsing, Jamie feels like she has the tools to better understand supply and demand and discuss it class tomorrow.
Appendix G. User Story Two: Researching a new topic and using other collections

Interest in topic

Jamie is also a student in Professor Washington’s History of American Sports course at OSU. After an interesting class one day, Jamie’s interest is peaked about Major League Baseball. Jamie knows that he can use the built-in TopicSearch feature in Txtbook to find more information about it.

Because Jamie just wants to get general information first, and maybe dive into more detail later, he just goes to the TopicSearch homepage and types in ‘baseball’.

Refining results

Not realizing that there would be so many options for the search ‘baseball’, Jamie is presented with multiple items to choose to learn more about the MLB.
Jamie was actually searching for Major League Baseball because he was specifically interested in the history of the league and its controversies. With that in mind, Jamie clicks on the first result, which is ‘Major League Baseball’.

**General knowledge**

Jamie is met with exactly what he was hoping to find. TopicSearch gave him a broad overview in the form of a text description that was loaded from Wikipedia. Thanks to Txtbooks powerful tools, the he knows that the Wikipedia entry is credible because professors have ranked it.

After he reads through the entry, he is interested in learning more about how baseball became American’s National pastime. Professor Washington has required the class to write a paper about one of the American sports, using several sources.

Jamie’s not sure where to start to look for sources until he notices that there are other courses that have Txtbooks that deal with the same subject matter. He decides that other professors and courses probably have good material, so he looks through the options and picks a similar course at UCLA.
Looking for sources

The UCLA course’s Txtbook loads, and Jamie begins to look through the entries. He is familiar with the system knows how to find sources based on course topics in the Txtbook. He sees that they covered the exact topic that he is thinking about writing about, and finds the text that they read for to cover it.

It happens to be a chapter of a book about the History of baseball. He clicks on the title to see more information about the source.

Evaluating usefulness

After double checking that the overall credibility of the book is good, Jamie look through the chapters to see if there is anything he can use. He notices that the chapter the UCLA professor recommended is very useful, according to the Txtbook ranking. In fact, the entire book looks like it will be useful, and he remembers that his friend wanted to write about a similar topic.

Sharing with a friend

Jamie decides that he will probably buy this book and add it to his Txtbook later, but in the meantime, he wants to share it with his friend. He clicks ‘share’ and sends the book off for his friend to discover.
Appendix H. Evaluative session walkthrough script and questions.

Open Econ Txtbook
This collection prepared for you by instructor. It contains the materials they believe will be most useful.

Reading and Searching Related

• Look for Supply and Demand
  • Read the chapter and come back to this page

Things to notice:

• Format category
• Quizzes
• Ask questions
• Organization of items

Questions

• Would you use those quizzes?
Browsing related by filter

- Clicked on ‘Related’ and open a related search
- Decides to look at other items classmates suggest
- Opens ‘Idiot’s Guide’

Things to notice:

- The different ways you can see related items

Questions

- Would you want to see any different filters here?

More info and Credibility

- Each chapter is available individually
- Ranking of Credibility and Usefulness
- See what Credibility ranking means - click on Expert Rankings your professor hasn’t ranked it,

Things to notice:

- Each chapter has a usefulness ranking, you can change it to filter by different topics
- Change it to ‘Cost Analysis’
Questions

• Would you trust these rankings?

• Do you like the feature about requesting credibility ranking from your professor?

Adding something to a Txtbook

• Find chapter you want to add

• Purchase at subsidized price

• Share it with someone right from here

• Share it on twitter

• Return to Txtbook to see that it’s added

Questions

• Does it make sense how it groups these things by topic?

• Would you organize them another way?

Searching for a new topic

• After learning a little bit about the scandals in the early years of baseball, you are curious and do a search

• Open TopicSearch feature of Txtbook (Txtbook link in nav)

• search for baseball

• Look through results and open MLB
Things to notice:

- Because you are searching with the Txtbook system, there may be recommendations that your instructor already made about this topic, you can filter here.

Questions

- If it was this easy to search, just like wikipedia, would you use this over the other? Why? Even if it connected directly to your class?

Learning about a topic

- Wikipedia-like overview
- Recommendations about things you can read

Things to notice:

- Credibility Rankings and usefulness buttons

Browsing other Txtbooks

- All textbooks are indexed by and searchable
- You can look through books at other institutions to see how they are covering a topic
- Open one of the textbook options, UCLA’s book
• Their interface is exactly the same as your textbook, you can look at the items they are using

**Things to notice:**

• You get the usefulness and credibility rankings again

**Share with the class**

• This book looks like it might be useful for everyone else in your class, you can easily share it with them.

**Questions**

• Does this concept seem like it would work better or worse than existing digital textbooks? Why or why not? Would you be likely to use this given the choice? What types of content would you like to see in a collection like this? Would you want actual assignments or grades integrated into a system like this?

• What factors would have to be in place for you to use this instead of just searching on the web for information?

• Other Comments
Bibliography


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